INFECTIONS OF THE NASAL ACCESSORY SINUSES

AND THEIR MODERN TREATMENT.

T H E S I S

Submitted for the

M.D. GLASGOW

by

WILLIAM BAIN, M.B.Ch.B. Glasgow, 1922

Clinical Assistant, Bristol General Hospital.

----------oOo----------

INTRODUCTION.

Infection of nasal sinuses should be considered from two aspects.

1. In its acute form, when it may be regarded as a separate entity, the patient presents more or less definite symptoms, and signs are quickly elicited which place diagnosis on a firm footing. Treatment can at once be started which if successful limits the disease to its initial site and general illness is prevented. This is the ideal but it is difficult to obtain if the patient is not seen in the early stages of sinusitis and he slowly drifts into the second stage when the seeds of a disastrous crop of illnesses may be sown.

2. Chronic infection of the sinuses is the natural sequence of an untreated acute infection and on account of its latency may go unrecognised for years until perhaps an acute exacerbation attracts the attention of both patient and physician. But before the supervention of the acute exacerbation the patient may have presented himself to his unsuspecting medical attendant with either a morbid systemic condition or a dangerously acute illness which I hope to show could have been avoided if a diseased sinus had been found and regarded as a focus of further trouble.

Besreaker has said, "It is the primary infection in the skin or mucosa that dominates the etiology of the

greater number of diseases in man that are caused by the staphylococcus as well as the streptococcus", and, surely this statement can be taken to include the mucous membrane of the nasal accessory sinuses.

It will be demonstrated later how these secondary infections occur but a recital of conditions due to focal sepsis and particularly sinus sepsis will at once attract attention to the importance of correct diagnoses and treatment of sinus suppuration.

Regional Complication of sinusitis.

1. Influence of sinus sepsis on mind and character has been repeatedly noted in my work among out-patients of Bristol General Hospital. Inability to concentrate, mental apathy, and symptoms of neurasthenia are common, and Watson Williams goes so far as to say that sinus suppuration may be and often is responsible for such grave disturbances as mental perversion and even insanity with suicidal tendencies. Criminologists are interested in sinus suppuration as a probable cause of deliquency.

At present in my care I have a female patient who suffers acutely from neurasthenia and who also has a definitely infected antrum. Her general condition is always aggravated by a fresh attack of sinusitis and it is my opinion that if she could be prevailed upon to undergo radical treatment her condition would be greatly ameliorated.

2. Sciatica has been cured by antral lavage, but I do not suggest that every case of Sciatica has for its origin focal sepsis. Migraine, supraorbital and occipital headache are common symptoms and "tic doloureux" has been traced to a nasal infection.

3. It has been my experience to meet with cases of chronic pharyngitis and laryngitis of a "catarrhal" nature which have been cured by attention to sinuses, while middle ear disease has been cut short by the timely intervention of sinus drainage.

4. Chronic bronchitis and bronchiectasis and a syndrome suggesting pulmonary tuberculosis have been proved to have been preceded by chronic sinusitis and from the investigations of Webb and Gilbert (J.A.M.A. 1921) it was found that many men had been mistakenly regarded as suffering from T.B. and that the condition really was chronic bronchitis, associated with chronic sinus disease. These investigations make a strong appeal for an examination of nasal passages in all cases of chronic cough when a negative sputum has been returned. It would appear from this that a more vigorous attention to sinus disease would do much to prevent chest complaints and would lessen the already too high mortality especially in influenza epidemics.

5. Lobar pneumonia. Mollison has quoted the observations of Dr. Darling on the relationship between sinus

suppuration and pneumonic infection. In post mortem examination of thirty-seven people who had died of pneumonic infection; twenty-two had lobar pneumonia; two acute pericarditis; nine acute meningitis, and it was found that ninety-two per cent. had marked sinus involvement and that the sinus condition was considerably older than the general condition.

6. Asthma. There are many cases of Asthma on record where nasal sinus disease has co-existed and I have in mind Miss O. who has bronchial Asthma associated with deflected septum infected antrum and extensive dental caries and pyorrhoea alveolaris. Teeth were extracted without the slightest improvement in bronchial trouble and she is now awaiting admission to the Bristol General Hospital for nasal treatment.

7. Chronic dyspepsia, gastric and duodenal ulcers while even appendicitis and cholecystitis have to be reckoned with when considering the nasal sinus as a focus.

The following scheme of a family of five sons will illustrate this point. (Watson Williams. Chronic Sinusitis).

Father (58) otitis from thirty years.

Chronic sinusitis still infective.

Five sons.

Age 30	28	26	20	16
No history of nasal sepsis.	Asthma Sinusitis	Asthma Sinusitis	Chronic rhinitis. Tonsils & adenoids removed.	Asthma Sinusitis.
Appendicectomy.	Appendicectomy.	Appendicectomy.	Appendicectomy.	

(Watson Williams).

8. Rheumatoid Arthritis. Dean and Armstrong (Annal of Otology, Rhinology and Laryngology 1919) have reported an investigation of chronic arthritis in twelve children under the age when dental sepsis could operate. Tonsils and adenoids were removed without success but all exhibited pus in antra or ethmoidal cells, and were relieved when thorough drainage was provided.

I am investigating the association of rheumatoid arthritis and fibrositis with infected sinuses and hope to put my findings on record in this paper.

9. Orbito-ocular complications are perhaps the most dangerous of all the sequelae of chronic sinus suppuration. Failure in diagnosis is fraught with disaster and has led to unnecessary enucleation of eyeball (Fish. Medical Record 1906) and even meningitis and brain abscess. The following is a case treated by Mr. Scarff and Mr. Iles at Bristol General Hospital the records of which I have studied. The case will show the importance of making the true diagnosis of ethmoiditis.

History.

Pain at back of right eye for one month and in right supraorbital region. Discharge from right nostril for four or five years, free until considerably diminished one month ago. Diplopia for one week.

Examination showed dullness of right ant~~erior~~ ✓um and right frontal sinus; numerous nasal polypi and pus in right nostril.

An abscess at outer end of orbital margin was opened and thick pus was drained. A second incision was made at inner end of orbital margin and continued down side of nose and although freely opened no frontal sinus was found. The passage of bougie up fronto nasal duct brought pus. X-ray showed that there was no frontal sinus but an extensive orbito ethmoidal cell was present.

The history shows that sinusitis had been present for years and had been unrecognised by patient as important until drainage of ethmoidal cells had been interfered with and orbital abscess has developed. The patient was seen frequently as an out-patient and was discharged well about eleven months after operation.

In two cases published by Mr. Logan Turner in Edinburgh Medical Journal, 1907, drainage of frontal sinus was performed successfully for oedema of eyelids, while in other two cases the frontal sinus was responsible for subperiosteal abscess.

The same investigation has also recorded a case of orbital abscess proceeding to meningitis illustrating the necessity for early diagnosis.

Here the patient presented herself one week after receiving a blow on face which produced slight epistaxis. On the next evening there was a slight swelling of upper eyelid and eventually, frontal, ethmoidal and sphenoidal sinusitis supervened with caries of bone and spread of septic

process to eye, cavernous sinus and then to frontal lobe.

The researches of Birch and Hirschfield show that out of six hundred and eighty-four cases of orbital infection fifty-nine per cent. were due to sinus infection. It was also noted that ethmoidal cells rank higher in producing morbid orbital phenomena and next in frequency frontal sinus.

Optic neuritis may be caused by the passage of a virulent infection from sphenoidal sinus or sometimes from posterior ethmoidal cells to optic nerve. (Gavin Young. British Medical Journal 1922). Reference to varying relations of optic nerve and posterior nasal cells will be made later.

It will be seen that the sequelae of untreated nasal sinus suppuration are many and varied and that distant as well as near complications may result from unrecognised cases, and it will be my object to show the importance of sinus infection in the realms of general medicine.

---------oOo---------

ANATOMY.

Frontal Sinus.

The frontal sinus, pyramidal in shape lies in the ascending ramus of frontal bone behind the superciliary arches. The two sinuses are rarely symmetrical and are divided by a septum, which may deviate considerably. The septum however is always constant at its insertion behind the junction of the nasal bones where it lies in middle line (Diagram 1).

The frontal sinus develops in late foetal life from middle meatus and shows considerable increase in size about the 7th and 8th years, reaching full size at puberty when the average measurements are:- height 3 cms.; breadth 2.5 cms; depth 2.5 cms.

Anterior wall varies in thickness and is formed by convex outer table of frontal bone.

The posterior wall, thinner than anterior forms the anterior wall of anterior cranial fossa and is therefore in relation to frontal lobe.

The inferior or orbital wall is very thin especially at the junction of anterior and internal walls and it is at this point where swelling frequently occurs in infection of the sinus.

Defects in the walls are of common occurrence and allow the spread of infection to orbit and cranial contents.

Medially the frontal sinus overlaps the ethmoid and laterally it overlies the orbit to a varying extent. One sinus may be absent or may extend into zygomatic process of frontal or upwards to frontal tuberosity or posteriorly to lesser wing of sphenoid (Diagram 2). Irregular offshoots are sometimes found extending upwards towards the vertex or towards the temple and these are often responsible for relapses after drainage has been attempted in frontal sinusitis.

The ostium is situated in the sinus floor and is satisfactorily placed for drainage, leading into fronto nasal duct which opens into middle meatus at infundibulum. The fronto nasal duct, or continuation of hiatus semilunaris traverses the ethmoidal labyrinth and is about ½ inch in length. This is the direct method of drainage, but if an infundibular cell is situated in hiatus, the hiatus ends blindly and is not continuous with infundibulum. In this case the ostium opens above. The duct may open into an anterior ethmoidal cell. (Diagram 3).

