

INFECTIONS OF THE NASAL ACCESSORY SINUSES  
AND THEIR RELATION TO SYSTEMIC DISEASE.

Thesis submitted for the

M. D. Edinburgh

by

Andrew Mackenzie Ross,

M.B. Ch.B. (Edin.) 1924.  
D.L.O. London. 1928.

Present Appointment.

Assistant Surgeon,  
Ear, Nose and Throat Department,  
Cornelia Hospital,  
Poole.

Past Appointments.

House Physician,  
Worcester General Infirmary. 1925-26.

House Physician,  
Royal Liverpool Sick Children's  
Hospital. 1926.

House Surgeon,  
East London Sick Children's  
Hospital. 1927.

Clinical Assistant,  
Ear, Nose and Throat Departments,  
Royal Infirmary Edinburgh and Western  
Infirmary Glasgow. 1927-28.



I.

Infections of the Nasal Accessory Sinuses  
and their relation to Systemic Disease.

Introduction.

The subject of Nasal Accessory Sinus infection is a very important one, which has been but little understood until some thirty years ago, when Rhinologists in America and on the Continent realised the importance of the many complicated cavities and cells in the anterior part of the skull and devoted a vast amount of time and study on the anatomy, histology, neurology and pathology of these spaces.

In this paper I wish to discuss the whole subject of Nasal Accessory Sinus infection, and particularly as a factor in the Causation and maintenance of disease when unrecognised.

Obscure unrecognised accessory sinus infection may cause effects similar in their gravity to the results of oral sepsis. I am convinced that this condition is more common than is usually thought to be the case. The sinuses are loculated spaces with openings or ostia which are invisible to direct examination,

and unless their presence and anatomy is remembered, the focus of infection or the maintenance of infection, in many obscure cases of headache, optic neuritis, nasal discharge, earache, deafness, bronchitis, obscure pyrexia in children, multiple arthritis, and other conditions, will be missed.

A very large percentage of cases of chronic nasal catarrh prove on careful examination to be cases of accessory sinus infection.

In my experience of the past eight years, I have been struck by the considerable number of cases suffering from totally different conditions, where on close questioning and examination of the nose, one has found a latent undiagnosed and seemingly unimportant and harmless accessory sinus infection, which proved to be the cause of maintaining the disability, as after appropriate treatment the symptoms cleared up.

This has been particularly noted in children, from the age of four upwards.

In a large percentage of cases where tonsils and adenoids have been removed, and where the nasal discharge has not cleared up

as well as was expected, there has invariably been found, an infection of one or other of the accessory sinuses and more frequently the maxillary antrum.

This fact or rather the failure to remember this condition has been responsible for many of the so-called unsuccessful results following removal of tonsils and adenoids in children.

This statement applies to adults also, though less frequently.

Suggested Addition to the Introduction:

Recently it has also been shown conclusively that infection of one or other of the accessory sinuses, more particularly in the form of closed or "occult" sepsis, has been responsible for the onset and maintenance of various types and degrees of mental disorder. After appropriate treatment to the affected sinus or sinuses the mental disability has gradually disappeared and a return to normal health has resulted.

2. Anatomical and Physiological Considerations.

From both anatomical and clinical considerations it is convenient to divide the accessory sinuses into two groups, according as to whether their ostia open (a) Anteriorly into the middle meatus, below the attachment of the middle turbinate, or (b) Posteriorly into the superior meatus, and above the middle turbinate:

The Anterior Group consists of Maxillary Sinus, Frontal Sinus, and Anterior Ethmoidal cells, while the Posterior Group consists of Posterior Ethmoidal cells and Sphenoidal Sinus.

The Maxillary Sinus, or antrum of Highmore may be likened unto a Pyramid (see figure). The temporal or posterior wall, formed by the body of the superior maxilla is very thick. The thin orbital wall forms the roof of the sinus. The anterior wall corresponds to the facial surface of the superior maxilla, and over the canine fossa, it may only measure 2 m.m. in thickness. The base of the pyramid corresponds to the lateral wall of the nose, which consists of the following constituents, maxillary process of inferior turbinate, portion of palate bone,

uncinate process, lamella of ethmoidal bulla, and the pars membranacea. The latter part which is very thin, is that through which exploratory puncture of the sinus is made. The natural opening of this sinus is found on this wall, but nearer to the roof than to the floor of the cavity. It opens into the middle meatus by the ostium maxillare, at the posterior extremity of the hiatus semilunaris. One or more accessory openings are sometimes met with, also in the middle meatus, generally posterior to the ostium. The junction of the base and the anterior wall forms what is often referred to as the floor of the sinus. It is really a rounded angle, lying above the alveolar border of the superior maxilla. The roots of the teeth, particularly the second bicuspid and first molar are only separated from the cavity by a thin lamella of bone. The mucoperiosteum is frequently arranged in folds or ridges. The floor of the sinus and that of the nose may be on the same horizontal plane, but that of the sinus is generally about  $\frac{1}{2}$  inch lower.

A large adult maxillary sinus will hold about 1 ounce of fluid, but the cavity may be represented by a mere chink, or more rarely, be entirely absent.

Development. The maxillary sinus exists at birth in a rudimentary form, and reaches its full development about the age of twelve years.

Fig. I



- a.. Ethmoidal cells.
- b.. Opening of Maxillary Sinus.
- c.. Maxillary Sinus.

Skull Viewed from Right Side.

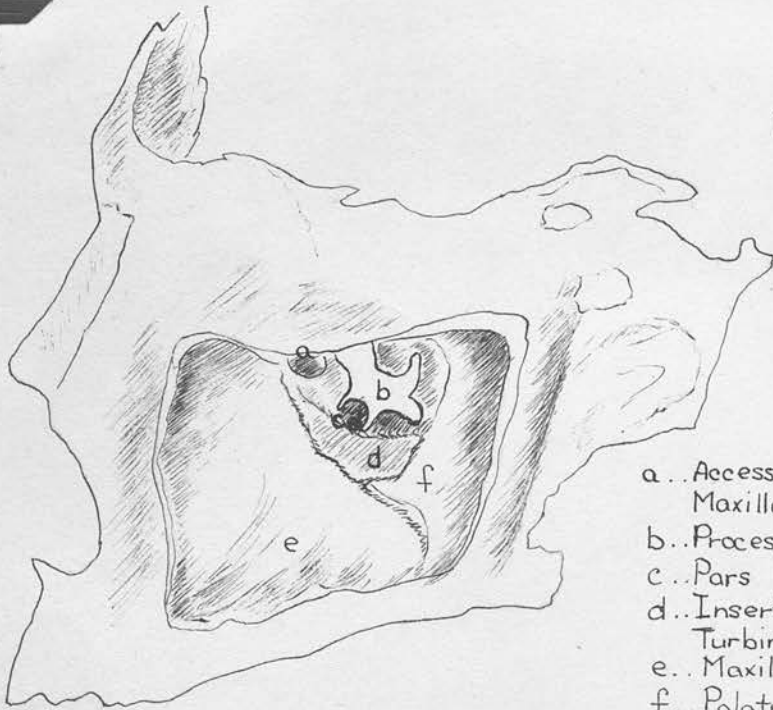
Fig II



Lateral View of Tooth Root Projecting  
Into the Maxillary Sinus.



Fig. III

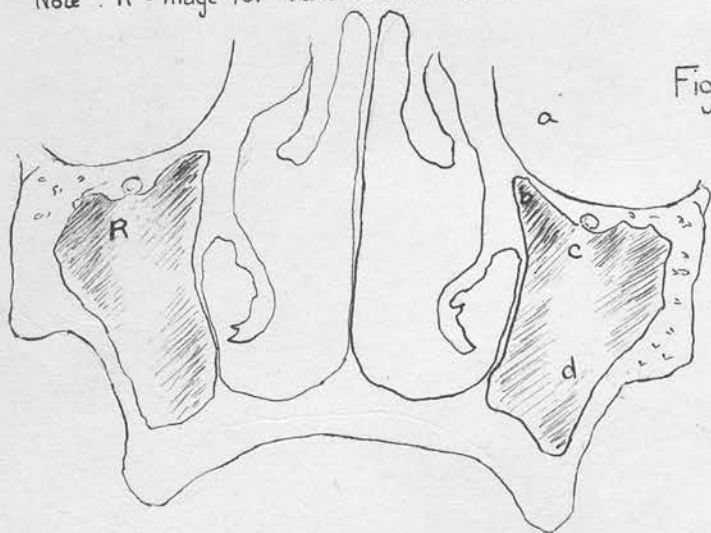


- a.. Accessory ostium of Maxillary Sinus.
- b.. Processus Uncinatus.
- c.. Pars Membranaea.
- d.. Insertion of Inferior Turbinate.
- e.. Maxillary Sinus.
- f.. Palate bone.

Structures Entering Into the Base of the Maxillary Sinus.

Section Through Anterior Portion of Antrum Looking Forward.

Note . R = Ridge for Transmission of Infra-orbital Vessels & Nerve.



- a.. Orbit.
- b.. Infra-orbital Recess.
- c.. Ridge for transmission of Infra-orbital vessels and nerve.
- d.. Maxillary Sinus.

The Frontal Sinus.

The Frontal Sinus is pyramidal in shape and presents usually a vertical or frontal portion and a horizontal or orbital part. It has three walls and a septum or partition which intervenes between the two sinuses. The Anterior wall, formed by the convex outer table of the Frontal bone, varies in thickness and frequently contains diploë; the posterior or cerebral wall in part vertical and in part horizontal, is thinner and consists of compact bone: the Inferior wall or floor - the thinnest of the three - lies in the horizontal plane and forms part of the orbital roof. Medially the sinus overlies the anterior ethmoidal cells, and laterally the cavity of the orbit, the latter area varying with the extent of the development of the horizontal portion of the sinus. The septum, as a rule a thin bony partition, intervenes between the two sinuses. It may occupy the mesial plane throughout its whole length, but it is subject to considerable deviation to the right or left, thus producing, in some cases, marked asymmetry of the two cavities.

The Frontal ostium is situated in the floor of the sinus in relation to the medial or ethmoidal

portion, and is thus advantageously placed for the drainage of inflammatory products.

One or both frontal sinuses, may be absent (in 17 per cent of European crania: Logan Turner).

The sinus, both in its vertical and horizontal parts, varies in size in different individuals. It may be a shallow cavity confined to a small area above the root of the nose, or it may extend laterally into the base of the zygomatic process of the frontal bone (external angular process): and vertically it may reach the frontal tuberosity or eminence.

Similarly the horizontal portion is subject to great variation, being limited in one case to the inner third of the orbital roof, in another extending backwards as far as the apex of the orbit and laterally to the zygomatic process. An air cell in the crista Galli of the Ethmoid bone has been found to communicate with the Frontal Sinus. (Onodi). Thus the relations of the sinus to the frontal lobes of the brain and to the contents of the orbit show considerable variation. The sinus may be irregularly subdivided by incomplete bony partitions, and contain recesses and diverticula which may become pockets of infection when the cavity is the seat of suppuration.

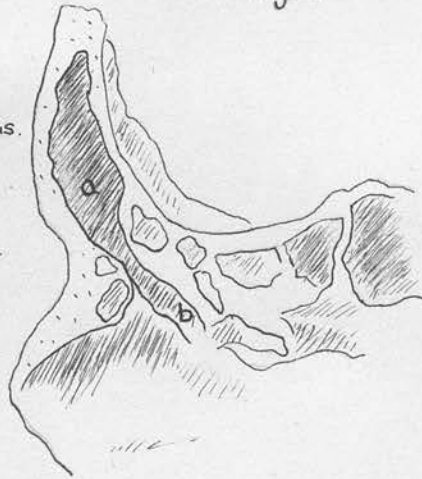
Development:

The Frontal sinus develops soon after birth as an upward prolongation of the frontal recess situated in the middle meatus. As the result of absorption of the cancellous tissue between the two tables of the frontal bone, the cavity extends for a varying distance into its frontal and orbital plates, and occupies an area above the root of the nose and the supra-orbital margin. The development of the cavity in early years of life is subject to considerable variation, but a well-formed sinus has been recognised and opened for the relief of suppuration between the ages of three and four.

Fig.V

a. Frontal Sinus.

b. Hiatus  
Semilunaris.



Lateral View of a Medium Sized Frontal Sinus

With Direct Passage into Hiatus Semilunaris.

Fig.VI

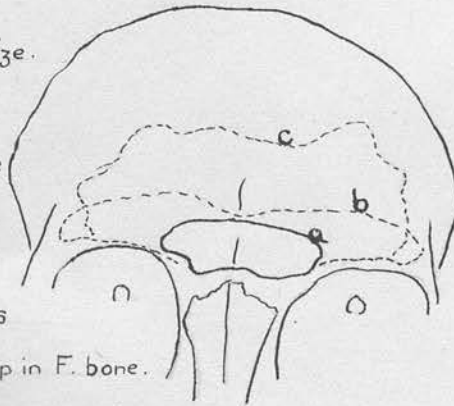
a. Moderate Size.

b. Large Sinus

reaching to the  
Ext. Angular  
Process.

c. Large Sinus

reaching high up in F. bone.



Diagrammatic Representation of Form &

Extent of Frontal Sinus. (Hazek).

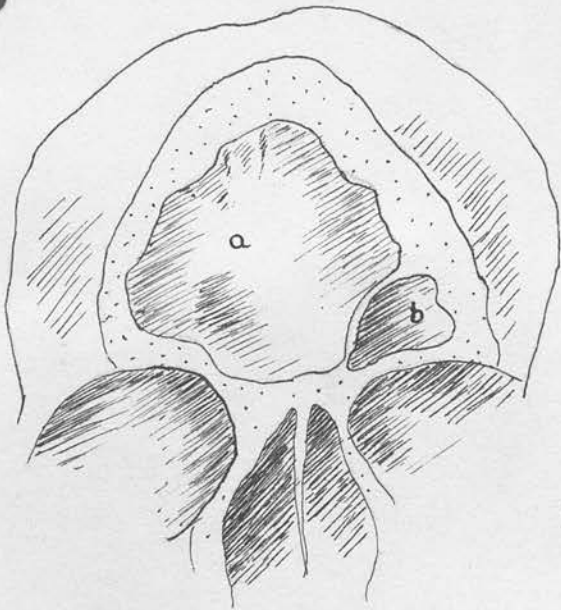
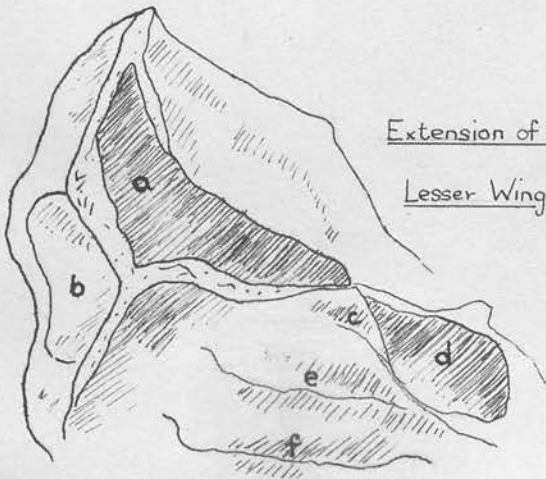


Fig. VII

- a.. Right Frontal Sinus.
- b.. Left Frontal Sinus.

Extreme Superior Extension of Right Frontal Sinus.

Fig. VIII



Extension of Frontal Sinus Posteriorly Into  
Lesser Wings of Sphenoid.

- a.. Frontal Sinus.
- b.. Orbit.
- c.. Superior Turbinate.
- d.. Sphenoidal Sinus.
- e.. Middle Turbinate.
- f.. Inferior Turbinate.

Direct Communication of the Frontal Sinus with an Anterior  
Ethmoid Cell.