The mucosa is thin and adherent to bone and mucous glands are scarce. Blood supply is from branches of sphenopalatine entering by ostium.

Venous return is by

1. Externally - facial vein.

2. Internally - into nose.

3. Posteriorly - to dura.

4. Into orbit.

This is important in regarding the spread of infection.

The Sphenoidal Sinus.

The sphenoidal sinus occupies the body of sphenoid and develops as an offshoot from the nose probably as a result of air pressure. Coffin in his investigations found the sinus small in children where the presence of adenoids altered the normal nasal air pressure. A septum divides the two sinuses which are usually asymmetrical. The average measurements are:- height 2.2 cms.; breadth 2 cms.; depth 2.2 cms.; but variations in size are often seen depending on the amount of absorption of bone that has taken place.

It is convenient to regard the sphenoidal sinus as a six sided cube with the walls as follows:-

1. Anterior.

2. Posterior or basilar.

3. Superior or cerebral.

4. Inferior or Choanal.

5. External or cavernous.

6. Internal or septal.

1. Anterior wall inclines downward and backward and articulates laterally with the ethmoid. The ostium is situated in the medial part of the upper third and is unfavourable for

drainage. The ostium opens into spheno-ethmoidal recess. (Diagram 3).

2. Posterior wall is thick and therefore its relations are of less surgical importance.

3. Superior wall varies in shape and thickness and may show dehiscences bringing mucous membrane into contact with cranial contents. The relations from before backwards are, frontal lobe, olfactory tract, optic commissure, (Diagram 5) the pituitary body and sometimes, pons varolii. Close to the angle formed by the roof and lateral wall lie the optic nerves and ophthalmic artery (Diagram 6).

4. The Inferior wall forms part of vault of naso pharynx. The vidian nerve is in relation to this wall, in the pterygoid canal. (Diagram 7).

5. The Lateral or external wall is in relation to the internal carotid artery and cavernous sinus and where it forms the superior orbital fissure anteriorly are the 3rd, 4th, and 6th nerves, and ophthalmic branch of 5th. This fissure also contains ophthalmic veins passing to cavernous sinus. (Diagrams 6&7). The foramen rotundum in greater wing of sphenoid carrying the superior maxillary branch of 5th nerve may come into relationship with this wall. This wall is often very thin and defective.

6. Internal wall is the septum and may deviate so much as to bring the sinus in close relationship with the cranial nerves of the other side, a point to remember in diagnosis.

Anomalies.

Increase in size due to over absorption of bone may cause prolongation of sinus into lesser wings of sphenoid, or into the antero-inferior angle or into the pterygoid process or into basilar part of occipital. Extension into lesser wings brings sinus into very close relationship with optic nerve which may even be within the sinus. Extension into antero-inferior angle brings the sphenoidal sinus into such relationship with maxillary sinus that only a thin plate may intervene. Stagnation in sinus results when it is prolonged into pterygoid process. A posterior ethmoidal cell sometimes pushes sphenoidal sinus backwards and downwards and so takes the relations of the superior or cerebral wall of sinus.

The mucous membrane is thin but not very adherent to bone and does not contain many glands.

The veins of anterior wall open into nasal cavity and into the ophthalmic vein. Those of the sides and roof open into the cavernous sinus. Arterial supply is from sphenopalatine, pterygo palatine and vidian arteries.

Ethmoidal Cells.

Ethmoidal cells begin to develop during late foetal life but are not readily recognisable at birth. They begin to develop appreciably about the fourth year and reach full size about twentieth year. They vary in size, shape and

number and are divided according to position into anterior and middle and posterior. The ostia of anterior group lie in the infundibulum in the middle meatus, the middle between uncinate process and middle turbinate about the centre of bulla ethmoidalis. (Diagram 4). The posterior cells open into superior meatus or spheno-ethmoidal recess. The total capacity of ethmoidal cells is about 10 ccs.

The ethmoidal cells lie between roof of nasal cavity and orbit from which they are separated by a thin and often defective plate of bone. They occupy about half the space between the nasal floor and cribriform plate.

The superior wall is completed by the depression on the ethmoidal edge of frontal bone. Inferior wall formed by the margin of orbital plate of maxilla in front and by orbital process of palatine behind. The lateral wall is formed mainly by lamina papyracea, while medial or nasal wall is formed by superior and middle turbinates. The cells of each group intercommunicate but the anterior and posterior groups are kept distinct by the lamella of middle tubinate.

The cells of one side are separated from those of the other by the lamina perpendicularis.

The posterior wall is formed by anterior sphenoidal wall on spheno ethmoidal recess.

The anterior cells are situated in (1) infundibulum, (2) pre ethmoid recess, (3) bulla.

1. Infundibula cells may be found anterior, posterior, and superior. Anterior cell when present lies beneath agar nasi and opens into hiatus.

2. Pre ethmoidal cells may interfere with drainage of frontal sinus by impinging on fronto-nasal duct.

3. A cell may project into floor of frontal sinus and is known as bulla frontalis.

The posterior cells are usually found at:-

1. Junction of middle and superior turbinate one of which may encroach on orbit.

2. A lateral cell may push into wing of sphenoid beneath optic nerve and ophthalmic artery.

3. Posterior cell may encroach on sphenoidal sinus pushing it downwards and backwards.

Air spaces may occur in the middle turbinate either from anterior or posterior group of cells and the crista galli may contain cells connected with the anterior group.

The blood supply is from sphenopalatine and anterior and posterior ethmoidals, branches of opthalmic artery.

Veins accompany arteries into orbit, thence to ophthalmic vein and cavernous sinus. The veins on cribriform plate anastomose freely with those of dura and superior longitudinal sinus.

Maxillary Sinus.

The maxillary sinus or antrum of Highmore is a pyramidal shaped cell occupying the body of maxilla and has a capacity

of about 12 ccs. in female, 18 ccs. in male. It is present at birth as a small sac leading from middle meatus when it occupies a position internal to and not inferior to orbit as it does in full development. Between the final eruption of temporary teeth in 2nd year and the appearance of permanent teeth in 7th year, the antrum shows a considerable increase in size and at 25th year, when the last permanent tooth has erupted the sinus reaches full size; height 3.5 cm., breadth 2.5 cm., depth 3 cm.

The bounderies of antrum are as follows:-

Above is the orbital plate indented by the infra orbital canal containing maxillary nerve and accompanying vessels. The floor is the alveolar border of maxilla and in the fully developed sinus the floor lies below the nasal floor and bears indentations of 1st and 2nd molar teeth. Along the floor ridges are frequently seen. (Diagram 10).

The anterior wall is formed by the canine fossa, the area lying between canine ridge and zygomatic fossa and is pierced in its upper part by infra orbital foramen.

The nasal wall forming base of pyramid is important and can be divided into a lower and upper segment by the attachment of inferior turbinate. The lower segment is completely osseous and forms lateral wall of inferior meatus. Bone is thinnest and easily pierced immediately below attachment of turbinate. The upper segment, the lateral wall of middle meatus is osseous in its anterior part and is composed

of the following structures from before backward; maxillary process of inferior turbinate; maxillary part of palate bone, the uncinate process, and lamella of bulla; pars membranacea is the posterior part of upper segment. Posterior wall separates the sinus from pterygo palatine fossa.

The ostium is situated near the roof of antrum, a position unfavourable for drainage in erect posture and leads into middle meatus between the posterior third of uncus and the bulla and is in the lower end of hiatus semilunaris. It may be oval or round and is about the size of a pea and is often divided by a ridge, accessory ostia open into pars membranacea posteriorly and below the main ostium.

Abnormalities.

The antrum may be enlarged by absorption of bone. The enlargement may be at the expense of orbital wall or of hard palate when bulging may be produced under pressure from antrum in the roof of mouth. The antrum may be small with thick walls, interfering with diagnostic transillumination test. Complete partitions are rare but ridges are common. A large misplaced ethmoidal cell may give the appearance of duplicating of antrum but as the opening for this cell is found in superior meatus its true nature is evident.

Mucous membrane is composed of ciliated columner epithelium, is very thin and has few glands.

The antrum is supplied by infraorbital and alveolar branches of internal maxillary artery.

Physiology.

Various theories on function of nasal sinuses have been advanced from time to time, the chief of which are the following.

1. That the sinuses are remains of rudimentery adjuncts to the sense of olfaction in lower animals. In the animals noted for keen sense of smell the presence of accessory olfactory ridges in frontal, sphenoidal and maxillary sinus has been discovered.

2. It has been claimed that the sinuses help the maintenance of balance by lightening the bones of skull.

3. Vocal resonance is said to be influenced by the sinuses and this view has come to be regarded as correct. It is significant that the Maori has associated with a dull non-resonant voice very small sinuses.

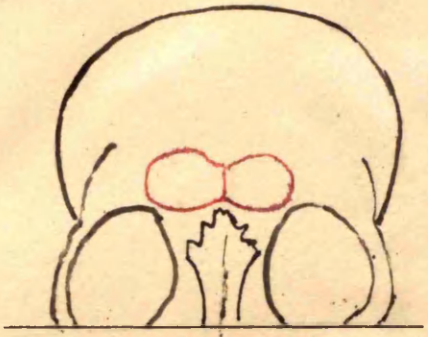
4. It used to be thought that the sinuses moistened the nasal cavities but the mucosa is almost devoid of glands and this theory does not seem feasible.

A certain amount of air change takes place in the sinuses with respiration, and it is possible that the air is moistened thereby.

---------oOo---------

NORMAL FRONTAL SINUSES.

1.



2.

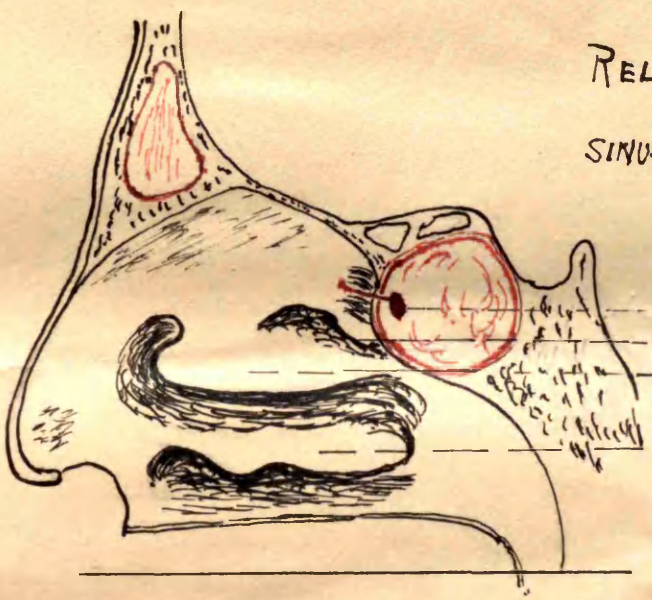
ATYPICAL FRONTAL SINUSES.

(1) EXTENDING LATERALLY

(2) EXTENDING UPWARDS.

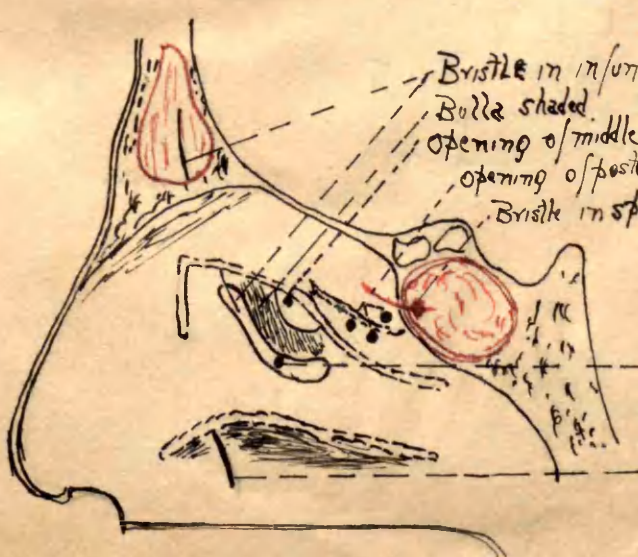
3.

RELATIONS OF FRONTAL AND SPHENOIDAL SINUSES IN NASAL CAVITY.

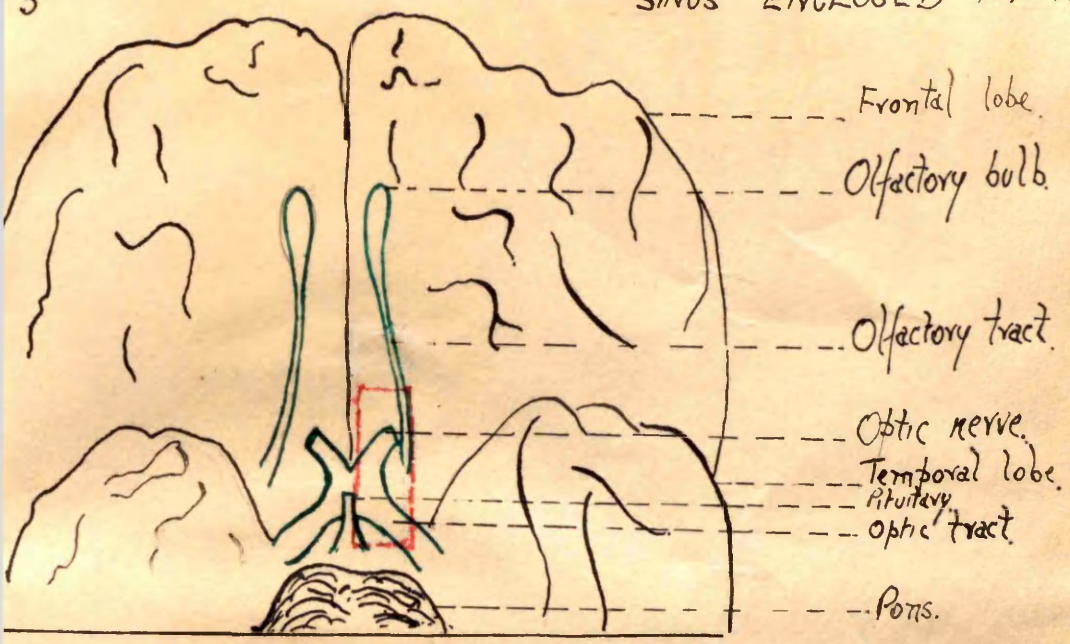


TURBINALS CUT AWAY TO SHOW OSTIA

4.

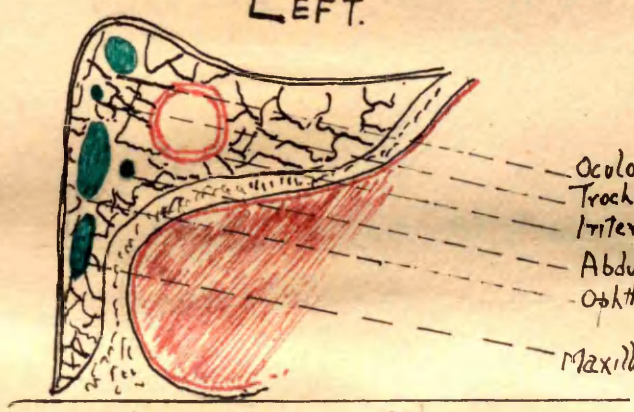


5 RELATIONS OF ROOF OF SPHENOIDAL SINUS ENCLOSED IN RED.



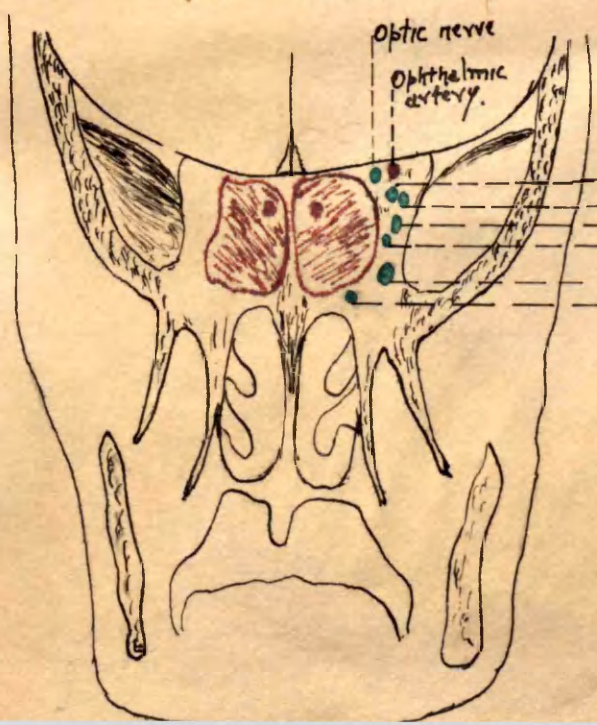
LEFT.