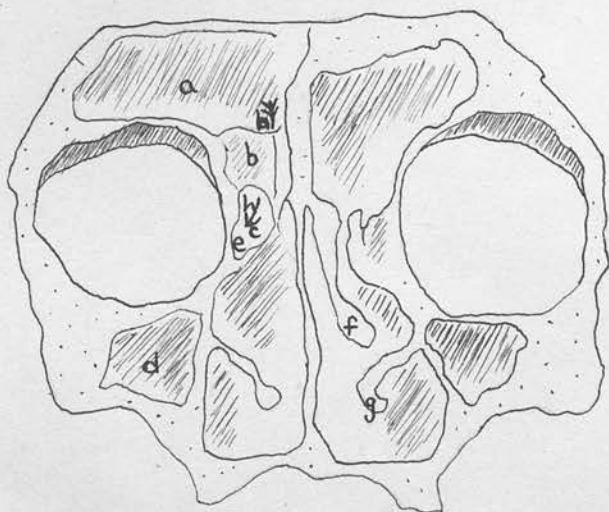


Fig. IX

- a.. Frontal Sinus.
- b.. Frontal Bulla.
- c.. Ant. Ethmoid cell.
- d.. Maxillary Sinus.
- e.. Processus Uncinatus.
- f.. Middle Turbinate.
- g.. Inferior Turbinate.
- h.. Stylus from Frontal Sinus  
into Ant. Ethmoid cell.



Formation of Ductus Nasofrontalis.



Fig. X

- a.. Naso frontal duct.
- b.. Bulla Ethmoidalis.
- c.. Hiatus Semilunaris.
- d.. Processus Uncinatus.

The Ethmoidal air cells, some of which are present at birth, arise as prolongations of the nasal mucosa into the lateral mass of the Ethmoid bone. In the adult, they vary in number, size and shape. They are grouped for clinical purposes, as Anterior and Posterior cells, communicating respectively with the middle and superior meatuses. The Ethmoid labyrinth is placed antro-posteriorly along the entire upper half of the nasal cavity, with the latter lying medially and the orbit on its lateral aspect. Six walls can be differentiated. The superior or cerebral wall is completed by the depressions on the ethmoidal edge of the orbital plate of the frontal bone, and the interior wall by the medial margin of the orbital plate of the maxilla in front and by the orbital process of the palatine bone posteriorly. The lateral or orbital wall is formed mainly by the lamina papyracea of the ethmoid, completed in front by union with the lacrymal bone, and posteriorly with the sphenoid bone, while the medial or nasal wall is formed by the convoluted ethmoidal conchae (superior and middle turbinates). Anteriorly the labyrinth is completed by the frontal process of the maxilla, and posteriorly by articulating with the sphenoidal spongy bone. The air-spaces in each group intercommunicate, but the anterior cells are closed off

from those of the posterior group. It is not uncommon to find the air-cells of one or other group develop beyond the boundaries just defined: for example, superiorly and laterally one or more air-spaces may extend into the orbital plate of the frontal bone, and thus lie posterior to or underneath the horizontal portion of the frontal sinus - orbito-ethmoidal cells; while another may project anteriorly into the medial portion of the floor of the frontal sinus - Bulla Frontalis - In a considerable percentage of skulls there is an extension anteriorly into the ethmoidal crest on the medial aspect of the frontal process of the maxilla: this constitutes the cell or cells of the agger nasi. Inferiorly and laterally a cell or cells may invade the orbital plate of the maxilla - maxillo-ethmoidal cell - and if well developed, will simulate a double maxillary sinus. Occasionally, also, a posterior ethmoidal cell is found invading the orbital process of the palate bone - palato-ethmoidal cell - Sometimes the ~~most~~ posterior of the ethmoidal cells grows backwards into the sphenoidal spongy bone and intervenes between

the basis cranii and the sphenoidal sinus placed below it - spheno-ethmoidal cell - . In these cases the optic nerve may lie in very close relation to the posterior ethmoidal cell.

Further, pneumatization may take place in parts of the ethmoid structure which are not as a rule, cellular. One or more air cells occur in the middle turbinate, derived either from the anterior or posterior part of the ethmoidal labyrinth.

Rarely, the crista galli of the ethmoid is a pneumatic structure, the cell communicating with the air spaces of the anterior group.

The cell spaces of the anterior group communicate with the middle meatus through several small openings under cover of the middle turbinate, while those of the posterior group open above the middle turbinate into the superior meatus, often by one ostium at its anterior extremity, while a second may be found in the wall of the spheno-ethmoidal recess above the superior meatus. The Ethmoidal labyrinth, in juxtaposition to the orbit, and separated from it by a thin osseous partition, sometimes perforated by congenital defects, and through which venous channels communicate with the ophthalmic veins, is a possible source of orbital infection, and indirectly, may be the starting point of thrombosis of the cavernous

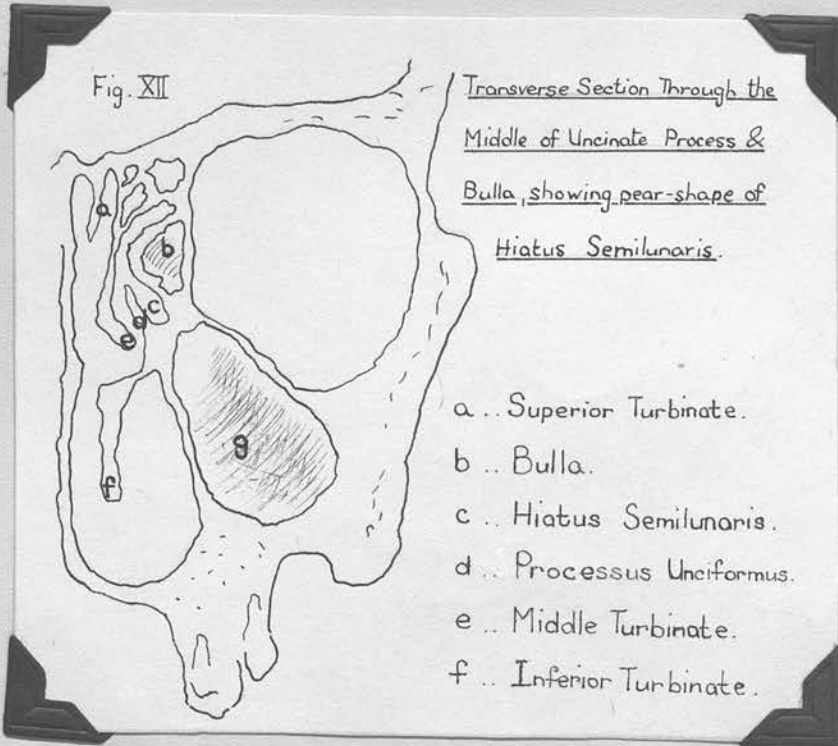
sinus. Further through its central position in relation to the other sinuses and its extensions into the bones with which it articulates, the suppurating ethmoid cells may infect the neighbouring air-spaces as a result of destruction of partition walls.

Frontal, Lachrymal, Ethmoidal & Superior Maxillary in Normal Position.



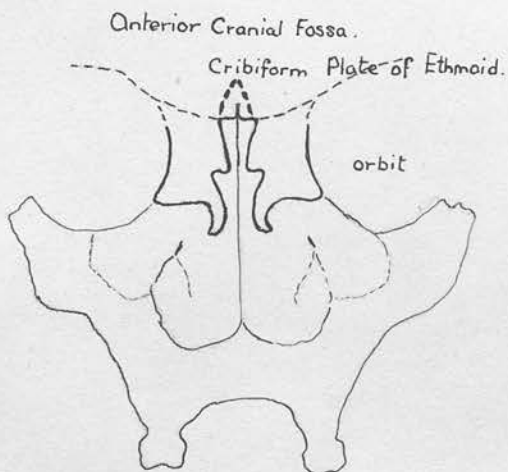
Fig. XI

- a.. Frontal Bone.
- b.. Ethmoid (orbital plate)
- c.. Lachrymal Bone.
- d.. Superior Maxilla.
- e.. Nasal Bone.



Relation of Ethmoid Labrynth to Surrounding Structures.

Fig XIII





Cross-section Behind Uncinate Process Showing relation of Ethmoid  
Labrynth to Surrounding Parts.

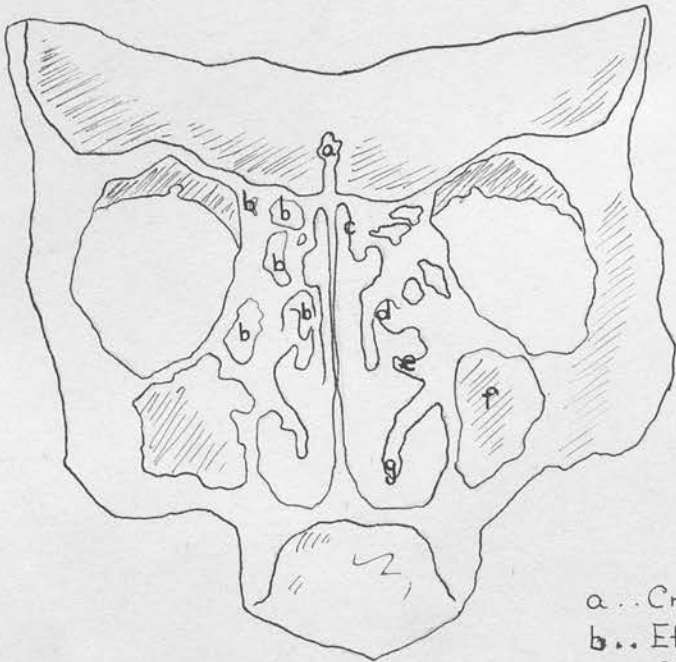


Fig. XIV

- a.. Crista Galli.
- b.. Ethmoid cells.
- c.. Superior Turbinate.
- d.. Bulla.
- e.. Uncinate process.
- f.. Maxillary Sinus.
- g.. Inferior Turbinate.

Lateral Wall of Nose with Anterior Half of Middle Turbinate

Removed.

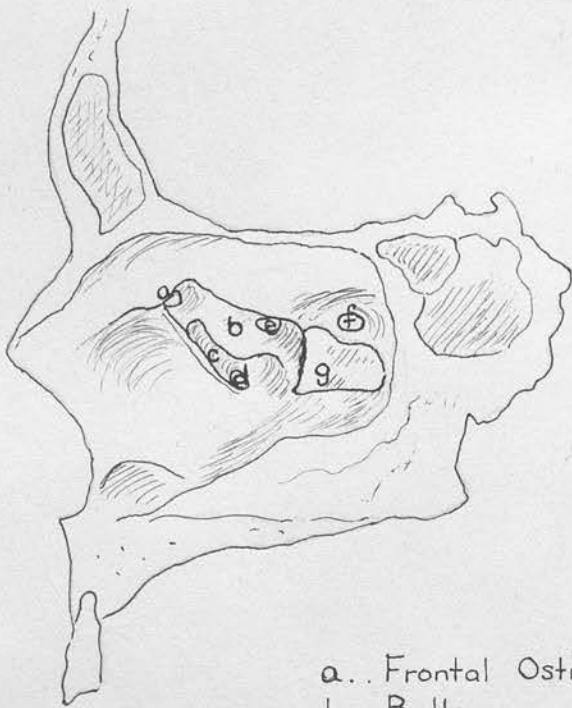


Fig. XV

- a.. Frontal Ostium.
- b.. Bulla.
- c.. Hiatus Semilunaris.
- d.. Maxillary Ostium.
- e.. Ant. Ethmoid Ostium.
- f.. Post. Ethmoid Ostium.
- g.. Post. End of Middle Turbinate.

The Sphenoidal Sinus occupies the body of the sphenoid bone. It is sometimes recognised at birth as a small offshoot of the nasal cavity, and may attain the size of a bean as early as the sixth year. The cavity is subject to considerable variations and may extend into the basi-occipital, the great and small wings of the sphenoid, and the base of the pterygoid processes. When the sinus is large, its walls are thin and its relationship to a number of the cranial nerves and vessels is correspondingly increased. The clinical importance of the sinus rests mainly upon its contiguity to the under surface of the brain and to certain cranial nerves in its immediate neighbourhood. Thus, in relation to the roof or superior wall lie, from before backwards, the frontal lobe and olfactory tract, the optic commissure, the pituitary body, and sometimes the Pons Varolii, while close to the angle formed by the roof and the lateral wall of the sinus, the optic nerve and the ophthalmic artery pass forwards to the orbit.

The lateral wall is contiguous to the Internal Carotid artery and the cavernous Sinus posteriorly: in close contact with its anterior part, where it

forms the inner boundary of the superior orbital fissure (sphenoidal fissure) are the third, fourth and sixth nerves, and the ophthalmic division of the trigeminus. The ophthalmic vein passes through the same fissure in its course from the orbit to the cavernous sinus. Piercing the root of the great wing which projects from the lower part of the lateral aspect of the body of the sphenoid is the foramen rotundum, transmitting the maxillary nerve (superior maxillary division of fifth,) while lying behind and slightly external to it is the foramen ovale, transmitting the mandibular nerve (inferior maxillary division of fifth.) In relation to the floor of the sinus, and traversing the root of the pterygoid process is the pterygoid canal, in which lies the nervus canalis pterygoidei (Vidian Nerve) formed by the union of the greater superficial and deep petrosal nerves carrying the motor and sympathetic roots to the sphenopalatine Ganglion.

The Medial or internal wall is the intersinus septum, and owing to the pronounced manner in which it may deviate from the medial plane, the sinus of one side, right or left, may come into close relation with one or more of the cranial

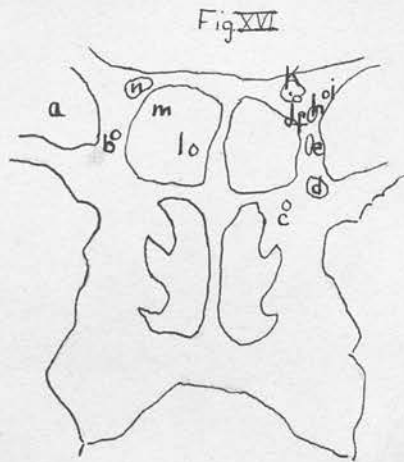
nerves of the opposite side, so that heterolateral symptoms and signs may develop in connection with inflammation in one sphenoidal sinus. The anterior wall, vertical in its upper part, inclines downwards and backwards to meet the floor of the sinus. Its external or ethmoidal portion articulates with the posterior end of the lateral mass of the ethmoid, and completes the ethmoidal cell labyrinth in this situation. In some instances the lower part of the anterior wall may form a partition between the sphenoidal and maxillary cavities. Its mesial nasal portion contains the opening of the sinus. The ostium sphenoidale is situated as a rule in the upper part of the nasal segment of the anterior wall, and therefore it is not well placed for the drainage of the cavity. Its position varies, however, both in its relation to the floor of the sinus and to the medial plane. It communicates with the sphenothmoidal recess, situated in the most posterior and superior part of the nasal cavity. When the sinuses are well developed, their osseous walls are correspondingly thin, and, in many cases, dehiscences occur in the bone: consequently inflammatory conditions may affect one or more of the contiguous nerves

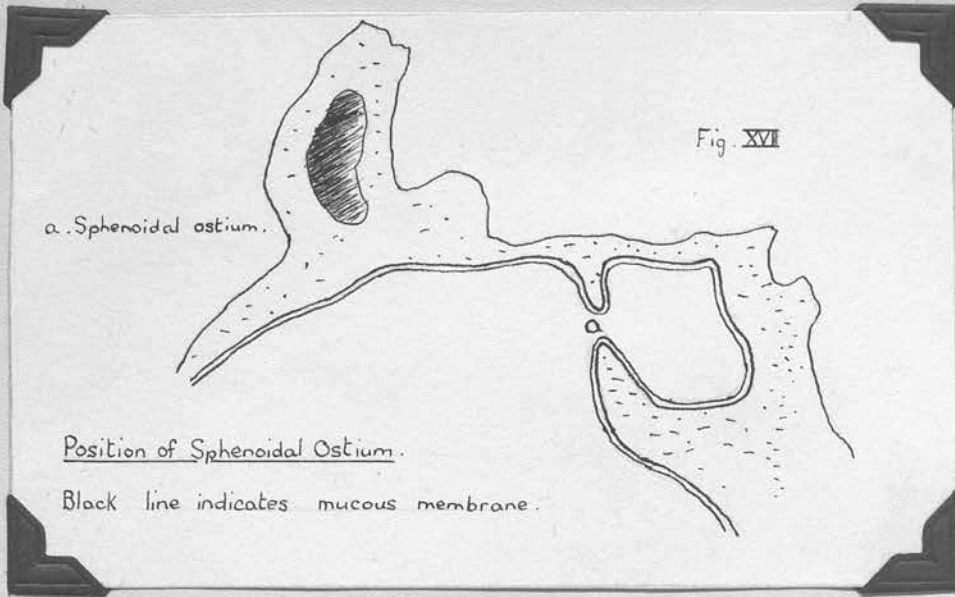
and give rise to visual disturbances, paralysis of orbital muscles, and neuralgia in the distribution of the trigeminus. For the same reason, cavernous sinus thrombosis and basal leptomeningitis may complicate inflammation in the sphenoidal sinus.