6. RELATION OF (LEFT) SPHENOIDAL SINUS TO CAVERNOUS SINUS AND CONTENTS FROM BEHIND.



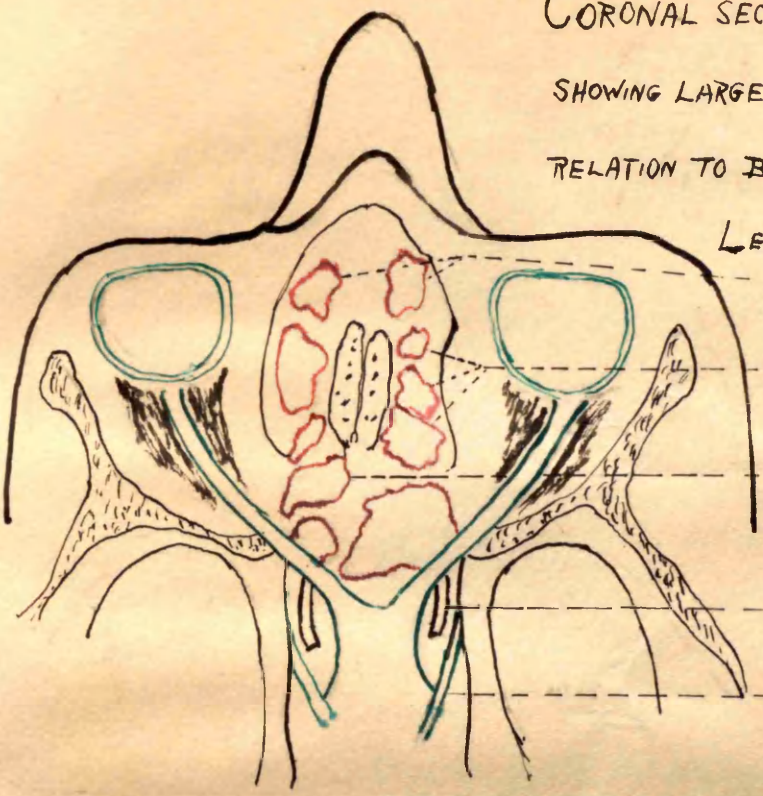
L. R

7. SECTION CUT IN FRONT OF CHIASMA SHOWING RELATION OF SPHENOIDAL SINUS TO VESSEL AND NERVES.



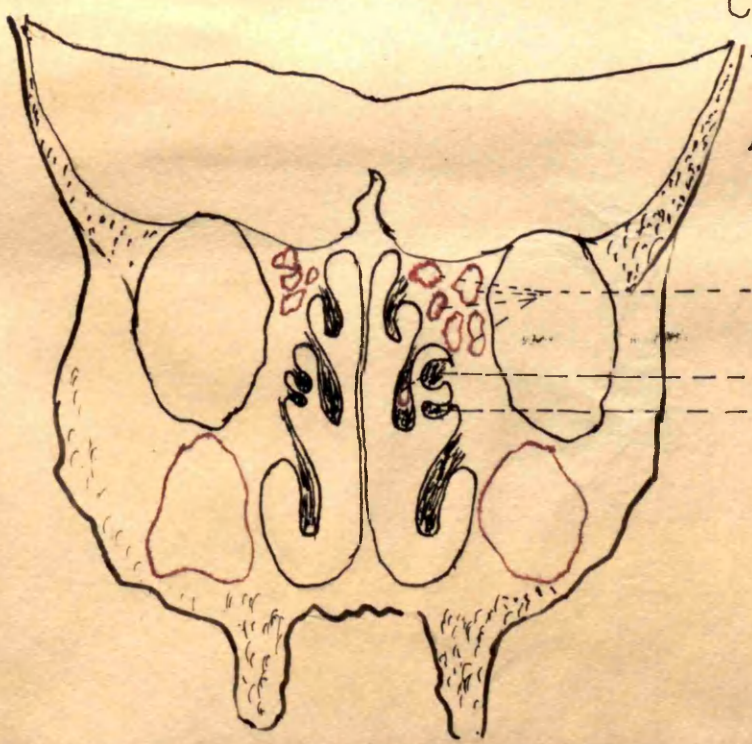
8

CORONAL SECTION AT ETHMOID LEVEL SHOWING LARGE RIGHT SPHENOIDAL SINUS IN RELATION TO BOTH OPTIC NERVES



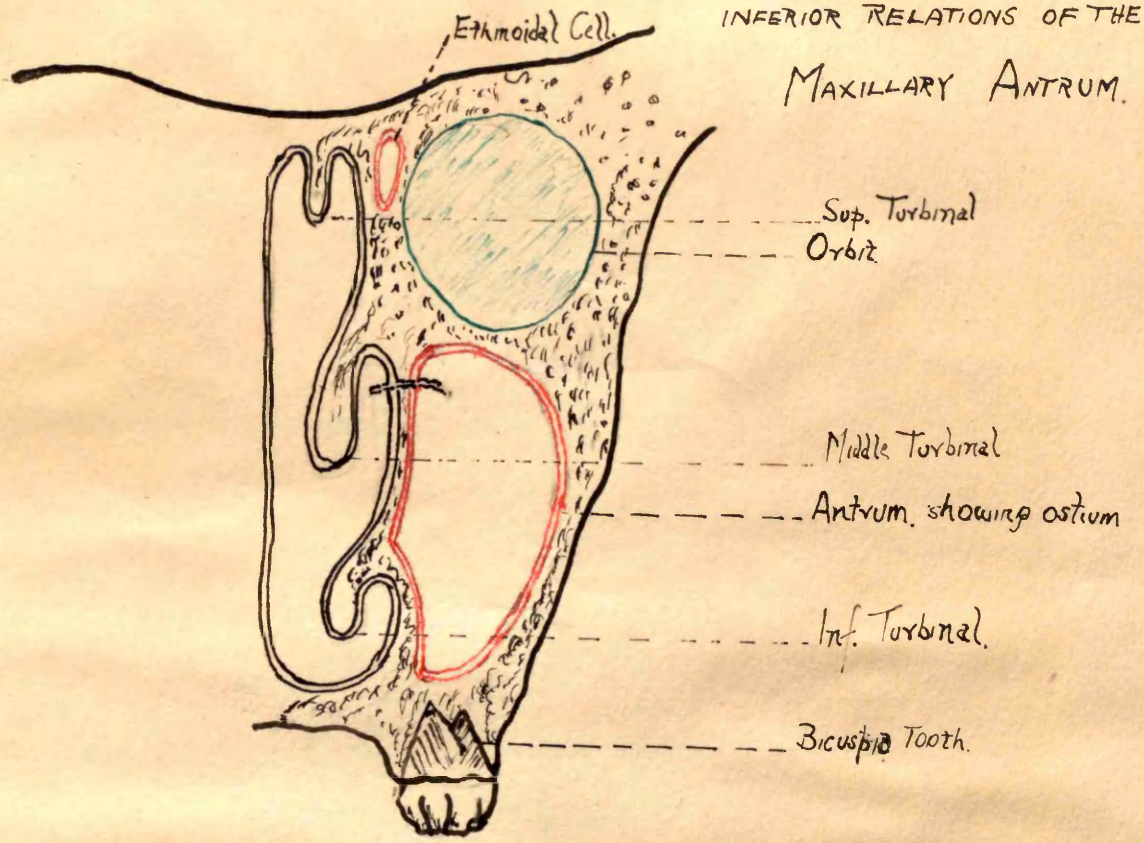
9

CROSS SECTION BEHIND UNCINATE PROCESS SHOWING RELATION OF ETHMOID.



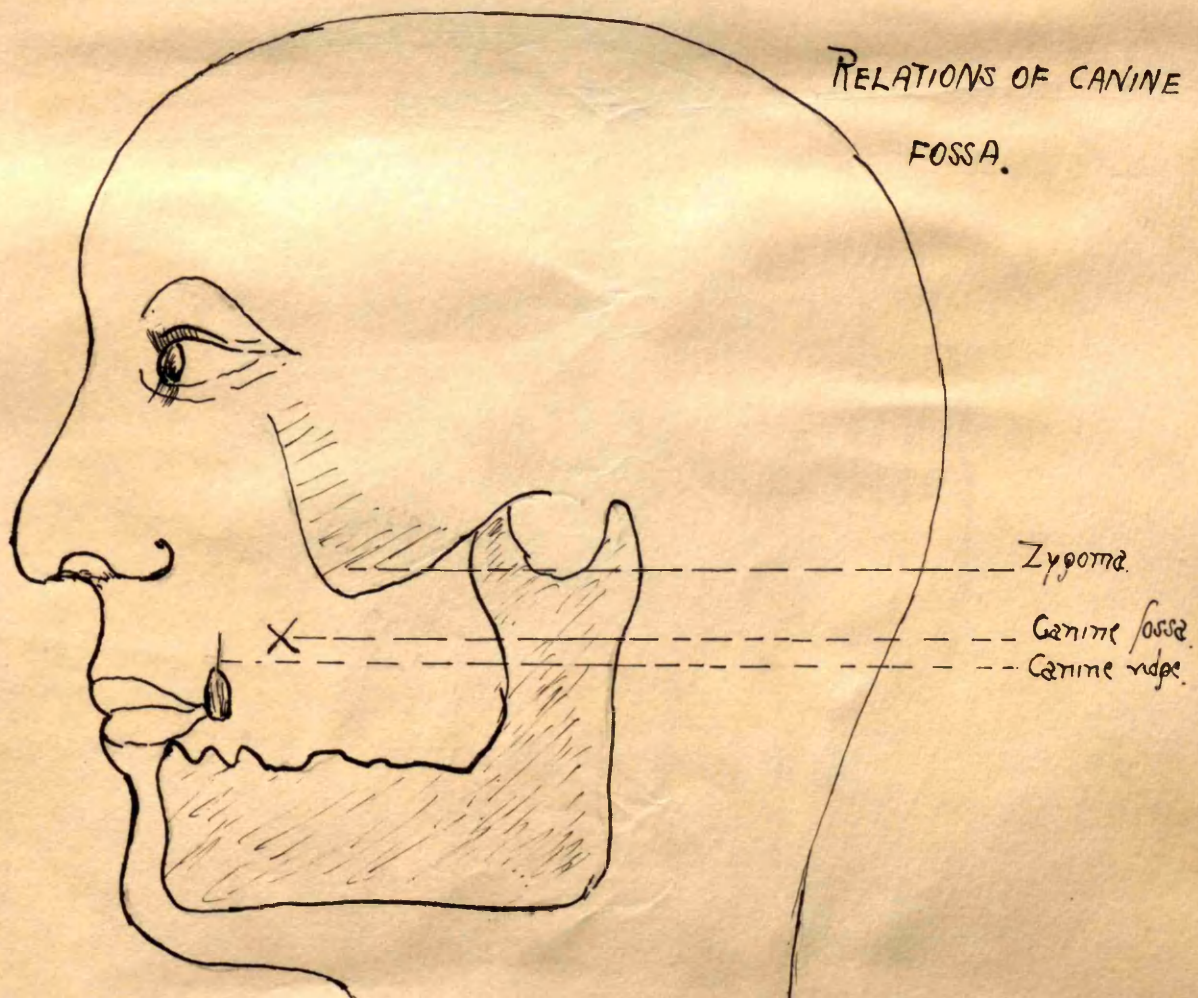
10

THE SUPERIOR, MEDIAL, AND INFERIOR RELATIONS OF THE MAXILLARY ANTRUM.



11.

RELATIONS OF CANINE FOSSA.



ETIOLOGY AND PATHOGENESIS.

The main factor in the etiology of sinus disease is a bacteriological one but why one subject should be infected and not another where apparently similar local conditions exist is not understood.

The disease may be caused by local conditions producing infection, the most important of which from point of frequency are.

1. Coryza or common cold.

Simultaneously or shortly after infection of nasal mucous membrane is established the infection passes through ostia to the sinuses or what is more frequently the case, to one sinus or group of cells. The nasal mucosa recovers more rapidly and more completely than that of the sinus and when another attack of coryza occurs it finds the sinus less able to resist and the first stage of chronic sinusitis has been passed (more will be said of this when chronicity is dealt with).

2. A frequent cause of sinusitis is to be found in the infective fevers especially in children. Scarlet fever, produces a very virulent form of sinusitis which frequently? goes on to osteomyelitis; measles also ranks highly in the etiology of sinus disease in children. Probably the infection most frequently associated with sinusitis as a sequel is influenza and this fact has been specially noted

during the past three months at the out patient department of Bristol General Hospital.

Lobar pneumonia is very often followed by sinusitis but it is important to note that Mollison has stated pneumonia is very frequently preceeded by sinus infection.

The Klebs-Loeffler bacillus has been found in an infected sinus following faucial diphtheria but false membrane has not been demonstrated on many occasions. In erysipelas it is doubtful if sinus infection occurs as a focus or is secondary, but general opinion favours the view that it is secondary.

Typhoid, cerebro-spinal meningitis, smallpox, glanders, mumps and gonorrhoea have all been found responsible for a sinus infection

3. In disease of the antrum the presence of carious teeth of the upper jaw especially the 2nd bicuspid and 1st molar is often found to be the infecting agent. A root abscess may rupture into the antrum or a stump may be driven in during extraction, thereby causing infection. This used to be regarded as the most important etiological factor in antrum disease but modern methods have assessed this at ten per cent, to thirty-three per cent (Tunis Laryngoscope 1910). My experience leads me to observe that this percentage is too high and that it is probably at the most ten percent. of all cases seen in the chronic state.

A recent case with antrum dull seen at Bristol General Hospital showed an alveolar sinus discharging pus following extraction of 2nd bicuspid for so-called neuralgia. Another case had a dental cyst opening into floor of antrum.

4. One sinus may be infected by another, the infection passing by gravity along the mucous membrane or through the bone or by lymphatics. In this connection it has been found that an antrum containing pus which has drained from frontal may resist the organisms and may in fact act solely as a reservoir.

5. External violence especially in fronto-ethmoidal region may cause infection and it is noted that trauma need not necessarily be gross to lead to infection. Frequently haemorrhage occurs in the cells and acts as a nidus for invading organisms which set up a virulent sinusitis often followed by grave intracranial complications. The details of a case of this type were given in the introduction showing that the only immediate sequel of the blow was slight epistaxis.

6. Foreign bodies have been found in infected sinuses or blocking the ostia and have been presumed to have been concerned as causatory agents. Among these are pieces of drainage tubing, gauze, cotton wool, flies and their larvae.

7. Diving into swimming baths, feet first, thus forcing infected nasal secretion or even foul water into the sinuses

has been named as a probable cause of sinusitis, while injudicious nasal douching and too extensive galvano-cauterization of nasal mucosa has frequently been followed by infection of sinuses.

8, Neoplasms i.e. carcinoma and sarcoma, tuberculosis and syphilis by attacking the bony structure of nose frequently involve the sinuses.

Subjects who have suffered from acute rheumatism, peritonitis, contracted kidney and metallic poisoning show a marked predisposition to infection of accessory sinuses.

A narrow nasal cleft associated with one or other of the above factors will by hindering the already difficult drainage predispose to sinus infection.

Nasal polypi may, by encroaching on the ostia cause sinusitis, but in my opinion they are more often the result than the cause of sinusitis and I have repeatedly observed that thorough eradication of the sinus infection will cure polypoid degeneration in a very large number of cases. Of course all nasal polypi are not associated with sinusitis either as cause or result e.g. in spasmodic and cerebro-spinal rheumorhoea polypi are often found as part of the general oedematous condition of nasal mucosa.

When nasal polypi recur after snaring, it may be said with certainty that they are due to ethmoidal suppuration and that only complete destruction of ethmoidal cells will

cure the condition. Occurring in antrum and sphenoidal sinus the polypus is usually single, and presents at the naso pharynx at the end of a long pedicle. These two examples may cause complete occlusion of ostia and lead to either sinus vacuum or infection.

A deflected septum by compressing middle turbinate against lateral wall of nose will decrease the free space of middle meatus and cause obstruction to the ostia of the anterior group of sinuses and consequently suppuration follows through insufficient drainage. Cellular distension of the middle turbinate operates in the same way and in fact may impinge on septum and cause irritation of mucous membrane and possibly infection which may enter other sinuses.

Etiology in Children.

Sinusitis as noted previously is frequently preceded by one of the exanthemata especially measles and scarlet fever, (figures will be forthcoming from my own investigation on measles as a cause), but probably the most common cause is diseased condition of adenoids. In my experience at Bristol General Hospital, antrum infection is frequently associated with enlarged tonsils and adenoids and furthermore the removal of these has frequently been found to be sufficient to effect a cure. My opinion of this is that a cessation of discharge from adenoids allows the rhinitis to subside and drainage of antrum follows the return of the mucosa to normal.

An investigation of sinusitis following measles in children was carried out by myself in March 1933 and of fifty cases examined by inspection and transillumination confirmed by puncture two were found to have an infected antrum. Both cases were associated with hypertrophied tonsils and adenoids and were cured following attention to fauces and nasopharynx. Another case was found to have had scarlet fever three weeks before onset of nasal discharge and measles about two months previously.

Pathogenesis.

The infective process attacks the mucosa for the most part and leaves bone almost untouched except for microscopic changes. Osteomyelitis is fortunately a rare occurrence in sinusitis but when it is present is severe and is frequently followed by intra cranial sequelae. The changes in mucous membrane are profound and destruction is often extensive. Mucous membrane becomes swollen and oedematous and a polypoid condition ensues from the action of oedema and gravity. This is well marked in ethmoidal cells which may be so distorted by the excessive polypoid formation as to cause a widening of the bridge of the nose and alteration in the facial appearance of the subject affected.

The bone resistance is so sturdy that although so thinned and twisted the bony walls do not become necrotic.

Chronicity of sinus suppuration is not as a rule due

to bony involvement but to local peculiarities such as ramification of cells as in frontal occasionally, and always in ethmoid, to the unfavourable position of the ostia for drainage as in the antrum and sphenoid and to the fact that the persistence of but moderate oedema round the ostia will prevent proper drainage and so lock up the infection in the various sinuses.

The changes in mucosa depend on:-

1. Duration and virulence of infection which is what is to be expected.

2. Resistance of mucosa which varies in different subjects and which is imperfectly understood.

3. Drainage conditions as in the antrum, the mucosa of which often shows most marked changes owing to the fact that the lower part is often bathed in pus.

When a certain amount of secretion has accumulated in the infected sinus the cilia lose their motility and as the ostia become blocked by the oedema, secretion goes on until resolution begins. Resolution may now set in slowly the oedema subsides and drainage becomes re-established. But if drainage is not obtained the condition may after a time become chronic and the mucosa so altered that a return to normal is impossible. In this state mucous membrane shows petechial haemorrhages and desquamation; epithelium loses its columnar ciliated appearance and becomes squamous in type and is thickened.

The bacteriology of sinus suppuration may be divided into two groups as suggested by Sir St. Clair Thompson.

1. Those of nasal origin - pneumococci, streptococci and staphylococci, aerobic organisms which produce non foetid pus.

2. Those due to dental disease, anaerobic and producing marked foetor.

----------oOo----------

SYMPTOMATOLOGY.

The symptoms of paranasal sinus infection may be divided into those caused by contiguity and the remote effects caused by absorption, and while very often the former are obvious and to be readily found for the searching, the latter may evade all but the most painstaking investigations.

In acute sinusitis the symptoms which one may meet in order of frequency are, pain, nasal discharge, and nasal obstruction, while in chronic sinusitis the patient's statement is usually opened by a reference to frequency of colds, chronic nasal discharge or post nasal catarrh, headache with occasionally a complaint of deafness and earache. At this stage the patient's general condition has deteriorated and one is frequently impressed by the patient's facial appearance of ill-health and apathy. The mentality usually suffers and the victim complains of lack of concentration, loss of interest in business and pleasure and in general shows signs of chronic toxaemia which in truth it is.

All these are characteristic of infection of sinuses and although they may not all be found at once, a combination of two or more should always lead to a detailed examination of the sinuses.

Acute sinusitis as already stated may follow coryza or influenza, and may be ushered in by a slight heaviness over the affected sinus, a rise of temperature and a meagre

amount of discharge usually regarded by the patient as nothing more than a cold. Again the condition may be severe with vague symptoms which evade diagnosis.

The symptoms will now be considered in detail.

Headache, pain and tenderness.

The presence or absence of headache is important for it is nearly always present in acute sinusitis, but may be absent in the chronic state. Not infrequently, headache is attributed by the patient to neuralgia constipation or "liverishness" or even "eyestrain". The reference to eyestrain is not without reason sometimes, for it will be shown that orbito-ocular symptoms may take a very important place in sinusitis, For the medical attendant who dismisses the headache as supra or infra orbital neuralgia there is little excuse and no mistake is fraught with more disastrous results than this, even if the end results are delayed.

The pain may be due to pressure of secretion under tension, or to the pressure of swollen mucosa on nerves, a state often noted when hypertrophied middle turbinal causes pain by pressing on septum. Vacuum headache is caused by absorption of air from a closed sinus, a fact which may be demonstrated by the relief brought about by the application of cocaine to the ostium. Ulceration of sinus walls though rare may be responsible for headache. Absorption of toxins in my opinion might be blamed for the diffuse type of

headache that often occurs.

Indulgence in alcohol and tobacco by causing cerebral congestion aggravates the headache and it may also be influenced adversely by a change of posture, straining at stool, or even by accommodation, which becomes an effort.

The headache of sinusitis is often marked by periodicity, the pain coming on about 10 a.m., and gradually receeding in the early afternoon. One patient of mine, a night worker complained of headache in the evening showing, I think, that periodicity of pain is explained by difficulty of drainage after the sinuses have accumulated pus following rest in supine position.