The presence of such clinical conditions as these should draw attention to the possibility of sphenoidal sinus or posterior ethmoidal cell disease.

Coronal Section Through Sphenoidal Sinuses & Posterior Part of Nasal Cavities (from behind) showing the Relations of some of the Cranial Nerves to the Wall of the Sinuses.

- a. Middle Cranial Fossa.
- b. Oculomotor Nerve. (3).
- c. Vidian Nerve.
- d. Maxillary Nerve.
- e. Internal carotid artery.
- f. Abducent Nerve. (6).
- g. Ophthalmic Nerve.
- h. Trochlear Nerve.
- i. Ophthalmic Artery.
- j. Right Optic Nerve.
- k. Sphenoidal ostium.







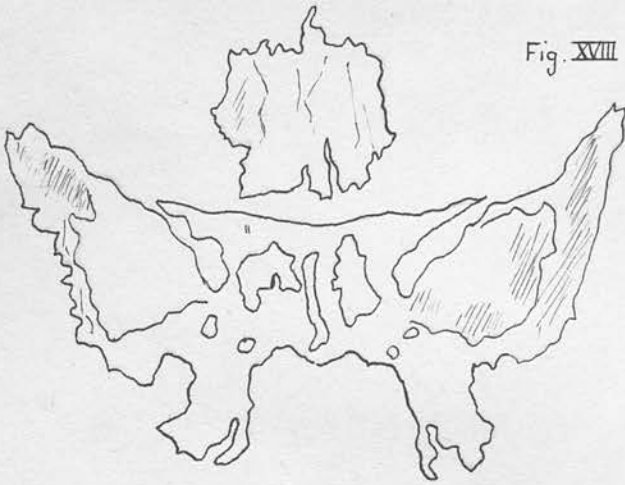


Fig. XVIII

Sphenoid Bone & Ethmoid Dis-articulated.

Sphenoid Sinus enlarged Anteriorly, Encroaching Upon the  
Space Normally Occupied by the Posterior Ethmoidal Labrynth.

- a. Superior Turbinate.
- b. Middle Turbinate.
- c. Sphenoid Sinus.



Fig. XIX

### 3. Etiology.

The causation of many cases of Accessory Sinus infection is clear, but in others it is obscure. In most instances it is due to the extension of infection from the nasal cavities: but it may also be due to infection through the blood stream, as Killian has pointed out in Scarlet Fever. In children the condition is frequently the result of one of the infectious diseases, e.g. scarlet fever, diphtheria, measles, etc. In adults it is frequently the result of influenza, and even pneumonia.

Inflammation may occur during an attack of acute rhinitis or 'cold in the head', and more especially if attacks are repeated and chronic rhinitis supervenes.

Other etiological factors are injuries to the facial bones, operations upon the nasal and post-nasal cavities, injudicious douching of the nose, bathing and diving, atrophic rhinitis, syphilitic caries or necrosis, tubercle, malignant disease and foreign bodies. In the case of the maxillary sinus, dental disease and tooth extraction may be responsible, but nasal infection of this cavity is more common. Finally one sinus may infect the other.

### Bacteriology.

According to the researches of Lewis and Logan Turner who have made a special study of the bacteriology of sinus inflammation, pyogenic cocci are more often responsible than bacilli for sinus suppuration. Four main types of cocci are commonly met with, viz. pneumococci, streptococci, staphylococci and diplococci of the type of micrococcus catarrhalis. The following groups of bacilli not infrequently occur (a-) B. Coli and its allies: (b) Putrefactive bacteria such as B. Proteus. (c) A diphtheroid group: (d) B. Influenzae. (e) Dental organisms B. gangrenae pulpaee and, B. necrodentalis: (f) An obligate anaerobic group containing B. perfringens and B. ramosus. The two latter groups occur usually in the maxillary Sinus. Tilley and Shattock have also reported the presence of fungus growth in the antrum and ethmoidal cells, demonstrating the mycelium of *Aspergillus niger*.

### Pathology.

The inflammatory affections may be non-suppurative (catarrhal) and suppurative, and in both varieties the inflammation may pass from an acute into a chronic stage. In simple catarrh there is oedema of the submucosa, with slight

alteration of the superficial epithelium, and with a moderate leucocytic infiltration of the submucous tissue. The discharge is somewhat mucoid, transparent, often appearing in the washings in the form of "blobs". In the suppurative type - the histological appearances vary. There may be little or no oedema, but considerable leucocytic infiltration, the epithelium being unchanged in some cases, but with extensive metamorphosis or with entire disappearance in others. On the other hand, the oedema and leucocytic infiltration are sometimes pronounced, with slight or extensive epithelial changes. The discharge is definitely purulent. Disease of the osseous walls is not a frequent concomitant of suppuration in the sinuses. When infection is virulent, however, or when the ostium becomes blocked and drainage interfered with, caries and destruction of one or more of the walls may occur, and the infection passes beyond the boundaries of the affected sinus, involving the cheek, the orbit, or the cranial cavity. It is important to remember and compare the pathological condition known as Mucocele of the Accessory sinuses. This condition arises occasionally in connection with the anterior ethmoidal cells and frontal sinus, and is characterized

by a swelling situated above the medial canthus of the eye, or occupying the area beneath the medial and middle thirds of the supra-orbital margin. The etiology of this condition is still somewhat obscure: injury has been suggested as a causative factor, while possibly a preceding catarrhal condition may lead to blockage of the ostium of the sinus or cells, followed by accumulation of secretion within the cavity and gradual thinning of the least resistant of its walls. The important point is that there is an entire absence of inflammatory mischief. If inflammatory symptoms do develop, the condition is converted into a pyocele.

Maxillary Sinus:

The antrum is more often diseased than its fellow sinuses, because it has one more etiological factor, namely, the intimate relation of its floor to the roots of the teeth. Also because of the extremely unfavourable position of its ostium, infection is much more prone to occur, and further certain affections of the alveolus are liable to affect this cavity. The teeth from the canine to the wisdom bear more or less relation to the floor, the second premolar and the first molar being the closest in proximity, so that any inflammatory condition around these roots could be easily trans-

mitted to the sinus mucosa. The following are etiological factors:

1. Idiopathic , i.e. arising in the sinus itself - rare -.
2. Direct extension from the nasal mucosa - coryza - .
3. Infectious diseases (circulatory system).
4. From the alveolus (contiguity -blood:) (continuity-bone).
5. Through contamination from overlying Sinuses.
6. Foreign bodies.
7. Traumatism (galvano-cautery and packing of the nose), direct or indirect. Frostbite.
8. Osteomyelitis, tuberculosis, syphilis, and malignant tumours.
9. Chronic or Latent Eruptyema.

Idiopathic infection although reported by several authors is very rare and I have never observed it.

Direct extension from the nasal cavity is the most frequent cause of maxillary Sinusitis, and there is a great liability for the disease to become chronic, owing to the high situation of the ostium, and the turgescient appearance of the middle turbinate blocking the outlet. In addition, the pathological changes in the mucosa which are

brought about by pressure and insufficient aeration causes the disease to become chronic.

Infectious disease:

The most important of this group is Influenza in adults, while any of the infectious diseases in children may cause it.

From the Alveolus; Formerly it was thought that every case of antral empyema was directly due to dental infection. As the result of much research work the relation is placed now at approximately 20 to 30 per cent.

Antral infection may result from dental origin in several ways:

1. By direct continuity - carious tooth.
2. Through Periostitis.
3. Through the circulatory system.
4. Circumscribed or Diffuse Osteitis of the alveolar process.
5. Rupture of an infected dentigerous cyst.
6. Secondary to teeth extraction. This infection may occur in three ways:
  - (a) Where roots of teeth lie bare within the antrum and on extraction leave a fistula which leads directly into the mouth.
  - (b) Where the dental roots penetrate the osseous floor of the sinus but are covered by the sinus mucosa only.



- (c). Directly as a result of traumatism  
from the improper extraction of teeth.

Infection by Direct Continuity may occur in  
three ways:

1. Manifest caries.
2. Hidden caries.
3. Dead teeth.

Through contamination from overlying Sinuses:

This can only occur from the frontal  
and possibly anterior ethmoidal under certain  
anatomical and pathological conditions. The  
anatomical conditions are that the uncinatè pro-  
cess must be of sufficient width to carry and  
guide the purulent secretion to its posterior  
extremity, and the pathological conditions are  
that the sinus mucosa must be in a condition to  
become infected from the secretion.

Foreign Bodies: Sinus suppuration may follow  
the action of foreign bodies which may gain  
ingress in three ways:

- (a) Through the natural ostium or an acces-  
sory ostium e.g. blood, vomited matter,  
snuff, parasites and worms, and chloride  
of iron.
- (b) Through the osseous walls, with injury to  
the mucosa.
- (c) Through an artificial opening in the

alveolus. Supernumerary and inverted teeth by their upward growth into the floor of the antrum may cause a spreading infection which involves the cavity of the sinus.

Traumatism - direct and indirect. This is usually the result of an accident from a fall, blows of a blunt instrument, unskilled extraction of teeth etc. Indirect through the nasal wall may be caused by galvanocautery of Ethmoid region, and tampons in the nose and intra-nasal surgical procedures .

Osteomyelitis: Not uncommon during first year of infant life, thereafter extremely rare.

Syphilis, occurs through necrosis of some portion of the bony wall through the dissolution of a tertiary lesion. The nasal wall beneath the inferior turbinate and the anterior wall have been reported thus affected, but the condition is rare.

Tubercular disease of the antrum occurs more frequently than with the neighbouring sinuses, yet is of itself of great rarity. In true tubercular infection the bacillus will always be found on microscopical examination.

Malignant Tumours: Sarcomas and particularly rapidly-proliferating epitheliomas, on account of their poor blood supply, can break down and ulcerate, thus producing by continuity, a

purulent process within the sinus cavity. This form of empyema is characterized by the peculiar intensive odour of the discharge and its being mixed with blood and broken down portions of the tumours. The lateral nasal wall is also usually displaced inward toward the nasal septum, thus greatly narrowing the nasal cavity on the affected side. The maxillary sinus is the seat of malignant disease more often than all the remaining sinuses together.

#### Chronic or Latent Empyema.

Under certain circumstances, maxillary sinus empyema may begin in a chronic form, particularly when the disease occurs from the alveolus. This is due to the primary irritation being mild and continued for some length of time, allowing the mucous membrane to react and fortify itself against the infection. The mucosa however, finally succumbs to the progressive inflammation, and a well-marked case of chronic empyema results.

#### Mucous Polyps.

Polypoid growths and hyperphopies in conjunction with a purulent discharge are commonly met with in the maxillary sinus, more rarely associated with a serous discharge. Single polyps sometimes attached to a long pedicle and unassociated with suppuration occasionally take their origin in the mucosa of the antrum: They

usually find their way into the nasal cavity through an accessory ostium or by causing an artificial accessory ostium by pressure ulceration through the pars membranacea. After emerging from the sinus they enlarge by growing backward and may form a so-called solitary choanal polyp.

#### Frontal Sinus:

Speaking generally, what applies to one sinus is equally applicable to another, so far as etiology is concerned. Individual points regarding the frontal, however, should be emphasized. The Frontal ostium often empties into a narrow tube (Ductus nasofrontalis), while the other sinuses have their outlets situated directly into one of the nasal passages. The nasofrontal duct is susceptible to occlusion by swelling of the anterior portion of the middle turbinate, thus offering a more or less impermeable barrier to the outflow of exudate.

Deviation of the nasal septum also exercises a considerable secondary influence in this respect from the mere mechanical obstruction of the middle nasal passage, which is doubly emphasized when inflammation sets in on that side.

In practice one almost invariably finds that in cases of Frontal Sinusitis there is deviation of the septum toward the affected side. This condition must therefore be an important etiological factor in the causation of Frontal Sinusitis.

Inflammation within the sinus may be set up by inflammatory approximation of the mucosa outside of the sinus leading to the ostium, thus preventing the ingress and egress of air. The negative pressure thus occasioned, but its sucking action causes the mucous lining to react in no uncertain manner, giving rise to serous inflammation (if no infection occurs) and to purulent inflammation should pathogenic organisms be present. There is also the possibility of infection of the Frontal sinus from the maxillary by contiguity. In purulent inflammation of the maxillary sinus the continually forming pus constantly exudes from the normal ostium and as a result of this continual irritation the mucosa around the orifice becomes affected, infection creeps along the infundibulum to the ethmoid cells and thence to the Frontal Sinus. Foreign bodies in the nose, particularly if lodged near the hiatus - semilunaris may readily set up an

infection which spreads to the mucosa of the Frontal Sinus. Tampons are especially a source of infection while in this region.

### Ethmoid Labyrinth.

The Ethmoid Labyrinth is subject to the following pathological conditions.

1. Acute Catarrhal Inflammation,
2. Acute suppurative Inflammation,
3. Chronic Catarrhal Inflammation (Hyperplastic Ethmoiditis),
4. Chronic Suppurative Inflammation (Empyema),
5. Chronic Catarrhal Inflammation with Suppuration.

Acute Catarrhal inflammation occurs to a greater or lesser degree with every acute coryza, depending upon the length and severity of the attack. The mucosa of the unciniate process, bulla and external surface of the middle turbinate becomes swollen, having the appearance of a myxomatous degeneration with punctiform hæmorrhages on various parts of the surface. The interior of the cells shares in these pathological changes. Resolution occurs more slowly than in the general nasal mucosa.

Acute Purulent Inflammation or acute empyema of the ethmoid cells, is generally speaking, an

uncommon affection. When it does occur it is usually associated with acute frontal sinus empyema, or if arising idiopathically may be traced to one of the infectious diseases (influenza, diphtheria, scarlet fever, measles, etc. Resolution occurs more readily than in the sinuses proper on account of the relatively good drainage of each cell, together with the action of the cilia, which on account of the small mass of secretion to be expelled, are not so taxed as in the larger cavities. In this form of disease the mucous membrane is deep red and covered with a thick purulent secretion. In contra-distinction to the catarrhal type, this form is directly due to micro-organismal invasion.

Chronic Inflammation of the Ethmoid Labyrinth is seen in three different chronic forms, two being entirely separate and distinct, and the third a combination of these.