This headache which is sometimes so conspicuous by its periodicity, can be very inconstant and difficult to elucidate and has no relationship to the amount of suppuration. Here as in other diseases, pain is relative, and I think depends very much on the mental or rather the psychotic character of the subject.

Grunwald has stated that headache is present in 100 per cent. of acute cases and in 50 per cent. of chronic.

The pain may be local or referred to the area of another sinus and in this way may lead to suspicion falling on a healthy sinus. It varies from a mild numbing sensation, to overwhelming agony, and Watson Williams is of the opinion that the pain of sinusitis may lead to suicide and

~~that the pain of sinusitis may lead to suicide~~ and that the overpowering headache so frequently referred to in the Coroner's Court may be symptomatic of sinusitis.

Tenderness is not of any great importance and I have seldom found it prominent except in frontal sinusitis, where it occurs on the under surface near the inner canthus. It is important not to confuse tenderness from pressure on supra-orbital nerve with that of frontal sinusitis and it is also important to use pressure on the other sinus as a control.

In acute sinusitis pain is not in my opinion a reliable guide to the sinus affected and to be a help to accurate diagnoses, must be considered along with the other symptoms. As already stated pain may be no more than a feeling of illness and tension or but a slight aching aggravated by conditions increasing cerebral pressure and with perhaps only slight tenderness over antrum in frontal sinus. But again the pain may be so distressing as to cause loss of sleep.

In chronic sinusitis, headache and pain although very confusing in distribution may be of some service in assisting diagnosis. It varies in intensity with the drainage of affected sinus and as more than one sinus is frequently infected the distribution may be complex..

The following, however, is an account on broad lines of pain as a diagnostic symptom.

Antrum.

The pain is often referred to the area of distribution of the supra orbital nerve and may suggest frontal sinusitis. When the infection is due to a septic tooth, pain in the cheek over the antrum will be complained of and this not infrequently extends up over the whole side of face.

Frontal sinus.

Infection of this sinus is accompanied by very definite pain and is usually associated with tenderness on upward pressure at inner canthus; at this point it is well to mention the oedema of upper lid one sees appearing morning and passing off as the day advances. This is inflammatory in origin and not to be confused with another type of oedema mentioned later. Periodicity of pain from frontal sinusitis is of diagnostic importance.

Ethmoidal.

The pain is usually experienced in the nasal bones and may be relieved by application of cocaine to the internal and external branches of naso-ciliary nerve in the upper and anterior regions of nose. (Tilley. British Medical Journal. April 1933). I have observed pain of a very persistent character in two cases with marked cellular formation of middle turbinate pressing on septum.

Pain and tenderness in eyes, pain on rotating and on reading are noticed when secretions are held under tension in ethmoidal cells, and pain extending up towards vertex is

sometimes noticed in similar circumstances.

Sphenoidal.

Sphenoidal headache is often referred to as being "inside the head behind the eyes" boring in character and accompanied by mental apathy or confusion. A note on reason for this will be made later.

This type of headache may be a very prominent symptom varying in intensity with the drainage of the sinus but never quite passing off. The onset of a paroxysm is dreaded by the patient and the mental effect is often very prominent. The pain besides being felt behind the eyes, may begin in vertex and extend to occiput or to the mastoid region in which position it has frequently been suspected as being due to mastoiditis. Vertigo is frequently associated with sphenoidal headache. An interesting type of pain sometimes occurs in sphenoidal sinusitis when the Vidian nerve is involved and is known as spheno-palatine syndrome - pain in supraorbital, ocular, supmaxillary mastoid and occipital regions, and even extending down arm to finger tips. (Tilley British Medical Journal April 1933). Tilley advises application of cocaine to Meckel's ganglion, behind and above the posterior end of middle turbinate as a method of diagnosing this condition.

Throughout the literature and in my own experience at Bristol General Hospital, I am frequently impressed by the insignificance or even absence of pain in latent types of sphenoidal sinusitis. Absence of pain should not lull one

to a sense of security, for if post nasal catarrh and toxic symptoms are present the sinuses should still be suspected until cleared by a negative bacteriological report.

Frequent colds.

A history of a succession of colds, increasing in frequency is a very common feature in the symptomatology of sinusitis and where given, should always lead one to search for an infected sinus. This may be the only symptom, especially in children, where in the absence of enlarged tonsils and adenoids a chronic infection of an antrum will produce a succession of colds without much provocation. Of course sinus infection may co-exist with enlarged tonsils and adenoids, but one usually treats the latter before thinking seriously of infection of antrum. One investigator (Cleminson J.O.L.O. November 1921) has stated that attention to adenoids and tonsils very frequently assists drainage of antrum and puts forward the interesting hypothesis that what has become to be known as the adenoid facies might in reality be an expression of sinusitis in children. I am of the opinion however that removal of adenoids by eradicating a source of infection will simplify the treatment by lavage in children.

Each successive "cold" in reality defines an acute exacerbation of a chronic infection and should be regarded as a symptom and not as an entity. This symptom also should

stimulate one to search for a definite cause just as repeated dyspepsia should lead to an investigation of gastric function.

Ethmoiditis in particular is characterised by a frequency of severe "colds".

Purulent nasal discharge is perhaps the most constant on a varying list of symptoms of sinusitis in the anterior group, i.e. antrum, frontal, and anterior ethmoidal cells and is accounted for by the position of the ostia in the middle meatus. The pus appears at the anterior nares in an amount depending on the stage of the infection and also on the potency of the ostia. If the discharge is abundant excoriation of vesitbule and upper lip is a possibility, from which may arise erysipelas.

Post nasal catarrh is very often a manifestation of sinusitis of the posterior group, i.e. post ethmoidal cells and sphenoidal sinus, and produces a characteristic discomfort and desire to clear the post nasal space. This long continued flow of pus down the pharynx gives the mucous membrane a peculiar dry and shiny appearance, bilateral if sinusitis is one sided. Besides this type of pharyngitis, laryngitis and bronchial complications may ensue from the irritation of purulent discharge. But it is noted that a pharyngeal or laryngeal sequal should not be taken as definite evidence of infection of posterior group because

I have seen several cases with catarrhal laryngitis where an antrum alone was responsible. I would explain this by the fact that the accessory ostium when present opens posteriorly and inferiorly to normal ostium and pus from it tends to drain backwards rather than forwards. I am of the opinion that accessory ostia are very frequently present.

The discharge varies in appearance from a milkly fluid in acute stage, to sticky pus of greenish hue, with crusting in chronic stage. The odour may be nothing more than a mere mustiness but again it may be particularly foul smelling especially when the infection is of dental origin.

As already stated an acute exacerbation of a chronic sinusitis increases the amount of secretion which may vary at different periods of the day and sometimes when the nose is examined pus may not be seen. This is due to the fact that a sinus may drain quickly and if a careful history has been taken the examiner should not be satisfied and should ask to see patient's handkerchief which will give ample evidence of purulent discharge.

Pus is most frequently found in the morning hours, because in the recumbent attitude of sleep it accumulates in the sinuses and drains out when patient arises and assumes the upright position. This statement is true of frontal and sphenoidal sinuses which drain in the upright position only but should be qualified when considering the antra.

When the subject lies on his side pus will accumulate in lower antrum and will drain from the upper.

Disorders of the sense of smell are frequently encountered in sinusitis, the most important of which is cacosmia when patient alone is aware of a disagreeable odour. This is very characteristic and is regarded as diagnostic of antrum suppuration.

Nasal obstruction.

Nasal obstruction of varying degree, is the rule in sinusitis and may be due either to the presence of pus or to the structural hypertrophies and abnormalities which take a place in etiology, or to a combination of both. In the acute state the obstruction is caused by hyperaemia of mucosa covering turbinate and septum. Hypertrophy of these structures is seen in chronic sinusitis, and the air passages may be narrowed still more by the presence of true polypi and polypoid degeneration of turbinates to say nothing of deflection of septum. I have observed a frequently occurring swelling of septal mucosa at the anterior end due probably to the constant bathing of pus to which this part of the septum is subjected.

The uncinate process may be abnormally large; the middle turbinate and bulla ethmoidalis may contain ethmoidal cells and so add to the difficulty of nasal breathing. Obstruction and pus in olfactory cleft produce anosmia by preventing particles in the inspired air reaching the olfactory area and it has been repeatedly observed by the

writer that this anosmia tends to become permanent when chronicity in sinusitis has been reached.

An enlargement of inferior turbinate is usually seen with an infected antrum, while the middle turbinate and bulla ethmoidalis are frequently hypertrophied when disease attacks the ethmoidal cells.

Frontal sinusitis may not be accompanied by intra nasal hypertrophies but usually the middle turbinate is affected.

Oedema of the middle and superior turbinates especially the posterior ends is a frequent finding in sphenoidal sinusitis and a deflected septum may be present in all forms of sinus infection.

The presence of mucous polypi and pus causing almost absolute obstruction is regarded nowadays as pathognomonic of ethmoiditis although choanal polypus arising from antrum and presenting in naso pharynx must be borne in mind, as a possible cause of obstruction. I have seen several cases of vigorous polypoid growth without pus, reappearing a few weeks after removal by snare, completely filling the nasal cavities and presenting at the anterior nares. This type of polypi suggests new growth and is due to a hyperplastic condition of ethmoidal mucosa rather than an inflammatory condition. Broadening of bridge of nose by lateral displacement of nasal bones is a common deformity caused by vigorous polypoid growth and epiphora by obstructing nasal duct may also be noted.

Although polypi are most commonly seen in ethmoidal sinusitis it is not forgotten that they may appear in chronic rhinitis, spasmodic rhinorrhoea and malignant disease in ethmoidal region.

Laryngitis is a symptom one sees quite frequently, following sinusitis, especially one thinks, of the influenzal type. This sequence was frequently noted in the few months following the recent epidemic of influenza and was thought by myself to be due to a virulent type of infection assisted by a lowered resistence in patient. My observations in this type of laryngitis is that cords are usually thickened and may show some slight intrinsic palsy with swelling of arytenoids. In this type I take the precaution of having the chest X-rayed and examined by physician for presence of T.B. which it closely resembles, although the history and presence of post nasal discharge usually betrays the underlying cause. The following case will illustrate the difficulty mentioned.

H.S. age 30 had cough and nasal obstruction for three months following influenza. Hoarseness developed about six weeks later and patient began to lose weight. Nose is narrow, fauces red, uvula long and thickened, septum is deflected and there are numerous polypi in narrowed side, pus in middle meatus of other side. Both antra are relatively dull with diminished crescent illumination; one vocal cord is slightly thickened at anterior end.

An examination of chest disclosed râles at both bases; sputum negative and X-ray showed nothing suggesting tuberculosis but still the patient is coughing and losing weight.

A submucous resection of septum and double antrostomy was performed with beneficial results. Four weeks after operation, weight was steady and cough and hoarseness had diminished.

I have also seen one case of laryngeal spasm associated with empyema of antrum and since antrostomy was performed three months ago, there has been no further laryngeal disturbance.

Catarrhal deafness also has been more frequently found with sinusitis since the outbreak of influenza. One patient who complained of deafness, had a narrow air way at middle turbinate and dullness in one antrum. Deafness was removed in one week's time with menthol and steam inhalations.

The deafness associated with sinusitis is catarrhal in type i.e. obstructive and if the association is observed before adhesive process has become advanced prognosis is good. Successful Eustachian catheterization is the guide to prognosis and if the hearing can be improved by the use of the catheter, the sinus infection may be dealt with confidently.

I have on more than one occasion known deafness in children to be due to an infection of antrum but here I take the precaution of having mastoid X-rayed.

This brings one to an important consideration in sinus disease, namely the possibility of otitis media and cranial complications as symptoms.

Otitis Media.

Sinusitis is a frequently recognised predisposing cause of acute purulent otitis media in so far as it may be the focus of infecting organisms which reach the aural structure via the Eustachian canal.

One patient seen by me gave a history of pain behind the ear, slight deafness and aural discharge of four year's duration. The X-ray showed a sclerotic mastoid and both antra opaque. In this case nasal symptoms were not prominent and the patient complained mostly of aural condition.

Another case had intermittent earache for two years without discharge. The right antrum was dull; there was pus in middle meatus and hypertrophy of middle turbinate. Pus was found by my proof puncture and was purely streptocoocal and it is hoped that drainage of antrum will prevent mastoid involvement in this case. Six months later this patient showed no symptoms.

Yet another case seen by myself had deafness and aural discharge with purulent nasal discharge from pus in both antra following influenza and tonsillitis. In this case it was difficult to say with certainty whether nasal or aural condition was primary but it does show them associated after an infective illness.

An interesting point raised here is the possibility of a sinus infection following an aural one, the pus draining through Eustachian tube into naso-pharynx and thence to sinuses. I have not been able to demonstrate this occurrence but think it is not an impossible one.

Intra cranial complications may follow otitis media due to sinusitis but for the purpose of this paper the cerebral sequelae of orbital infection are more important.

Oculo-orbital symptoms.

Symptoms from both acute and chronic sinusitis are of common occurrence in the eye and this is readily understood when it is remembered that the orbit is in relation to all the sinuses. A varying part of the orbital roof is in relation to the frontal sinus of which it forms the floor. The anterior ethmoidal cells are in relation to its medial wall, the antrum to the floor, while the posterior ethmoidal cells and sphenoidal sinus are closely related to the posterior half of the medial wall and to the optic nerve.

Suppuration in the anterior group of cells may produce oedema of eyelids, conjunctivitis, and epiphora, orbital cellulitis, orbital periositis, orbital abscess and dacryocystitis; posterior suppuration may be followed by retrobulbar neuritis, optic atrophy and paralysis of muscle though involvement of oculomotor nerve. Intra ocular conditions

such as retinitis, choroiditis, iriodocyclitis are further sequelae of sinus suppuration.

In an infected sinus of the anterior group, oedema of eyelids, increased lachrymation and photophobia are very early local signs, followed by chemosis of conjunctiva, proptosis and displacement of eyeball. An orbital abscess may then follow and cause sloughing of orbit if untreated, death supervening by cavernous sinus thrombosis and meningitis. When the above symptoms are present the nasal sinuses should be suspected, even if their diseased condition is not at first obvious. Here a note on my belief that if the Watson Williams method of diagnosis be adopted early enough, time will be saved in recognising what may speedily develop into a grave cranial condition with a high mortality rate.

Watson Williams (Journal of Laryngology and Otology Vol. 47 p. 412. 1932) gives an interesting account of three cases of palpebral oedema of a spasmodic nature, accompanied by itching and lachrymation and occurring with sinusitis. He states that the condition is not an inflammatory one but rather of an angioneurotic nature cured by attention to the infected sinuses.

I have seen a case of this nature in a sailor who complained that the oedema was most noticeable after leaving port and that it lasted for several days. I knew that the

man had a liking for alcohol and without examining him carefully enough dismissed him with this diagnosis. However at his next visit about a year later he had what he called a violent cold, actually an exacerbation of chronic infection of an antrum and the oedema of eyelids and face of which he had originally complained. Drainage cured the condition and he had had no recurrence six months later.

Of all the intra orbital disturbances retro bulbar neuritis is one of the most frequent and yet the one most difficult to diagnose without a thorough knowledge of the anatomical relations existing between the sinuses and orbit, and before discussing the subject a note on the anatomy will explain the frequency of retro bulbar neuritis in association with sinusitis on the sphenoid and posterior ethmoidal cells.

Young (British Medical Journal 1923) found that the relationship between optic nerve and sphenoidal sinus and posterior ethmoidal cells was a very close one and that not infrequently the nerve was found actually traversing the sinus. He also found that the septum was sometimes so deviated as to bring one sinus into relationship with both nerves thus producing abnormal visual phenomena on both sides. It was found too, that venules passed through the sinus cells and that infection could easily reach the optic nerve by that route.

Thus retro bulbar neuritis becomes a not uncommon

symptom of infections of the posterior group. My experience is that the ear, nose and throat department usually receives these cases from the eye department, with the statement from the patients that they had suffered for some time from frequent colds and post nasal discharge and defective sight. Diminished field of vision, central scotoma and amblyopia are the distinguishing points made by the ophthalmologist.

The optic nerve may become affected by pressure from infected sinuses and this is shown to be so, by the fact that drainage often brings an immediate improvement in sight. Mucocele may also be responsible by causing pressure on optic nerve. Pressure also may be due to thrombo-phlebitis, periositis or orbital cellulitis and if the ophthalmic artery is involved complete blindness will result.

Wood and Dunn (Journal of the American Medical Association. April 1923) made an investigation of eighty-six cases of retro bulbar neuritis and found that 12:7% were due to sinusitis and furthermore that many cleared up after treatment.

Intra cranial symptoms.

Infection of the antrum is rarely followed by intra cranial symptoms but I think it is possible for osteomyelitis of antral wall to infect orbit and via the cavernous sinus to lead to meningitis.

Periostitis and osteomyelitis as a complication of acute and chronic frontal sinusitis should always be borne

in mind and may be very extensive and produce a subdural abscess and meningitis by infection through Haversian canals. To illustrate the extent of damage caused by osteomyelitis it has often been found necessary to remove most of the frontal bone before infection has been arrested.

The infection of ethmoiditis may pass through the cribriform plate to bring about involvement of cavernous sinus and meningitis.

Cavernous sinus thrombosis, is a very important, and serious sequel to sinus infection and is due largely to the imperfections of the sinus wall, although in some cases the infection is carried by the small veins and lymphatics.

The slowly forming thrombus quickly becomes infected and breaking down may produce metastasic abscesses in the brain.

A rapid pulse, profuse perspiration and intermittent pyrexia, pain followed by stupor, combined with oedema of eyelids and lower part of forehead and exophthalmos are the symptoms on which a diagnosis is founded.

Suppuration of frontal sinus may spread through the floor to produce orbital cellulitis and through the posterior wall to be followed by subdural abscess in the frontal lobe and as this is a silent area of the brain i.e. focal symptoms are not manifest, diagnosis is difficult. When the anterior wall of frontal sinus is affected a large swelling appears and abscess formation becomes obvious.

Sir St. Clair Thompson (British Medical Journal. 1906) records two interesting cases, the first of which died of meningitis following sphenoidal suppuration.

The patient had an almost life long nasal discharge and had complained of frontal headache of definite periodicity. After an attack of influenza the pain became localised in occipital region and he became morose and irritable and looked ill. Post mortem findings were sphenoidal sinus full of pus which had oozed out over meninges. Although meningitis was diagnosed the surgeon did not attempt drainage of sinus, a proceedure which I think might have led to a happier ending.

The second case reported was one of cavernous sinus thrombosis following sphenoidal sinusitis in a girl of sixteen years showing that the sinus may be infected before it reaches its full development between twenty and twenty-three years. No complaint of pain or discharge had been made by the patient and when seen oedema of eyelids, and proptosis was associated with a small amount of pus in the olfactory cleft.

This was in my opinion a case of latent infection of sphenoidal sinus, illustrating the point that the severity of sequelae are not to be judged by the paucity of nasal symptoms. Watson Williams further illustrates the folly

of being misled by nasal symptoms by recording four cases of keratitis which he cured by lavage in three of which nasal symptoms were absent and even X-ray was negative.