In contradistinction to empyema, the causative factor for Hyperplastic (Chronic Catarrhal Inflammation), Ethmoiditis depends rather upon a protracted and a more or less continual disturbance in the nutrition of the Ethmoid capsule than upon inflammatory changes with bacterial invasions.

Mechanical causes would seem to be pre-eminent. Repeated attacks of coryza, each one leaving greater changes in in the mucosa, certainly contribute to the ultimate formation of polypoid tissue. Particularly wide nares, allowing the inspired air to act as a distinct irritant, are often found associated with polypoid degeneration of the operculum of the middle turbinate.

It is a well-known fact that once polypoid tissue is formed in the nose, just that much greater tendency the mucosa exhibits to transmit this hyperplasia to neighbouring cells; therefore the longer the process has been standing, the greater in all probability the polypoid infiltration.

The continual slight irritation of a certain portion of the mucosa causes at first hyperaemia with subsequent outflowing of serum into the interstitial spaces of the connective tissue. If the irritation be mild the hypertrophy will tend to spread itself over a broad area, gradually losing its polypoid character in the surrounding tissues. If, however, it be great, the continual collection of serous elements, assisted by the force of gravity, will soon cause the appearance of a true mucous polyp. These changes



occur principally upon the anterior end of the middle turbinate, along the uncinatè process or in the region of the ethmoidal bulla (floor of ethmoid capsule), when the changes occur in the cells proper, some interference has taken place in the collateral circulation from partial occlusion of their ostia or direct continuation of the process from one cell to the other.

Microscopically. The external lining membrane before polypoid changes occur shows considerable round cell and leucocytic infiltration. No metaplasia of the ciliated epithelium into squamous occurs until the tissues assume a marked polypoid character except over the area which has been subjected to irritation.

There is marked connective-tissue formation beneath the basement membrane, the meshes of which become dilated and filled with exudate. The mucous glands are primarily hypertrophied, not infrequently showing enormous cystic dilatation of their acini. The blood vessels are surrounded by leucocytes and soon begin to atrophy. The periosteum is hypertrophied and shows fibrous degeneration along the bone, numerous bone-cells range themselves, some forming new osseous tissue, (osteoblasts) others causing reabsorption

(osteoclasts). In well-marked cases the osteoclasts appear to predominate. These pathological changes are transmitted directly through the bone to the periosteum and subjacent tissues. (Skillern - The Comparative Pathology of Hypertrophic and Suppurative Ethmoiditis.)

Chronic Suppurative Inflammation (Empyema).

Suppuration in the ethmoid cells usually is but an accompaniment of empyema in one of the larger cavities: however it may occur as a separate process. Acute infectious diseases seem to exert a peculiar influence toward ethmoidal suppuration, in all probability by lowering the vitality of the lining mucosa. Another factor is the forcible blowing of the nose during a coryza, thus forcing pus and inflammation into cells that would otherwise remain normal. Suppuration in the Ethmoid cells not infrequently following packing the nose after an intra-nasal operation. Cauterisation with the actual cautery after the removal of polyps often causes purulent infection, as the direct result of the intense inflammatory reaction. It is also possible for infection of the ethmoid cells to occur through the lamina papyracea following orbital abscess of idiopathic origin.

Pathology: Chronic suppuration in the ethmoid

cells is invariably due to bacterial infection. The changes in the mucosa are similar to those in empyema of the large sinuses, being thickening with a marked formation of fibrous tissue. There is a marked tendency toward occlusion of the ostia through swelling of the mucosa, particularly in the smaller cells - a condition due to the special tenderness and looseness of the ethmoid mucosa. Round cell infiltration is prominent: gradual proliferation of the epithelium occurs, which in severe cases is often absent in spots, being replaced by granulation tissue.

Chronic Hyperplastic Inflammation with Suppuration.

This classification (Ross Skillern's) has found considerable opposition, as most observers contend that the suppuration precedes and does not follow the polypoid hypertrophies.

It has been an old and accepted view that the constant drainage of a purulent secretion over a given area of nasal mucosa will sooner or later give rise to polyposis: therefore these hyperplastic structures are the result of secondary irritation due to the outflow of secretion.

Ufrenorde, on the other hand, contended that the suppuration was more often secondary to the polyposis: He reasons as follows: From repeated

attacks of simple catarrh, numerous polyps make their appearance from the ethmoid region until a greater portion of the nasal chamber becomes occluded, ventilation, as well as the possibility of cleansing by blowing is so seriously interfered with, that the continually-forming secretion becomes stagnated between the polyps. Putrefaction follows and infection results, particularly during an attack of acute coryza. As the ostia of the sinuses are more or less occluded, the infection spreads along their mucosa and results in its permanent involvement. This theory took its inception from the reports of Alexander and Skrodski, who found on the section table, absolutely no relation between the occurrence of polypi and the existence of sinus empyema. Huder seems to consider that the purulent infection precedes the hyperplasia for he says "as the inflammatory process continues the secretion loses all purulent character and the hyperplasia begins. Lewis and Turner are of opinion that nasal polyps occur more frequently in cases of associated sinus suppuration than in simple cases, particularly in ethmoidal disease.

To sum up this difference of opinion, it is found that polypi occur in a certain percentage



of accessory sinus suppurations. It apparently does not depend upon which sinus is affected, although they occur more often with ethmoidal disease. They often occur entirely disassociated with Sinus suppuration and vice-versa. Why they occur in certain cases of sinus suppuration and not in others is as yet unexplained.

### Sphenoidal Sinus.

#### Acute Inflammation:

The deep lying position of the sphenoid sinus prevents the observation of primary changes in its mucosa, therefore little is known of the initial pathology of incipient sinusitis affecting this cavity. The ostium being situated comparatively high upon its anterior wall, in an unfavourable position for drainage, it resembles in some respects the maxillary sinus. The extreme narrowness of the spheno-ethmoidal fissure also predisposes to occlusion, particularly during the engorgement coincident to an ~~attack~~ ~~of~~ acute coryza. The sphenoid is more or less affected during the course of every acute coryza. In most cases resolution of the sinus mucosa sets in as soon as the primary factor (the coryza) abates: whether the sinus disease becomes chronic depends largely upon the condition of the passages for sufficient drainage and aëration of the diseased

cavity. It is rare that the sphenoid becomes acutely infected per se without some of the other accessory sinuses, particularly the posterior ethmoid cells, sharing the infection. The latter, however, by reason of their better drainage, may entirely recover, leaving the disease isolated in the mucosa of the sphenoid. This is particularly true in those cases which follow the infectious diseases, notably influenza. The pathology and microscopic histopathology of the changes in this sinus differ but little from those observed in the other sinuses.

Chronic Inflammation:

The vast majority of acute inflammations within the sphenoid recover either with or without direct treatment, but following every attack there remains a greater predisposition for the sinus to become again involved at every fresh attack of coryza. Therefore successive attacks of acute inflammation predispose to chronic inflammation. Any anatomical irregularities, such as deviated septa, or pathological products, as polyps or hypertrophies, which contribute towards partial occlusion of the spheno-ethmoidal fissure, must also be predisposing factors. Tuberculosis of the

sphenoid is a very rare condition, but has been found.

#### Pathology.

The changes seen in the mucosa during chronic inflammation depend upon the intensity of the pre-existing acute process. Regeneration occurs in some parts, leaving islands of inflamed or degenerated mucous membrane. The areas of predilection for these poly-poid swellings would seem to be in the region of the ostium and on the floor of the sinus. A peculiarity to this sinus is the tendency of the lining mucosa of the floor to become detached from the underlying bone, thereby predisposing to osseous involvement from the inflammatory products, lying in direct apposition to the bony floor.

#### Microscopic Histopathology.

Unless the entire lining of the sinus is chronically affected, two conditions are usually found:

(a) oedematous and (b) sclerotic. The first represents a condition where the mucosa has but recently become infected or it has possessed sufficient regenerative power to partially combat the inflammatory process.

The second or sclerotic condition, represents an advanced stage of pathological degeneration

of the mucous membrane. In certain cases the mucosa is enormously thickened and has a velvety consistency. This inflammatory hyperplasia is, for the most part uniform, as it is extremely rare that one finds true pedunculated polyps springing from the mucosa of the sphenoid sinus, although occasionally they have been encountered.

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Maxillary Sinusitis.

In my experience the commonest etiological factor of infection of this sinus in children has been the infectious fevers, and also following operations on the throat and nasopharynx.

In adults following influenza and operations on the throat in debilitated subjects.

I have also had two cases - both adults - whose antra were involved from infected dental cysts.

In several cases the exciting cause has been a sequestrum of a portion of the Ethmoid labyrinth, and in others carcinoma of the Ethmoid and Maxillary Sinus.

Quite a large number of cases have also been infected from disease in overlying sinuses, particularly the anterior Ethmoid cells and sometimes even from the Frontal Sinus.

One case which ended fatally was due to infection with actinomycosis.

I have had two cases where the Maxillary antrum, in each instance the right antrum only, was infected by the diphtheria bacillus. These cases have been described fully in my Notes of cases, but in case No. 8, it is of interest to note that even after infected tonsils and adenoids were removed elsewhere, the nasal discharge did not clear up and it was only when sporadic outbreaks

of diphtheria were traced by the public health authorities to this particular patient, that the case was referred to me and I found an infected antrum. This case bears out my contention that even after operation on the throat, all cases should be thoroughly re-examined in four to eight weeks time, to exclude any accessory sinus infection.

I have also quoted in my Notes of cases an example of antrum infection following Whooping Cough. Case No. 3.

#### Frontal Sinusitis.

I have found that severe attacks of Influenza and recurring "colds" have been the chief predisposing cause of Frontal Sinus infection. In addition most of my cases have exhibited sepsis either in the nose - ethmoidal disease - or in the throat - tonsillar or dental sepsis - while a large number have also had a marked anatomical deformity in the form of high deviation of the septum.

I have given full accounts of three cases, Case No. 1, No. 2. and No. 12, in Notes of Cases, where the Infection of the Frontal Sinus was precluded by Influenza of seven to fourteen days

duration, resulting in severe headache and nasal obstruction alternating with nasal discharge. In one of my cases, Case No. 5. the infection resulted in association with Maxillary antrum infection following Tonsillectomy. This patient was a hospital nurse who had been in a debilitated condition for some months previous to operation, and who had<sup>also</sup> a chronic aural discharge.

Ethmoidal Sinusitis:

I have found this very common, sometimes occurring alone, sometimes in association with Frontal Sinusitis and less commonly with antral sinusitis. The etiological factors have been extreme deviation of the nasal septum, frequent colds, infectious fevers, influenza and irritation from coal and flour dust, and also sepsis in the mouth (teeth) and throat (tonsils and adenoids). As regards Nasal Polypi, I have had more cases where there was an associated sinus suppuration, and yet others where the polypi were obviously predominant with practically no sinus suppuration.

In my view where there has been a definite source of irritation in the form of, say coal or flour dust, the polyposis is primary and suppuration if any is secondary. On the other hand,

the majority of cases seem to me to be associated with a definite infective basis and suppuration would seem to be the primary factor in the production of Polypi.

I have given notes of two cases, Case No. 10, and Case No. 11, where there was Ethmoidal Sinusitis, associated with gross polypi formation. In case No. 11, there was a definite etiological factor in the form of coal dust, and I am of opinion that in this case the polyposis was primary.

In Case No. 10, the etiology was recurring colds in the head, and an infective basis seemed to be the primary factor in the causation of polypi.

#### Sphenoidal Sinusitis:

This sinus is more or less affected during every acute coryza, but resolution occurs normally as a rule when the coryza abates: unless the condition of the passages precludes sufficient drainage and aeration of the affected sinus.

Frequent recurring colds in the head, deviation of the nasal septum, polypi or hypertrophies which tend to cause partial occlusion of the sphenoidal fissure are the chief predisposing causes of chronic infection in this sinus.

#### 4. Symptomatology.

The symptomatology of Accessory Sinus infections must be divided into local and general.

Localised Headache. Headache is one of the commonest symptoms. As an individual symptom indicative of disease of a particular sinus it is thoroughly unreliable, but its presence or absence in the entire symptom-complex is most important. Its mere absence proves nothing, while its presence may be of inestimable value in making a correct diagnosis. The character of the headache varies between the sharp twinging of neuralgia and a heavy, full, benumbed sensation: often the pain is indistinguishable from ordinary trigeminal neuralgia. These conditions are frequently associated, the acute neuralgia being followed by a diffuse headache or more often by a sense of weight and fullness. As a general rule, acute inflammation of a sinus is characterized by neuralgic pain in the affected cavity (frontal and maxillary): there may accompany this referred pain through the other nerve branches. In chronic Sinusitis the headache may take on any form, however one characteristic is always noted, that is, diffuse headaches from accessory sinus disease during recurrent attacks, cause pain in the

same portion of the head. Regarding the frequency of pain in sinus inflammation, Grünwald puts it at 100 per cent. in the acute forms, and 50 per cent in the chronic. In certain cases intervals of complete rest are observed between the attacks of pain. Not infrequently headache manifests itself at a certain time of the day, lasting a few hours, then vanishing as quickly as it appeared, only to return at the same time the following day. The pain in these cases usually appears in the forenoon and lasts several hours, and this is characteristic of Frontal Sinus inflammation. The head pain is intensified by constipation, straining at stool, stooping, sudden jarring as jump-ing and lighting upon the heels, also by severe mental work and loss of sleep. The indulgence in indigestible foods, as well as alcohol and tobacco greatly contributes towards this cause. Occasionally the pain and general feeling of distress in the head will become so great as to excite suicidal tendencies in the patient. As regards definite localised areas, a dull pain between the eyes is usually significant of ethmoidal disease, and this is usually accompanied by a sense of weight over the vertex. Acute Maxillary sinusitis, during some stage of its course, will often show neuralgic pain

directly over the sinus. In chronic antral suppuration the pain is often limited to the distribution of the supra-orbital nerve. In chronic Frontal Sinus inflammation, the pain, when present, is apt to be limited to the supra-orbital region, is often remittent in type, while during remissions of pain, a dull heavy sensation frequently intervenes.

Inflammation of the sphenoid sinus can give rise to the most excruciating pain through the temples, extending into the mastoid process and even the middle ear and over the vertex, which in this region changes its character to a sense of heavy weight and oppression. This sinus along with the posterior ethmoidal cells, also causes varying degrees of pain in the occipital region.

#### Tenderness over the Sinuses.

This is of value as a diagnostic symptom when present only over the frontal sinus, very rarely over the maxillary. The point of tenderness is confined to a small area on the floor of the sinus directly above the inner canthus of the eye. This is the point where swelling usually occurs, being the thinnest bony portion of the wall, and is often the seat of exquisite tenderness.

This symptom, when present, is pathognomonic of frontal sinus inflammation, but comparison should be made with the sound side to elicit the distinction as in neurotic individuals false impressions may often be obtained.

Purulent secretion in the Nose.

If purulent secretion re-appears in the same spot of the nose shortly after being removed, the evidence is positive that a reservoir of pus exists in a particular locality of the nose (beneath the anterior third of the middle turbinate for anterior Sinus disease, in the olfactory fissure and above the posterior end of the middle turbinate for posterior disease), and is the classical symptom of sinus empyema. This symptom when present is pathognomonic, unfortunately, however, it is often absent, particularly at the morning examination.

In acute cases and acute exacerbations of chronic inflammations the secretion is rather profuse. Diminution of secretion is usually a sign of remission of the inflammation; but sometimes it is due to occlusion of the drainage passages with exacerbation of the disease. However in the latter circumstances, the subjective symptoms are always intensified to such a degree that the diagnosis is unmistakable. The



consistency of the secretion may change from time to time, depending upon attacks of acute coryza, the state of the weather etc. If the discharge is profuse, there may be a superimposed eczema on the tip and around the angles of the nose, which proves a source of extreme annoyance and discomfort. In acute infection the secretion is not so organised and mixes with the irrigating fluid to form a milky mass, while in chronic forms it forms balls and lumps which sink to the bottom of the liquid.

Cacosmia or a subjective sensation of an offensive odour in the nose is almost pathognomonic of sinus disease. This is intensified by sniffing.

Complete anosmia is not uncommon, specially if the olfactory fissure is closed by hyperphobies, or purulent secretion, or deviation of the septum.

Laryngeal Symptoms:

It occasionally happens that sore throat or hoarseness of various degrees may be due to infection in one or more of the accessory sinuses, and in this connection it is appropriate to quote the remarks of Grünwald who says "An

examination of a patient with chronic laryngeal affection must be considered incomplete until the exact condition of the nose and nasopharynx has been thoroughly investigated."

Pharyngeal Affections:

The symptoms resulting from pharyngeal disturbances depending upon sinus disease are either those of attacks of angina, often the result of tonsillar infection from the secretion, or those caused by chronic pharyngitis. In the latter the symptoms are caused by the continual irritation of the drying secretion, which produces constant hawking and rasping and a very irritable pharynx.

Bronchial symptoms, asthma, bronchitis, bronchiectasis and emphysema have been reported as complicating accessory sinus empyema by various writers. Gastric disturbances and even vomiting have also been complications of this type of infection.

Dizziness and vertigo are a frequent accompaniment of sinus suppuration. Physical and intellectual disturbances occur more particularly in the chronic form of the disease and manifest themselves as all kinds and

conditions of symptoms referable to disturbed mental equilibrium.

General Symptoms.

Sinus infection, particularly obscure ethmoid and sphenoid disease can produce Rheumatism and Fibrositis in various parts of the body.

Pyrexia is always present with acute inflammation and acute exacerbations of chronic affections.

Circulatory disturbances, ranging from a slight acceleration of the pulse to an actual condition of general congestion and producing flushing of the face, prominence of the superficial veins of the forehead and temple, visual disturbances and general irritability may occur at any time, but are usually synchronous with the occlusion of drainage. A predisposition to sleeplessness and even actual insomnia may be present also.

Nervous disturbances:

These are a frequent occurrence in sinus disease, and range from a feeling of great weakness which may suddenly appear and totally incapacitate the individual while present, to attacks of severe depression bordering

on melancholia. These symptoms are more marked in chronic frontal sinusitis than in any of the others, with the possible exception of the sphenoid.

Albuminuria and even acute nephritis have also been found to be directly associated with and probably depend upon purulent sinus disease.

In the event of these two occurring simultaneously the cause of the headaches might be obscured when albumen is found in the urine. Under these circumstances, it is wise to treat the sinus condition and the kidney affection as separate entities in order to give the patient the benefit of the doubt and clear up the conditions at the earliest possible moment.

Symptoms indicating the set of Accessory Sinuses  
Affected.

Some indication as to whether the anterior or posterior set of cavities is affected can be gained from the position of intra-nasal swellings, from the position and course taken by the discharge, and by the position of the pain in the head. If oedematous swelling and polypi are confined to the anterior third of the middle turbinal and to the corresponding part of the uncinate process on the outer wall, it is strong

presumptive evidence that one or other of the anterior set of sinuses is affected, i.e. one of those which open into the hiatus semilunaris.

If on the other hand the swelling is confined to the posterior third or upper surface of the middle turbinal, the probabilities are in favour of the posterior set being involved. Again, if pus is seen to be coming from under the middle turbinal or to be lying high up in the middle meatus, and if it is quickly replaced after being wiped away, suppuration of one or more of the anterior set of cavities may be diagnosed. If on the other hand, pus is coming from above the middle turbinal or lying in the olfactory cleft, or if on posterior rhinoscopy it be seen tracking over the vault of the naso-pharynx or lying on the upper surface of the posterior end of the middle turbinal, one or more of the posterior set of cavities is in all probability affected. Too much stress, however, must not be laid on the mere presence of pus in the post-nasal space as indicating disease of the posterior cavities, for in certain cases of suppuration of the anterior cells, and especially of the maxillary sinus, no pus may be seen in front, but there may be profuse post-nasal discharge. This is most likely to occur in disease of the

antrum of dental origin, in which the interior of the nose is normal, that is when the cilia of the nasal cavity are active and able to carry the discharge backwards along the normal route to the pharynx. In fact, in some cases of antral suppuration profuse post-nasal discharge may be the only symptom of which the patient complains. As regards headache it may be said, broadly speaking, that frontal headache accompanies disease of the anterior set of cavities, and that occipital headache accompanies disease of the posterior set, whilst vertical headache may occur in either.

Symptoms indicating the Particular Sinus involved.

This may be obtained from a consideration of the position in which the greatest pain is felt, the situation of direct tenderness, and that of referred tenderness. Some help may be gained also by a further consideration of the discharge. Occasionally also a temporary redness of the overlying skin may indicate the sinus involved.

Symptoms pointing to the Maxillary Antrum.

Pain: This varies with the amount of discharge retained within the sinus and with the chronicity of the disease. In some instances it may be most severe, in others entirely absent.

In recent subacute cases, commonly met with after influenza, the pain is chiefly in the infra-orbital region and along the malar eminence, and there is often a specially painful spot about an inch in front of the temporo-maxillary joint. There may also be pain in the teeth of the upper jaw. In more chronic cases the pain is chiefly over the side of the nose, and in the supra-orbital and infra-orbital regions. Supra-orbital pain does not by any means always indicate sinus disease, as it may be due to pressure of an enlarged middle turbinal against the septum. Direct tenderness is only met with in the more acute cases in which the sinus is distended by retained discharges. It may be discovered by pressure in the canine fossa or on the cheek.

#### Referred Tenderness.

Superficial tenderness, or rather sensitiveness of the skin is found on the side of the nose, over the malar bone and in the supra-orbital region. That over the malar bone is strongly suggestive of antral suppuration, but that on the side of the nose and in the supra-orbital region may also be present in frontal and ethmoidal troubles, and is probably due to pressure of the middle turbinal against the septum (Lack).

The Discharge:

The discharge from the nose may be continuous and profuse, or noticeable only on stooping or bending down the head. The latter is highly suggestive of suppuration of the maxillary antrum, though it sometimes happens in frontal sinus disease. Further if after cleaning the middle meatus, the discharge is not immediately replaced, but quickly reappears on bending the patient's head down and to the opposite side, there is a strong probability that the pus comes from the antrum.

Symptoms pointing to Frontal Sinus disease:

Pain: In Frontal Sinus disease pain is more often present than in antral disease, and is periodic. It commences in the morning and increases in severity till the discharge begins to flow from the nose, being sometimes so severe as entirely to incapacitate the patient. It is most marked over the upper part of the forehead and top of the head, but it is also common in the supra-orbital region. Pain on the top of the head is the most frequent and characteristic symptom of frontal sinus suppuration.

Direct Tenderness: In subacute or recent cases of frontal sinus suppuration, there is



often considerable tenderness on pressure over the sinus, especially in the angle between the orbital plate of the frontal bone and the nasal bone. In some chronic cases this tenderness can also be found and is a valuable diagnostic sign.

Referred Tenderness: In addition to the areas just referred to as indicative of pressure of the middle turbinal against the septum, superficial tenderness is often found on top of the head and over the upper part of the Frontal bone.

Discharge: When the frontal sinus is affected the discharge is greater in quantity and more continuous when the patient is in the upright position. After being wiped away from the middle meatus, the pus commences to collect again almost at once. Its reappearance is not as a rule hastened by bending the head down.

Symptoms; indicating disease of the Anterior Ethmoidal cells.

Pain: As a rule there is not much pain accompanying suppuration of these cells. There may be some dull aching between the eyes and on the vertex. If the pain is really severe and periodic, it generally means that the frontal sinus is affected

as well as the ethmoidal cells.

Direct and Referred Tenderness. Nothing of diagnostic value can be definitely stated on these points.

Discharge is more profuse in the upright position and is usually quickly replaced after being wiped away. When there are numerous polypi or small oedematous granulations in the ethmoidal region with pus exuding between them, suppuration will invariably be found in the ethmoidal cells, with or without accompanying disease of other sinuses.

Symptoms indicating sphenoidal Disease:

Pain is by no means a constant symptom in sphenoidal suppuration: when present it is generally felt at the back of the head, but sometimes at the back of the eyes or deep in the nose.

In rare instances pus may be retained and the sinus become distended, when acute headache accompanied by sudden blindness and paralysis of the ocular muscles may occasionally occur, and cases of thrombosis of the cavernous sinus have been reported.

The discharge is seen in the naso-pharynx, sometimes tracking over the vault, and sometimes collected on the upper part of the posterior end of the middle turbinate, where it often dries into crusts.

Symptoms indicating Posterior Ethmoidal Cell Disease.

These cells are very rarely affected alone. Either the sphenoidal is also implicated or some of the anterior ethmoidal cells. In one case, reported by Watson Williams, in which the posterior ethmoidal cells were affected alone, there was a subjective sense of thickness over the frontal region, deep-seated headache and aching at the back of the eye, obscurity of vision, loss of memory, aprosexia and discharge of pus from both anterior and posterior nares.

Complications: - or Special Symptoms.

These may be divided into those which are caused by septic absorption from swallowing pus or the drainage of discharge into the air passages, and secondly those which arise from direct local extension of the disease.

Examples of the first type are anorexia, dyspepsia or symptoms simulating gastric ulcer: anaemia and general debility: chronic pharyngitis, laryngitis and bronchitis with acute exacerbations: tinnitus, vertigo, Eustachian catarrh, and dry or suppurative inflammation of the middle ear: tonsillitis and recurrent attacks of erysipelas: ocular complications such as iridocyclitis or retro-bulbar neuritis may also occur.

In the second type the following may be found. Abscess of the orbit, pressure on the optic nerve causing optic neuritis, and various intra-cranial complications: e.g. Thrombosis which is usually caused by suppuration in the sphenoidal sinus and arises in the cavernous sinus causing proptosis, chemosis of the conjunctiva and fixation of the eyeball. It usually spreads to the opposite side and terminates fatally.

Extra-dural abscess or cerebral abscess may occur, and usually arises from perforation of the posterior wall of the frontal sinus:

Meningitis may occur - commonly as a result of suppuration in the ethmoidal cells.

Another complication which may arise from empyema of the frontal sinus and ethmoidal cells, is acute osteomyelitis - which may spread over the vault of the skull until the patient succumbs to meningitis.

All my cases exhibited in greater or lesser degree most of the signs and symptoms which I have mentioned in the foregoing remarks, but the following were particularly outstanding and clear cut, so I make special mention of them.

In cases No. 1, No. 2 and No. 12, which were examples of Acute Frontal Sinusitis, the most dominating symptom was pain over the forehead and

particular over the affected sinus. The pain was periodic in character and very severe. There was tenderness on direct pressure over the sinus, and extreme tenderness/<sup>on</sup> pressure over the floor of the sinus at the inner canthus in each case. In cases No. 1. and No. 2. there was swelling and oedema of the right upper eyelid and right side of forehead. In Case No. 1, the swollen area was red, hot and very tender and showed fluctuation, signs of an underlying abscess.

In each case there was pus in the middle meatus of the nose, and this immediately re-appeared after it was wiped away. Another common symptom was nasal discharge followed by nasal obstruction.

In cases No. 4. and No. 5. there was pain over the maxillary sinus. In No. 4. which was a chronic infection, pain was also present over the side of the nose and in the upper and lower eyelid regions. In No. 5, which was an acute infection, pain was very severe over the malar bone and eminence and also in the teeth. Pain developed later over the frontal bone as it became involved. There was profuse discharge from the nose, worse on stooping, and followed by periods of nasal obstruction. In case No. 4, the discharge was very offensive to the patient and her friends. In cases No. 7 and No. 9.

there was a common symptom of feeling of pressure and weight over the bridge of the nose, cheeks and head, nasal obstruction intermittent with nasal discharge. In No. 9. there was rheumatic (fibrositic) pains in the feet, shoulders and neck.

In Cases No. 10 and No. 11. there were symptoms of nasal obstruction, extending over many years, frequent head colds, general lassitude and depression, but very little pain. These were cases of Polypi, and Anterior Ethmoidal Sinusitis. Profuse nasal discharge was also a prominent intermittent symptom. In Cases No. 3 and No. 8. both children, there was no pain, merely chronic nasal discharge and nasal obstruction alternately.

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5. Diagnosis.

The diagnosis is not difficult when any of the characteristic or special symptoms are present.

Difficulties arise, however in dealing with a case presenting only general symptoms or hidden sepsis. The question is what is the origin of the sepsis?. Is it dental, oral, nasal, tonsillar, pharyngeal?. A thorough examination in such cases of the teeth, nasal mucosa, middle ear, posterior nares, antral, sphenoidal, frontal and ethmoidal sinuses has to be made. Conditions further afield must also be considered such as, the vagina and cervix in women, the urethra. There may be an abdominal focus e.g. and infected gall-bladder, a pyosalpinx, an inflamed appendix.

When a patient is suspected of having sinus disease the first step is to examine for free pus in the nose. If this is found it is then most important to ascertain whether this is the overflowing of a reservoir or is merely due to circumscribed inflammation of the mucous membrane. This is readily distinguished by merely wiping away the pus with a cotton mop. If it reappears in the course of a few minutes, a larger quantity

is somewhere concealed and this is an important positive sign of sinus disease.

It has to be borne in mind however, that purulent secretion in the nose can be caused by several conditions, such as foreign bodies, mucous surfaces in apposition, polyps, hypertrophies etc., adenoids, atrophic rhinitis, tuberculosis, syphilis and malignant tumours. Of these the only condition that is liable to be confounded with sinus disease is polyp and hypertrophic formation associated with secretion. The latter occur in a certain percentage of cases of accessory sinus suppurations, and more often with ethmoidal disease. On the other hand, they often occur entirely dissociated with sinus suppuration and vice-versa. Why they occur in certain cases of sinus suppuration and not in others is as yet unexplained.

If the pus has been found in the middle meatus of the nose after removal with a cotton mop, the next step is to ascertain which particular sinus or sinuses of the first series (anterior group) is affected. The maxillary sinus should be inspected first because:

1. It is more frequently affected than the others.
2. It is situated at the lowest level.
3. It is reasonably easy of access. Needle or proof puncture of the sinus should now be carried



out. If pus has been washed out, we have to consider whether this has been secreted by the maxillary mucosa, or whether the antrum has merely acted as a receptacle for pus coming from one of the overlying sinuses. A further examination should be made later in one or two hours, and if at the end of that time traces of pus are noted beneath the middle turbinate, one can definitely say that one of the sinuses higher up (frontal or anterior ethmoidal) is affected. The next step should be a refracting or retracting of the middle turbinate towards the septum and so giving a better view of the conditions existing between the uncinatè process and the bulla. An attempt should now be made to introduce a sound into the frontal sinus, and if successful, to bend a cannula after the curve of the sound, and blow air into the cavity. If it is impossible to introduce the catheter, it will be necessary to resect the anterior end of the middle turbinate. Presence of polyps and hypertrophies may prevent further access to the frontal sinus, and these should be removed before a probe can be introduced into the sinus cavity. The frontal sinus should now be washed out, and if an appreciable amount of

pus is expelled one can state with certainty that this cavity is diseased and has secreted purulent material.

After the drainage passages of the frontal have been cleared by resection of the middle turbinate, the secretion finds its way into the nose instead of being directed backwards to the ostium of the maxillary sinus, consequently after a few days of treatment to the frontal sinus, on making a proof puncture of the maxillary it will be found empty. If however, secretion is continually found in the maxillary sinus, the following experiment will definitely determine the condition. The maxillary and frontal sinuses are thoroughly lavaged, and then a pledget of cotton wool is inserted into the superior portion of the hiatus so as to exclude all secretion coming down from above. In the course of several hours to a day, depending upon the profuseness of the secretion, the nose is again examined. If no pus is found beneath the pledget of wool, it is probable that the maxillary sinuses are healthy. Needle puncture will positively clinch this supposition. If however, pus is seen below, the maxillary is either diseased or the secretion has leaked through the cotton. On removal of the plug the secretion from the frontal

immediately descends into the nose. Differentiation between frontal sinus empyema and suppuration of the anterior ethmoidal cells is more or less of a rhinological nicety and it is now generally conceded that when frontal sinus disease exists, the anterior ethmoid cells are similarly affected.

As regards the posterior sinuses, namely, posterior ethmoidal and sphenoidal, secretion from these must appear in either one of two places a. Olfactory fissure (b). in the choana above the posterior end of the middle turbinate. An attempt should then be made to use the long Killian speculum to push aside the middle turbinate and thus widening the olfactory fissure. If this does not give a satisfactory view of the anterior wall of sphenoid, an attempt should now be made to pass a sound into the sphenoidal ostium. If successful, the sinus should now be washed out and probably a considerable amount of pus will be washed out. To clinch the diagnosis, the nasopharyngoscope should now be used, and by means of it the point of the sound can be guided into the ostium, and in many cases actually see the purulent secretion as it exudes from the sinus. The region of the posterior ethmoidal cells can be equally well examined by turning the instrument and obtaining

the proper focus.

It may however be necessary to remove the posterior half of the middle turbinate and this usually allows a clear view of the nasal portion of the sphenoid wall with the ostium. The following conditions may be present (1) sphenoidal empyema (2) Posterior Ethmoid Empyema, (3) combined Empyema, (4) pyosinus in the sphenoid. To differentiate, the sphenoid is thoroughly washed out and cleansed, and the patient allowed to recline on the bed for about half an hour. Then, an examination is made and if no pus is found on the anterior sphenoidal wall, one can be reasonably sure that the posterior ethmoid cells are not affected. If this experiment fails, then the sphenoid is cleansed and the ostium firmly plugged with cotton. If on examining the next day, no secretion is seen outside the cotton, and on removing the plug, pus spurts out of the ostium, a positive diagnosis of uncomplicated sphenoidal empyema is apparent. If the purulent material is seen outside of the cotton, and on removal and lavage no more is obtained from the sphenoid sinus, one can be sure that the posterior ethmoids are affected and the pus found earlier in the sphenoid had oozed from these cells. If pus was present

on both sides of plug, then the condition is probably one of combined empyema, or the plug of cotton has leaked . It is always better therefore in these circumstances to make consecutive pluggings until it is settled beyond all doubt that secretion comes from both cavities.

Pyosinus in the Ethmoid as a result of suppuration in the sphenoid, is not possible, except to a very limited degree, on account of the anatomical configuration of the parts. A spheno-ethmoidal cell situated above the sphenoid wall may become infected and render more difficult the diagnosis. In such cases the purulent material would appear continually on the sphenoidal wall, yet the sinus would be free.

It is very necessary that the secretion should be followed to its source before a correct diagnosis can be reached. This may be a matter of days and even weeks.

Important supplementary means of diagnosis are by means of (1) Transillumination, (2) X-Rays, (3) Suction and (4) Tuning fork.

Transillumination:

This method is applied to the maxillary and frontal sinuses only and is useful only as an adjunct to the diagnosis. In the case of

the maxillary sinus the method consists of applying a small electric lamp in the patient's mouth and switching on the current until the part is luminous. This illuminates the maxillary sinuses. If one sinus remains decidedly dark and the other light, one assumes that some affection is present in the dark sinus which excludes to a greater or lesser degree the light. The dark shadow is in direct ratio to the density of the affection. In addition to direct transillumination of the anterior sinus wall, light in the pupil, and translucency of the infra-orbital region are also diagnostic features in empyema of the maxillary sinus. Too great reliance cannot however be placed on the findings, as the bony structures through which the rays pass may be dissimilar in thickness and density, the maxillary sinuses may be of unequal size and the light may not be held directly in the centre of the roof of the mouth. To overcome these disadvantages the light should be placed in the gingivo-buccal fold above the last molar teeth, as far posterior as possible. The light rays then penetrate the external antral wall, which is considerably thinner and broader than the inferior. The light is

placed first in one side, then in the other, and any difference noted. This method is extremely useful and should always be employed in addition to the ordinary methods of transillumination, and may give positive findings when the other methods have failed.

In the case of the Frontal sinus, a metal cover is placed over the light so that the rays only escape at the tip. The end of this is placed firmly against the floor of the frontal sinus at the inner canthus of the eye, taking care to exclude all light from escaping. The double light is best, so that comparison can be made without changing. If one side appears considerably lighter than the other, it can be presumed that the side remaining dark is diseased. I only use this method as an adjunct to diagnosis and always follow up with an X-Ray of the sinuses. The best results obtained by the help of the X-Rays have been with the superficial sinuses, frontal, anterior ethmoidal and maxillary. The posterior ethmoid and sphenoid are not so easy to X-Ray.

X-Ray of the sinuses may also prove and frequently does in my opinion prove, a valuable aid in determining one's method of treatment, as in

a small sinus one may expect good results from intra-nasal treatment, while in a large sinus with recesses/<sup>and</sup>septa, an external operation will probably be indicated. Blurring of the sinus outlines which are faint and inclined to be indistinct rather than sharp and clear is perhaps the greatest diagnostic sign in X-Ray of the sinuses.

X-Ray of the Frontal Sinus is of inestimable value in determining its height and depth before operating, and also shows the presence or absence of recesses, partial septa, projections, situation or presence of orbito ethmoidal cells. When disease is unilateral, skiagraph is essential, and as a rule, unilatara shadows are diagnostic of disease.

Such observers as Coakley and Killian place the greatest reliability in unilateral shadows, and claim that subsequent operations have always substantiated the presence of disease wherever these shadows were distinctly outlined on the plates. This has been my experience also, as I will show by reference to all my cases. It is however often difficult and even impossible in many cases, to state with certainty whether the



shadow is due to purulent secretion or to hyperplasia of the mucosa. Intra-nasal findings help to guide one to a determination of this question. Antro-posterior and lateral views should be taken in all X-Rays.

In my experience skiagraphic findings of the Anterior Ethmoidal cells are practically always reliable, but before operating I always confirm the diagnosis as far as possible by clinical manifestations.

X-Ray of the Maxillary sinus is a necessary adjunct in the diagnosis, but is of less importance in the case of this sinus, as there are other means of diagnosis at one's disposal e.g. Needle Puncture. It shows however, the precise relation of the roots of the teeth to the floor of the antrum, and the presence as well as the size and shape of neoplasms, cysts, sarcoma, etc. The roots of teeth may be the cause of the antral suppuration and treatment can be carried out accordingly.

If a tumour is present, the configuration and extent of it will be shown, and decision can be made as to its operability or otherwise, and if operable how much tissue it will be necessary to remove.

It is only very recently that the posterior Ethmoidal and sphenoidal cavities have been satisfactorily X-Rayed. With the plate

under the **chin** and the light on the vertex, the pathological condition of these sinuses, can be carefully studied, but in a certain number of cases, the presence even of pus and of polypoid tissue may not be present as a shadow on the plate. The most important sign of disease in these sinuses is the blurring of the septa between the cells, and this is much more indicative of disease than the appearance of the actual shadow. It is necessary also that many successive exposures should be made before deciding on extensive operative procedures either intra-nasal or otherwise in this region.

Biers' Hyperaemia as Applied to the Nasal Sinuses.

This form of treatment has been applied to the nose for diagnostic as well as therapeutic purposes.

To diagnose sinus disease the nose is first thoroughly lavaged in order to remove all free secretion. The bulb is then placed in one nostril and while the patient continuously articulates the letter K, suction is applied. If a large quantity of free pus is found in the nose, the diagnosis of sinus disease is made. To corroborate, suction should be applied on the following day, and if the result is identical,

the diagnosis is assured. Practically, this method often leads to disappointment, and in my opinion it is a redundant procedure, but in some of the American observers' hands it is reported to have yielded reliable diagnostic conclusions.

The Tuning Fork Test:

It has been shown that if a Tuning Fork be sounded and placed over the root of the nose in the median line, the sound will be heard in the ear corresponding to the side on which the accessory sinus disease is present. This is probably due to general inflammation of that side embracing the Eustachian tube, and to the purulent secretion and thickened mucosa, forming better bone conduction. The test is most striking in pansinusitis of one side, although with maxillary and sphenoid disease positive results are obtained. These measures should only be used as a means to an end, namely, to corroborate rather than to make a diagnosis.

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Treatment.

Treatment of Acute Inflammation and Suppuration.

In every case in which the diagnosis of acute inflammation is made, the first consideration is to establish free drainage through the ostia by reducing the swelling of the nasal mucous membrane, and secondly to employ such means as may be thought suitable to relieve the patient's discomfort or pain. Certain measures may be adopted which are applicable to all the sinuses when acutely inflamed. The patient should be confined to bed or to his room and not exposed to variations in temperature. The bowels should be opened and, aspirin phenacetin or a diaphoretic mixture given at frequent intervals. Smoking should be forbidden, while hot fomentations to the forehead or cheek are soothing. Pernal inhalations of steam impregnated with menthal are useful, especially when given in the form of an alcoholic solution 10-20% Menthol in Alcohol. A half to one teaspoonful of the alcoholic solution should be added to a pint of water in a two-pint jug, the water being at a temperature of 140°F to 150° F, the inhalation to be continued for ten

minutes and repeated twice or thrice daily. In addition to, or as a substitute for menthol, the swelling of the mucosa may be reduced by the application to the middle meatus of cotton-wool pledgets soaked in 5 or 10% Cocaine Solution, with or without the addition of a few drops of adrenalin solution (1-1000). Various proprietary preparations of Ephedrine in oil are now available having a somewhat similar but more prolonged effect on the nasal mucosa. The employment of the electric-light bath, introduced by Killian, has proved very useful in the early treatment of these cases, especially in acute inflammation of the frontal sinus. The bath may be given once or twice daily, and the first sitting should be carried out in the early morning before the onset of the severe pain which characterizes the acute frontal case. The duration of treatment at one sitting should be for about 30 minutes. After its use it is advisable to take precautionary measures against exposing the patient to chills. Radio-therapy in the form of Infra-Red Rays is a recent form of treatment which has been successfully employed and commented on by W. Annandale Troup. I have personally had no experience of

this treatment, but I feel sure that in those cases which do not clear up by the usual time-honoured measures, it will prove a useful adjuvant.

Suction treatment is also another useful adjuvant. A Politzer bag, fitted with an olivary-shaped nozzle and emptied of its air contents, is inserted into the nostril of the affected side. The anterior nares are closed by the surgeon's fingers and the patient is directed to swallow, the bag at the same time being allowed to expand rapidly. By such means discharge may be withdrawn from the frontal sinus and from some of the anterior ethmoidal cells, but the value of its application to the maxillary sinus is doubtful. A suction pump however may effect this in a more satisfactory manner.

While one or more of the above measures of treatment may be employed in acute inflammation of the sinuses and recovery follow in a number of instances, special operative procedures are necessary in individual sinuses when such treatment fails, or when orbital or intra-cranial complications arise.

#### The Maxillary Sinus:

Spontaneous cure of acute maxillary sinus

suppuration does sometimes occur, but as the position of the ostium does not favour drainage, operative measures are frequently necessary. Puncture through the lateral wall of the inferior meatus or through the membranous portion of the middle meatal wall should be employed with lavage of the sinus. This is carried out in the same manner as is done in the exploration test. In some cases one lavage is sufficient, in others it may be necessary to repeat the operation at intervals of about a week. With great care it is possible to pass the trocar through the same point in the bone on each occasion and thus to minimize the discomfort of the operation. It is very necessary in these cases, to exclude the presence of a diseased tooth, as a possible factor in maintaining suppuration and to deal with it: otherwise lavage may prove a failure.

In some cases where there is much swelling of the mucosa, a double cannula has to be inserted to allow of better lavage and drainage. If repeated punctures fail to produce a cure, an intranasal antral drainage may be necessary through a large opening in the inferior meatus.

#### The Frontal Sinus and Ethmoidal Cells:

If conservative treatment should fail to

effect a cure, or in the event of symptoms becoming aggravated, it is necessary to take steps to improve the drainage. In some cases, the nasal septum requires to be resected and straightened before any further intra nasal operative measures are possible. Dislocation of the middle turbinate towards the middle line may afford better aeration or drainage of the middle meatus. The attachment of the anterior end of the middle turbinate, the mucous membrane of which may be oedematous, should be divided high up on the lateral wall of the nasal cavity by turbinotomy scissors and the loop of a wire snare passed round the detached end which is then removed. The removal, by means of punch forceps of the anterior ethmoidal cells especially those of the agger nasi is an additional procedure in the establishment of better drainage and aeration of the frontal air cavity. The patency of the ostium or nasofrontal duct can then be ascertained by the passage through it of a probe or a small sized rasp without using the rasp to enlarge the duct. Should these procedures fail to relieve acute symptoms, or if signs indicative of orbital or intracranial inflammation arise, an external



operation on the sinus will then be necessary.

#### Sphenoidal Sinus:

If a diagnosis of acute suppuration is made, it will be necessary to remove the middle turbinate to expose the anterior wall of the sinus and to establish drainage by enlarging the ostium.

The administration of the appropriate autogenous vaccine may be found useful in clearing up the discharge from any of the affected sinuses after drainage has been established.

It is very necessary to keep cases of acute sinusitis under observation until cure has been effected. Only in this way can the number of chronic cases of sinus disease be diminished.

#### Treatment of Chronic suppuration in the Nasal Accessory Sinuses.

The two main points in the treatment of chronic nasal sinus disease are (1) the establishment of drainage and (2) the removal if possible of the cause. The treatment of chronic suppuration is still essentially operative. Other methods have been adopted, such as the employment of vaccines, but though they are helpful in some cases, they cannot be recommended as a substitute for operation. Chronic Maxillary Sinus Suppura-

ration has been successfully treated by Ionisation and this method has been advocated by Friel. In every case in which active interference is contemplated, it is necessary to consider whether the end in view will be best obtained (1) by establishing the maximum of drainage with the minimum of destruction of the mucous membrane of the cavity, or (2) by complete detachment of the diseased mucous membrane and an attempt to obliterate the cavity by removal of one or more of its osseous wells.

The adoption of one or other method will depend upon various factors, such as the actual sinus affected, the number of sinuses involved in a particular case, the chronicity of the discharge, the age and sex of the patient and the experience gained by the surgeon in his previous work.

#### The Maxillary Sinus:

The method of choice should be the establishment of drainage, by conservative methods if possible, but radical if necessary. Thus intranasal drainage of the antrum through an opening made into the inferior meatus followed by a course of lavage through the naso-antral opening may be all that is required, but when the disease has been of

long standing and does not clear up after the intra-nasal drainage, then the more radical operation through the canine fossa, with, if necessary, the removal of all the lining mucosa may be required. The choice of alternative routes is what the surgeon has to consider. In a considerable number of chronic cases drainage and lavage established by the nasal route will effect a cure and in my experience this is almost invariably the case in children. In other cases again this procedure fails, as in consequence of the pathological changes already present in the lining membrane of the sinus, the septic process will not yield to this simple measure.

It is often difficult to determine what degree of change has taken place in the mucous membrane. Neither the duration of the discharge nor the shadow obtained by transillumination will help to elucidate this problem. But recently the improvement in Radio-graphic technique and experience in reading the radiographs has helped the surgeon considerably. By its aid he may recognise, in the one case, the oedematous swelling of the superficial layer of the mucosa characteristic of the acute and subacute cases. And in the other the less swollen but denser shadow of the thickened periosteal layer present in the chronic cases. When

the latter is associated with discharge in which the mononuclear leucocyte predominates and a streptococcus is present, then treatment by drainage alone is less likely to prove successful, and removal of the lining mucous membrane is the more appropriate procedure, and this can only be efficiently carried out by opening the sinus through the wall of the canine fossa.

#### The Intra-nasal Route.

The first step in this method is the removal of the anterior third or less of the inferior turbinate: this procedure gives the necessary access to the lateral nasal wall, it allows the patient during the after treatment to introduce the cannula into the sinus with greater ease and it provides better aeration and drainage of the sinus. An opening is next made into the lateral wall of the inferior meatus with a suitable rasp, the opening to be as far forward as possible. Punch forceps are next used to remove fragments of bone and to enlarge the opening backwards. It is important that the opening should be a large one, as contraction and cicatrization tend to occur. In twenty-four or forty-eight hours after the antrum is washed out by a special antrum

cannula. Warm sterile saline is used and this is repeated twice daily for several days, then once a day until the discharge ceases. A weak solution of iodine or silver nitrate is often useful if the discharge tends to persist.

The Canine Fossa Route - Caldwell-Lac Operation:

This radical procedure may be briefly described as follows: An incision is made along the gingivo-labial fold over the canine fossa, the periosteum is raised and an opening made in the bone. This is enlarged medially so that a thorough inspection can be made of the mucous membrane of the antrum. Where it is grossly diseased it is removed and this is usually on the floor or alveolar recess and lining the canine wall. Then the anterior third of the inferior turbinate is removed and a counter opening made in the lateral meatal wall through the canine aperture. An important point is that the opening in the lateral nasal wall should be made flush with the floor of the nose, otherwise drainage will be inefficient. The buccal wound is sutured together and after treatment is similar to that when the sinus is opened by the nitra-nasal route.

The Frontal Sinus:

In a small proportion of cases of chronic

frontal sinus suppuration, operative interference may be withheld, as when the cavity is small, when the patient is free from headache or pain in the region of the sinus or when his mental and bodily vigour are unimpaired by the small amount of discharge which is daily secreted. In these cases, occasional inspection of the nasal cavity and the removal of any polypoid mucosa which may have developed in it may prove sufficient treatment.

On the other hand, the occurrence of headaches, a state of mental depression and aprosexia, and those constitutional symptoms which are regarded as dependent upon a chronic toxæmia are indications for interference. Further when there is evidence of the extension of inflammation into the orbit or cranium, active treatment should not be delayed. Two routes of access are open to consideration: the establishment of free drainage and aeration of the cavity either (1) by way of the nasal cavity or (2) by obtaining access through an external cutaneous incision. In certain circumstances however it may be advisable to remove the lining membrane of the sinus and even one or more of its osseous walls with the object of making a thorough exploration of the cavity and then obliterating it. This more radical procedure should be reserved for

those cases in which the onset of intra-cranial symptoms demands more complete investigation or when more conservative operations have failed to affect a cure. Extensive removal of bone may also lead to infection of the diploë of the cranial bones and diffuse osteomyelitis with fatal results. In all cases careful preliminary study of postero-anterior and lateral radiographs of the sinuses should be made.

When the frontal cavity is of average dimensions, is devoid of accessory partitions and pockets and when there is obviously considerable available space between the nasal and frontal cavities for instrumental manipulation, the attempt should be made in the first instance to remove the underlying diseased ethmoidal cells and drain the cavity by intra-nasal operation. On the other hand in the case of a large and irregularly shaped cavity with an orbital extension and with infected ethmoidal cells extending into the orbital roof, the external route is preferable. It is now generally accepted that external operative treatment of the Frontal Sinus should not be undertaken without due consideration: that drainage of the underlying ethmoidal cells, with removal of the middle turbinate to permit free drainage of the naso-frontal duct should be the first operative procedure.

Intra-Nasal Operation:

This method follows the lines of the operation described in connection with the surgical treatment of acute suppuration in the Frontal Sinus. Free removal of the diseased ethmoidal air-cells is essential with a view to preventing re-infection of the higher sinus.

External Operation:

The main principles which guide the surgeon are the complete removal of the infected ethmoidal air-cells, the establishment and maintenance of free drainage of the frontal sinus and so far as possible, the avoidance of disfigurement of the patient. Howarth's modification of Jansen's operation answers the principle and is the operation of choice. Briefly this operation consists in removal of the floor of the Frontal sinus, of extensions of ethmoidal cells in the orbital roof, and of all diseased ethmoidal cells and the establishment of a large communication with the nasal cavity. The results following this operation are eminently successful and I have had a completely successful result in one case on which I operated recently,

The Ethmoidal Labyrinth.

Because of the position which the Ethmoidal Labyrinth occupies in the nasal cavity and of its



extensions beyond the boundaries of the Ethmoid bone, it is often difficult to determine the extent of the affected area in cases of chronic suppuration. Treatment may consist in opening and draining the individual cells affected, or in complete removal of a part or the whole of the labyrinth.

Intra-nasal Operations:

Intra nasal operations on the Ethmoid cells have been found very satisfactory and are to be preferred in the first place to the external route unless the frontal sinus as well as the ethmoid cells is involved.

These intra-nasal procedures consist of

- (1) Dislocation of the middle turbinate, partial removal of the middle turbinate or the local removal of polypi.
- (2) Simple opening of the Bulla Ethmoidalis, unciniate process or **a**gger nasi cells.
- (3) Opening of all the anterior cells with punch forceps, without removal of the middle turbinate.
- (4) Opening of the anterior and posterior cells with removal of the middle turbinate.

When all the anterior and posterior cells are affected on the other hand, minor operations frequently repeated are very unsatisfactory and the patient becomes more sensitive at each sitting and with continuance of discharge in spite of what has

what has been done, he becomes less inclined to undergo further treatment. In this type of case, the whole of the diseased labyrinth may be dealt with at one operation by a block dissection with complete removal of the middle turbinate and the sphenoidal sinus opened if necessary at the same time. This operation is a Radical procedure carried out intra-nasally. It can be carried out under local anasthesia with the addition of block anesthesia of ~~Neckel's~~ ganglion and the Nasal nerve by cotton wool-tipped probes dipped in 70% cocain solution.

If diseased fronto-ethmoidal or maxilla-ethmoidal cells are present even such a radical intra-nasal measure may not effect a complete cure of the discharge; while unforeseen accidents with fatal intra-cranial complications have sometimes arisen in connection with this line of treatment.

The Ethmoid cell labyrinth may be removed at one sitting by operating lateral to the vertical plane of the medial surface of the middle turbinate; in this way the dangerous area of the nasal cavity is thus avoided and the olfactory perineural sheaths and the cribriform plate escape injury. The anterior end and the greater part of the lower border of the middle turbinate are removed with forceps by a downward, backward movement: the posterior

end of the turbinate is then removed with the snare, and then working laterally with forceps the cell walls are removed as far as the anterior face of the body of the sphenoid bone.

External operation:

This method of approach is advisable in certain circumstances:

- (1) When in association with frontal sinus suppuration, the decision has been made to open it, the ethmoidal cells are dealt with at the same time.
- (2) When an external fistule above the medial angle of the orbit communicates with the labyrinth.
- (3) In the presence of an orbital abscess or of acute inflammatory complications within the cranium.

This method gives good access to the diseased extensions of the ethmoidal cells in the roof of the orbit, and the whole field of operation with the dangerous area in its immediate neighbourhood come under the direct observation of the surgeon. The procedure follows the lines adopted in the External Frontal operation (Howarths).

The Sphenoidal Sinus:

Excepting those cases in which an External operation on the Ethmoid cells is completed by opening the sphenoidal sinus, this cavity is treated by

the intra-nasal route. Operation should be conservative, and confined to the establishment of free drainage.

Good lateral radiographs are essential in all cases before the sphenoid sinus is opened, so as to determine the anteroposterior and vertical diameters of the cavity. The thinness of the walls in so many cases, the frequency with which dehiscences may be present in the bone and the numerous important vessels and nerves in close proximity to the lining membrane of the sinus, render the employment of curettes within the cavity extremely dangerous.

Local anaesthesia may be employed alone or combined with ether. The middle turbinate is completely removed, and if the ostium is not brought into view by this procedure, removal of the wall of a projecting posterior ethmoid cell may be necessary. A sphenoidal sinus hook is then inserted into the ostium which is enlarged by pulling away the thin anterior wall forming its lower boundary. Into this opening one blade of the sphenoidal cutting forceps is passed and a portion of the anterior wall nibbled away in a downward and outward direction. The interior of the sinus must not however be curetted for the reasons just stated.

Summary and Conclusions:

Twelve cases of Accessory Sinus infection and their relation to systemic disease have been described.

The importance of early recognition of nasal sinus infection is stressed, as prompt and early treatment gives the best chance of cure.

In children particularly after any of the infectious diseases, it is most important to exclude nasal sinus infection, otherwise dissemination of the infectious disease may be prolonged, as for example in ~~Diphtheria~~ (case 8), as well as maintenance of gross ill health.

In adults and more especially young adults, it is necessary to remember the vulnerability of the accessory sinuses after influenza, and particularly the Frontal Sinus.

Two cases (No.2 and No.12) were treated successfully by Intra-nasal operation, while in a third case (No.1) an External Operation was necessary owing to the virulence of the infection causing a Subperiosteal orbital abscess. The end result in this case was also successful.

Two cases (No.10 and No. 11) of chronic Infection of the Ethmoids and Antra with Polypi have been described and treatment has brought about great

relief, but it is to be noted that had early advice been sought - recognition and treatment of the abnormal conditions would have brought about quicker and more permanent successful results.

In three cases (Nos.6,7,and 9) treatment of the accessory sinuses had to be followed up by treatment on General medical lines in the form of Vitamin A, Cod Liver Oil and Iron, to ensure lasting benefit.

One case (No.5) is described of infection resulting after operation in a debilitated subject.

I am of opinion that this occurs more frequently than is supposed to be the case, especially in children, and shows the necessity for looking for and excluding nasal accessory sinus infection after the Tonsil and Adenoid operation. In my view every child who has had a Tonsil and Adenoid operation, should, after a period of four to eight weeks, have a thorough sinus investigation and appropriate treatment carried out if necessary. By so doing, the large number of cases of chronic ill health and general debility with resultant chronic sinus infection and its

sequelae in later life would be reduced to a minimum.

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APPENDIX.

Case I. Holland. M. Female. age 20.

Admitted to Hospital on 20th Sept. 1933.

History of neuralgic headache over Right Eye following Influenza, duration of headache 6 days.

Four days before admission swelling of Right upper eyelid was noticed; the following day it was very swollen.

Symptoms and Physical Signs.

General malaise. Temp. 99° F. Pulse 80. Severe headache over Right Forehead. Swelling and oedema of Right Upper eyelid and right side of forehead. Tenderness on pressure of Right Frontal bone. Nasal mucosa of Right side congested with pus in the Right Middle meatus.

Diagnosis:

Inspection: Pus in Right Middle Meatus and congestion of whole of mucous membrane of Right side. Dullness of Right Frontal Sinus on Transillumination.

Acute Suppurative Frontal Sinusitis with Subperiosteal abscess.

Treatment:

Intra-nasal treatment was attempted, namely, after cocainising the Right Middle

meatus and Right Turbinate the Frontal Sinus probe was passed. This proved inadequate and so Howarth's External operation was performed on the Right Frontal Sinus; The anterior ethmoid cells were found to be infected and so they were curetted, and the floor of the Frontal Sinus was removed.

Progress: very satisfactory. Patient discharged from Hospital on 12.10.33. She attended at regular intervals as an out-patient until 26.2.34 when she was discharged.

On 21.11.34 that is 9 months later she was readmitted with a swelling over the floor of the Right Frontal Sinus. At operation two bony sequestrae were removed and the Naso frontal duct was enlarged. Patient was discharged on 16.12. 34 and attended regularly at weekly intervals until 2.1.35. when she was asked to report in 3 months: on 27.5. 35. i.e. 6 months later she was quite cured, there was no nasal obstruction, or discharge or headache.

On 30.4.36. i.e.  $1\frac{1}{2}$  years after admission she reported. She had no frontal or nasal signs or symptoms. Her Tonsils which were observed to be septic were removed.

Conclusions:

This was a case of Acute Suppurative Frontal Sinusitis coming on suddenly after Nasal obstruction following Influenza and resulting in a Subperiosteal abscess over the floor of the Right Frontal bone. By means of the External operation (Howarth's) the patient was alleviated from all her symptoms, and although two sequestra appeared one year after operation, these were successfully removed, the condition settled down and patient was finally cured. She was able to breathe freely through the nose and her excruciating headaches had disappeared.

Case 2.

Groves. M. Female. age 42.

Admitted to Hospital on 24.8.36.

History of severe headache, swelling of Right upper eyelid and drooping of the right upper eyelid for four days prior to admission following on severe head cold. Temp. 102'4°. Pulse 110.

Signs of Symptoms:

Severe headache right sided, nasal obstruction and nasal discharge - the discharge being intermittent. Headache worse in the fore-noon and gradually passing off in the late afternoon. Inability to see properly with right eye, because of dropping of upper eyelid, swelling of Right Eyelid, irritation in the right eye.

Diagnosis:

Pus in the right middle meatus and in the floor of right nostril. Engorgement of Right Middle Turbinate. Tenderness over floor of Right Frontal Sinus on deep pressure. Oedema in Right upper eyelid. Chemosis of Conjunctiva: Transillumination dullness of Right Frontal Sinus and Right antrum (slight).

Treatment:

Right Fronto nasal duct opened and some peri-infundibular caries scraped away. The fronto nasal duct appeared to drain freely, and the swelling of right upper eyelid gradually subsided. The temperature which was undulating, gradually came down and settled to the normal level in 3 weeks.

On 22.9.36. i.e. 4 weeks after admission patient was discharged from hospital. She reported weekly and on 19.10.36. the fronto-nasal duct was probed again.

On 16.11.36. there were signs of a definite Ethmoiditis Right and this was curetted.

On 22.2.37. patient reported and was free from all signs and symptoms and was considered cured. Transillumination showed all sinuses to be clear.

Conclusion:

This was a case of acute Frontal Sinusitis (Suppurative) with oedema of right upper eyelid, proptosis and chemosis of the conjunctiva, treated successfully by conservative measures, and by the passing of the Frontal Sinus probe to enlarge the nasofrontal duct and keep it patent, and then

followed by curetting of the anterior  
Ethmoid cells which were also infected.

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Case No. 3.

Henning, May. Age 3.

on 14/8/33 had septic Tonsils and adenoids removed.

on 18/9/33. Zygomatic swelling left side.  
Subperiosteal Zygomatic abscess and  
Acute Left Mastoiditis.

Operation:

Zygomatic Mastoid operation performed:  
subperiosteal abscess found over Zygoma.  
This was incised by an incision in front  
of the Tragus. A Carious mastoid and  
attic region was found and the upper part  
of the mastoid incision was left open.

on 30.9.33. Now has developed signs of  
consolidation Right base and septicaemia.  
Is very ill.

Steady improvement maintained after 8/10/33.

on 31.1.34. discharged very fit. Left Ear  
dry. Sinus behind ear almost dry.

on 5.2.34. reported. Left Ear dry. Has  
developed Whooping Cough.

on 5.3.34. Mastoid sinus dry. Is recovering  
from Whooping Cough.

on 7.5.34. Still has persistent cough.  
Whooping Cough vaccine given.

On 27.7.36. i.e. over 1 year later came to report. There was slight discharge from the mastoid sinus and it was seen both nostrils were full of purulent discharge. On Transillumination both antra were very dull, and this was confirmed by X-Rays which showed them, very opaque. Swabs of the pus grew a staphylococcus albus organism.

on 22.10.36. The persistent mastoid sinus was exposed and scraped and packed with B.I.P.P. Both antra were washed out then and at weekly intervals thereafter.

on 15.1.37. discharged from hospital. Mastoid wound healed: Nose showed slight mucopus in the nostrils:

on 15. 2. 37. Reported nose quite clear and free from discharge. Sinuses appeared clear on transillumination.

Conclusions:

This case illustrates how an infectious disease (whooping cough) caused an infection of the nasal sinuses, particularly the antrums of Highmore with the result that through the neglect, or rather ignorance on the part of the parents, no



treatment was instituted early enough to prevent a spread upwards of infection via the Eustachian tubes to the ears and a reopening of a healed mastoid wound. The child was in a debilitated state and developed whooping cough before convalescence from the Mastoid operation was complete.

The sinus had to be opened and curetted and intra-nasal treatment performed over a period of six weeks on the Maxillary Antra. The nasal infection gradually settled down and cleared up entirely. The mastoid sinus healing up also and giving no trouble.

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Case No. 4.

Rogers Miss R. Age 14.

12.3.34. History of Diphtheria four years ago. Has had post nasal discharge ever since. Very offensive. Frontal headaches severe, especially Right side.

On examination pus was seen in the floor of the Right Nostril and in the Right Middle Meatus. Transillumination showed Right Frontal and Right antral sinuses slightly dull.

A Purulent Ethmoiditis (Right) was diagnosed. The Right Ethmoid was curetted, but as patient was extremely nervous and unwilling to co-operate, very little could be done.

on 1.4. 11.35. i.e. 1 year and 8 months afterwards she attended hospital complaining of offensive nasal discharge and headaches: on Transillumination, the right antrum was markedly dull, the other although/sinuses were clear. X-Ray showed a chronic catarrhal infection of the Right Antrum. On Proof Puncture the

return fluid showed pus from the right antrum, that from the left was clear.

Diagnosis: Chronic Maxillary Antritis.

On 9.1.36. The Caldwell Luc operation was performed on the right side. This was followed by daily wash outs for about 10 days and then twice weekly for two months.

At present she has very much improved, but still requires an operation on the Right Ethmoid and possibly on the sphenoid too, but she is unable to undergo this at present.

Conclusions:

This case illustrates a chronic infection developing in the Right Maxillary antrum and Right Ethmoid (a slight mild infection developed in the Left side also but cleared up), following Diphtheria four years previously.

A Radical Caldwell Luc was performed on the patient, but though great improvement resulted, the Ethmoid Labyrinth is still infected and requires exenteration. At the moment the patient is unable to undergo further

operative treatment, as she does not  
wish to lose her post.

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Case No. 5.

Nurse S. age 24.

5.8.36. Acute Influenza.

24.8.36. Tonsillectomy.

29.8.36. Secondary Haemorrhage:

14.9.36. Swinging temperature: Infection  
of Right Max. Antrum and Rt.  
Frontal Sinus:

Transillumination: Rt. Antrum  
very dull, Rt. Frontal Sinus:  
slightly dull.

X-Rays: Rt. Antrum, Ethmoid and  
Frontal Sinus shows increased  
opacity:

21.9.36. Rt. Antrum wash out = pus:

5.10.36. Throat well healed and satis-  
factory. Rt. Maxillary antrum  
slightly dull.

12.10.36. Antrum clearing.

26.10.36. Steady improvement continues.

9.11.36. Has had a cold. Further nasal  
discharge and post-nasal dis-  
charge:

Rt. Antrum wash out = fluid pus  
and blobs of pus.

23.11.36. Feels much better. No  
mucopus or pus in Nose or Meatuses.  
Transillumination all sinuses clear.

Conclusion.

This illustrates a case which developed Right-Maxillary, Ethmoidal and Frontal Sinus infection following Tonsillectomy. (3 weeks after to be exact), in a very debilitated hospital nurse, who had a secondary haemorrhage. Beyond Antum wash-outs (three in all) treatment was conservative and in a little over two months time, the infection cleared up entirely.

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Case No. 6.

Parken Master age 6.

On 2.9.29. Complained of stuffiness in nose and frequent colds:

On Examination: Large pad of Adenoids and septic Tonsils.

17.9.26. Removal of the Adenoids & Tonsils:

24.10.29. Very satisfactory progress.

On 28.12.32. i.e. 3 years later developed stuffiness again and frequent colds.

An anti-catarrh vaccine (stock mixture) was given with some improvement.

On 4.8.33. Developed a very severe cold - loss of appetite, profuse nasal discharge and cough. Stuffy nose.

6.9.33. X-Rayed: No fluid level in the antra observed - but a? thickening of the membranes in the Ethmoids and Antra. ? Chronic catarrhal infection of Ethmoids and Antra.

On Transillumination all Sinuses appeared clear.

Operation: Partial resection of Middle Turbinate and curetting of Rt. and Left Ethmoid cells and Antral wash -outs .

This was followed by considerable improvement.

On. 5. 10. 35. i.e. 2 years after last operation complained again of stuffiness in the nose, and catching colds easily always blowing his nose: This symptom I attributed to a bad habit. His inferior turbinates were enlarged, hypertrophied and very pale in colour, I cauterised these and previously had a swab of the nasal mucous taken for an autogenous vaccine to be prepared. This was given at regular intervals along with Ext. Malt  $\bar{o}$  OL. Morrhuae. .  
He has made a good recovery.

Conclusions:

This was a case of a flabby adipose type of child who was prone to catch colds easily and who developed a habit of snuffling - which was quite out of proportion to the amount of organic trouble found in his nose. He certainly had a Hypertrophic Catarrhal condition of his Turbinate and Ethmoid, but there was



no frank pus found in the Ethmoids or in the Antra. Operative treatment gave considerable relief but had to be followed up by treatment on General lines especially in the form of a Vitamin product, along with breathing exercises and a strict censure of the bad habit of sniffing. The ultimate result has been very gratifying and successful.

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Case No. 7.

Kendall. Miss G. Female. Age 40.

On 5.10.36. Gave a history of an acute stuffiness in the nose and head following a cold in the spring of 1936.

Has been very stuffy in the nose since and at times has a profuse discharge with purulent secretion present. Is generally depressed owing to inability to breathe through the nose: Right antral wash out showed a purulent return.

X-Ray: showed slight opacity of Right Antrum, and of Right Ethmoid, otherwise other sinuses appeared clear.

Operation:

Resected anterior half of Right Middle Turbinate and curetted anterior and posterior Ethmoid cells. Carious catarrhal debris removed.

Right antrum wash out = pus.

Left Ethmoid was also curetted.

On 17.10.36. was discharged from hospital. progress satisfactory. Can now breathe freely. A stock anti-catarrh vaccine

was given for four months with satisfactory results.

Conclusions:

This case illustrates a very satisfactory result following operation on the antrum and Ethmoids. But treatment was followed up by a course of anti-catarrh vaccine which has helped to maintain a standard of improved general health as well as kept the patient free from colds.

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Case No. 8.

Miles Mastr. D. agell.

Admitted to Isolation Hospital on 29.5.35. as a Diptheria carrier: Was in hospital about six years ago with ? Nasal Diptheria and was found to be a carrier about 2 years later. This cleared up. Was not referred to any Ear, Nose and Throat Surgeon:

Two weeks ago was again found to be a positive diptheria carrier - organisms found in a persistent purulent nasal discharge. Nostrils noted to be unhealthy. The case was referred to me at this stage. I found septic Adenoids and also Tonsils:

on 3.6.36 the Tonsils and Adenoids were removed: Progress satisfactory. After three negative nose and throat swabs was discharged on 20.6.36.

The case was then referred to me again on 19.1.37 as a positive Nasal Diptheria. On Examination I found a purulent nasal discharge and a Deflected Nasal Septum with a spur on the floor of the Right side. Transillumination showed

both antra slightly dull. X-Ray: both antra very opaque. Chronic catarrhal inflammation.

On 6.2.37. Aspiration of Right and Left Antra was carried out followed by antral wash outs. In the aspirated fluid from the right side, the diptheria bacillus was found. Four swabs taken after this were negative for K.L. Bacillus for the Nose and Throat. On 26.2.37. repeated antral wash outs. Fluid was returned clear.  
Discharged on 3.3.37.

Conclusions:

This case illustrates how the Diptheria bacillus will invade an Accessory sinus (in this case the Right Antrum) and keep up an infective condition resulting in the patient becoming a carrier. Even after the septic Adenoids and Tonsils were removed the infection re-appeared, due as was proved by antral aspiration, to infection lurking in the antra. After this was cleansed by washing out, four negative swabs were obtained and the patient cured.

Case No. 9.

Knight. Mrs. age 30.

On 9.10.36. Gave a history of nasal catarrh of 4 years duration. Frequent colds in the head. Feeling of pressure and weight over the nose, cheeks and head. Noises in the head and ears. Hearing not as good as it used to be.

Frequent frontal headaches: Eyes tested and found normal in every way. Is unable to breathe through nose and snores at night. Has had sore throats and recently has had rheumatic pains of feet shoulders and neck.

On Examination:

Nose: Pus on the floor of both nostrils and under inferior turbinate. Narrow nostrils. Mucopus in both middle meatuses.

Throat: Tonsils very septic.

Transillumination: Both antra dull - frontal sinuses clear.

Right Antral wash out - pus in return fluid.

Left Antral wash out - pus in return fluid.

23.10.36. R. & L. Antral wash outs - very little pus, considerable improvement in the nose.

3.12.36. Tonsillectomy performed.

29.12. 36. Throat satisfactory. Nose appeared satisfactory.

4. 3. 37. For the past two weeks has had violent attacks of sneezing and a recurrence of nasal obstruction. Feels tired and has a recurrence of rheumatic pains.

On Examination: Throat satisfactory. No post nasal discharge. Deflected nasal septum with spur on the Right side. Pale anaemic mucous membrane, with Hypertrophic Rhinitis. No pus in the nose or in the meatuses. Transillumination: all sinuses appear clear.

Treatment: To have anti-catarrh vaccine and iron and Ext. Malt  $\bar{o}$  Cl. Morrhuae for about 3 months. Thereafter to have the septum straightened if necessary.

Conclusions:

This is an example of a case of

Nasal Catarrh and obstruction of four years standing in a pale debilitated subject, who was very considerably improved by treatment to the Maxillary Antra which were found to be infected - and by Tonsillectomy.

About 10 weeks after treatment, patient had a recurrence of nasal symptoms, rheumatic pains and a feeling of anorexia - the result of a recent cold: on examination, no post-nasal or nasal discharge was found and on transillumination all Sinuses appeared clear. The mucous membrane was pale, anaemic and oedematous. A course of treatment consisting of Ext. Malt  $\bar{o}$  Ol. Morrhuae Anti-catarrhal vaccine and Iron was prescribed. In my opinion this case is an example of the type - comparatively few in number, about 15-20% - which requires treatment on General Medical lines particularly in regard to addition of Vitamin A. to the diet - to secure that the local treatment carried out on the Accessory Sinuses and the Throat will be of lasting benefit.

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Case No. 10.

Sullivan. Mr. L.J.

On 28.10.36. Gave a history of Nasal Obstruction and continuous head colds for 5-7 years. Loss of sense of smell. Snores heavily in his sleep. General lassitude and depression. Frequent blowing of the nose with mucous discharge.

On Examination:

Left Nostril completely blocked with Polypi.

Right Nostril partially blocked with Polypi.

On Transillumination both antra and frontal sinuses appeared clear.

Treatment:

Polypi were removed from both sides at regular intervals and the anterior Ethmoid cells were curetted;

Conclusions:

This was a case of Right and Left Ethmoiditis with Polypi successfully treated by removal of Polypi and

cureting away of the diseased carious  
Ethmoid cells. Patient's sense of  
smell has also returned.

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Case No. III.

Foster. R.H. male - age 57.

On 18.3.35.

Complaint of inability to breathe through the nostrils for several years, and also profuse nasal discharge.

Causation: unknown : but as his occupation of a coal merchant entailed the inhalation of coal dust this may be a contributory factor.

On Examination: Both nostrils were absolutely packed with Polypi.

Diagnosis: Right and Left Ethmoiditis. I removed five large polypi from the Right side under local anaesthesia.

On. 23.5.35, under General anaesthesia and intra-tracheal insufflation, his Right and Left Ethmoids were opened up, curetted and all polypi removed. Right and Left antral wash outs showed mucopus:  
X-Ray: showed both Frontal Sinuses and Antra rather dense probably chronic catarrhal condition (Radiographer's report).

On 1.6.35 there was free nasal discharge: a Nose douche was prescribed.

On 16.10.35. He was able to breathe through each nostril freely, there was a little mucopus in the right nostril, otherwise the nose appeared quite clear.

On 25.3.37. He is still able to breathe quite freely through the nostrils and feels generally greatly improved in health.

Conclusions:

This was a case of Nasal Polypi of several years standing - doubtless much longer than the patient admitted - which produced nasal obstruction of a severe degree and also nasal discharge: and literally drove the patient to his doctor for advice.

After local treatment there was temporary and partial improvement, but after treatment under a general anaesthetic the whole of the right and left Ethmoids being exentrated and all polypi removed with very gratifying local and general results, and this has been maintained after a period of almost two years.

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Case No. 12.

Coningham. F. male - age 23.

On 9.9.35.

History of severe pain over the Right Frontal bone associated with a nasal cold of 14 days duration. Headache more severe when stoops forward.

On Transillumination: the right Frontal Sinus was dull. There was pus in the Right Middle Meatus. The Right Fronto-nasal duct was opened up and this gave temporary relief.

Inhalations and Rest in bed were prescribed.

Headache however became more severe, and so the anterior end of the Right Middle Turbinate was resected under local anaesthesia and the Fronto-nasal duct opened up again. There was free and offensive discharge from the sinus. Some oedema which was present over the Right Frontal Sinus gradually subsided.

X-Rays: showed opacity of Rt. Maxillary antrum and Right Ethmoid: Further operative treatment was advised:

On 5.10.35. Under Gas and Oxygen and Ether, an intra-nasal operation on the Right Ethmoid and Antrum was performed. The Middle turbinate was resected and a large amount of carious bone removed from the Right Ethmoid labyrinth.

The sphenoid sinus was opened and the hiatus enlarged. The Right Maxillary Antrum was opened and washed out with normal saline.

On 11.10.35. Much less discharge from the nose: no headache. No nasal obstruction.

On 10.1.36. Complained of slight stuffiness in the nose. This was due to a cold causing slight Rhinitis. It was noted that his Tonsils were definitely septic and removal was advised.

On 28.3.37.

He has been very well since the operation i.e. almost  $1\frac{1}{2}$  years ago. Has had no headache, no stuffiness, no nasal discharge.

On Examination to-day I find the Right

nostril quite clear, no discharge in the meatuses, and on transillumination both frontals and antra are clear.

His Tonsils however have not been dealt with and as they are still septic I have advised their removal soon, as otherwise he may get a reinfection of his accessory sinuses including the right Frontal Sinus:

Conclusions:

This was a case of Acute Suppurative Frontal Sinusitis of the Right side treated firstly by Conservative measures with partial success, and secondly by Intra-nasal operation with complete cure. It has to be noted however that a septic focus of infection remains, namely, the Tonsils and their removal by operation has been emphasized as very necessary, as otherwise, there is liable to be a reinfection of the nasal accessory sinuses including the right Frontal.

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