Some writers say that it is the hidden infection that is the more dangerous and that the non purulent discharge is more likely to be associated with systemic infection.

This leads me to the discussion of a hitherto hotly debated question. Can sinusitis be the essential cause of systemic disease?

It has frequently been demonstrated that teeth, tonsils, appendix, prostate and alimentary canal are responsible for many evils and why should the sinuses which can so easily become closed sacs be relieved of the grave responsibility of of causing the insidious rise of focal infection. I believe that the field of research here will prove to be fertile and that the spade work necessary, will be repaid by fruition.

It has been established that chronic sinusitis is not infrequently associated with rheumatoid arthritis, lumbago, fibrositis, sciatica and neuritis and I believe that if the search for a focus is not abandoned until the sinuses are examined bacteriologically the laryngologist can widen his sphere of usefulness.

I have not seen a case of malignant endocarditis associated with sinusitis but I have certainly been impressed by the severe degree of anaemia which is so often present.

Of twelve cases of rheumatoid arthritis examined by me two were found in which sinusitis was associated.

One case at present in Bristol General Hospital for treatment has a peculiar combination of malignant cervix uteri, rheumatoid arthritis and bronchitis associated with empyema of antrum. Two years ago the woman was seen by a gynaecologist of repute and given a very short prognosis after application of radium to cervix. Haemorrhage was free for about twelve months and stopped shortly after pain and swelling developed in left knee. Feeling that malignant disease had somehow become quiescent I searched for a focus for arthritis and found right nostril full of thick sticky green pus emanating from right antrum. She has had nasal discharge for years and I am hopeful that drainage will improve her arthritis and general discomfort.

Antrostomy was performed and bronchitis improved almost immediately. Arthritis did not improve and this failure was thought to be due to absorption from malignant uterus.

Another case, a woman of sixty-three has rheumatoid polyarthritis with deformity of knee and elbow joints and marked ulnar deviation of fingers. Chronic bronchitis and dyspepsia are also features but the patient unfortunately refuses operative measures for the relief of ethmoiditis which is also present.

Another case, a man illustrated the necessity of making a complete examination without allowing a preliminary

investigation to suffice. The man age forty-six, had posterior nasal discharge, of several years duration accompanied for about six months by morning vomiting. Gradually the onset ofpain and swelling was noticed in fingers and ankles and vomiting ceased. The teeth were sound but tonsils were hypertrophied and unhealthy. Right nostril was clear but left showed small dry crusts. Left antrum was slightly dull and I considered I had found a focus here, but this was not confirmed by X-ray.

It was felt that this man's symptoms were due to a nasal infection and notwithstanding the indefinite nasal signs both antra were explored and washed out. The ostia of both sphenoidal sinuses were enlarged and it was found that one sphenoidal contained a small amount of pus. A submucous resection completed the treatment. Three months later when he returned for tonsillectomy the man declared himself to be much better. Arthritis had gone and vomiting had not returned.

In general practice it is a common place occurrence to meet cases showing a frequency of colds, followed by bronchitis and lumbago or fibrositis of shoulder and arms and in a case recently examined, because of recurring bronchial attacks associated with lumbago, hypertrophy of inferior turbinate was found in conjunction with deflected septum and infected antrum. Improvement at once followed,

lavage of antrum and another case with bronchitis associated with nasal polypi and ethmoiditis also showed improvement after snaring of polypi.

One case of asthma associated with infection in both antra, deflected septum and carious teeth was not cured by dental extractions, submucous resection, and Caldwell-Luc operation, but the intervals between bronchitis attacks have been lengthened and asthmatic paroxysms have not been so distressing.

All these conditions, rheumatoid arthritis, lumbago, bronchitis and asthma are too often regarded as entities and not as symptoms of what is very often focal infection. From the literature of recorded cases and my own investigations there is enough justification for enthusiasm, bearing in mind of course that there are other foci than the nasal sinuses, to be thought of, and furthermore that it is the painstaking search of each individual sinus that will produce the brilliant and unexpected results.

So great a protagonist of preventative medicine as Sir W. Wilcox (Practitioner. 1926) is convinced that sinusitis is as great a factor in producing toxaemic conditions as dental sepsis. He states that where focal infection is suspected and no focus has been found the nasal sinuses should receive very careful attention and he also warns us that even with another focus sinusitis may be co-existent.

His view of the bacteriology is that the latent type is due to streptococci of the viridans group producing

baneful toxic effects with little or no local inflammatory reaction.

One case of his was suspected of paratyphoid and was found to have an infected antrum of dental origin. In my opinion it would be seldom that a dental organism would produce other than well marked symptoms of infection but in this case local symptoms were entirely absent. Another case of his showing intermittent pyrexia and thought to be tubercular was also due to sinusitis.

Colitis, pernicious anaemia, adenitis, diabetes and toxic neuritis were among the conditions which he found associated with sinusitis.

Chronic sinusitis is often marked by changes in the patient's mental character and mental apathy and sluggishness may develop in a patient once capable of clear thinking. It is claimed that insanity and sinus suppuration often co-exist and Pickworth (Journal of Laryngology and Otology 1932) says that this relationship is due to altered cerebral circulation brought about by the action of toxins on internal carotid artery. He satisfactorily shows that secondary effects of sphenoidal sinusitis can occur by:-

1. Diffusion of toxins.
2. Centrifugal spread of organisms from focus and
3. Action on sympathetic system finally altering the calibre of the small vessels of brain.

He says that mental deterioration results from the prolonged action in any of the above ways and it would seem that chronic sinusitis especially in the sphenoid is directly responsible for some cases of insanity.

James Harper (Journal of Laryngology and Otology 1932) describes the condition of latency as it appears in the antrum and calls it hidden infection. He states that an examination of the nose may not reveal much beyond stringy mucus stretching from septum to lateral wall a point which, he says, is of diagnostic significance, and perhaps some mucus in naso pharynx. All his cases had well marked toxic effects; dyspepsia, rheumatoid arthritis, bronchitis and asthma etc. and although pus was seldom found in antra, all contained bacteria.

The whole appeal in the article is for well balanced diagnosis by a consideration of all the signs and symptoms and with this I am in complete agreement.

----------oOo----------

DIAGNOSIS.

When it is remembered that nasal sinusitis besides being a localised infection causing pain and discomfort to the patient, may be a focus of infection elsewhere, the importance of an accurate, detailed diagnosis is obvious. In my opinion it is not enough to stop at a general diagnosis of sinusitis, but that care should be taken to ascertain if more than one sinus is affected and to take means to decide which sinus is infected. But that is not an easy position to arrive at, and not infrequently a considerable period of time, in which many examinations are made is necessary before diagnosis can be crisp and clear. Profound judgement is also necessary to cope with the various complex symptoms that may be encountered and this is brought home to one when one contemplates the anomalies that may arise with regard to pain, X-ray findings and the results of transillumination.

In my method of arriving at a diagnosis I take into account:-

1. History.
2. Results of inspection.
3. Transillumination.
4. X-ray findings.
5. Endoscopy
6. The results of proof puncture and it can only be by combining the various results in each case that I can satisfy myself of the presence or absence of nasal sinusitis.

1. A history of nasal discharge, with nasal obstruction probably following a cold or influenza, and periodic headache is to my mind presumptive evidence and I proceed to the next stage.

2. By inspection or rhinoscopy, anterior and posterior I endeavour to find a cause for the discharge. Is it due tohypertrophied turbinates, deflected septum, atrophic rhinitis, foreign body, malignancy or polypi? Bearing in mind that the detection of any of these conditions does not eliminate the possibility of sinusitis co-existing.

The first thing that usually strikes one in acute sinusitis is pus, and if this is seen by anterior rhinoscopy it may be observed in the middle meatus indicating infection of anterior group of sinuses or in the olfactory cleft indicating disease of posterior group.

If the infection is in the anterior group i.e. antrum, frontal, or anterior ethmoidal cells, one usually finds associated with the pus, hypertrophies of anterior end of middle turbinate and anterior end of inferior turbinate. But not always does the discharge from anterior sinusitis find its way into the anterior nares, for it may proceed backwards and be found by posterior rhinoscopy on the posterior end of inferior turbinate which may be markedly enlarged.

A diagnostic feature often noticed is a splitting of the anterior end of middle turbinate by a thin streak

of pus. This is accounted for by swelling of hiatus semilunaris pressing on the middle turbinate which is forced inwards towards the septum and is to be regarded as a certain indication of pus in one or more sinuses of the anterior group.

Having decided by anterior rhinoscopy that the infection lies in one of the anterior group it is my practice to make a differential diagnosis or rather to find presumptive evidence by a process of elimination of infection in any one particular sinus.

Antrum.

The discharge is not always present on examination but is most frequently seen in the morning hours when it may be foetid a point often actually noticed by patient. It has already been mentioned that when foetor is noticed by patient and not by friends, sinusitis and not ozaena is the probable cause. The postural test which owes its practicability to the fact that the ostium is situated high up in antrum wall should now be made. The middle turbinate if markedly hypertrophied may be touched with a swab of cocaine and adrenalin and pus wiped away from the middle meatus. The head is now bent forwards and well towards the other shoulder to allow the pus to drain and present itself again in the middle meatus. This manoeuvre may be unconsciously performed by the patient when resting in bed and explains why pus is found in nose in the morning if the uppermost antrum is the one affected.

The absence of pus does not exclude the antrum which may be the seat of closed sinusitis with occluded ostium, and characterised by marked pain due to tension. Again as Harper says, the antrum may be infected without throwing off pus and so it is seen that the presence of purulent discharge in middle meatus is not a "sine qua non" of antrum infection.

It has been mentioned before that the antrum may act as a reservoir for infection of frontal sinus but I do not think it is necessary to take steps to prove this point because I am of the opinion that if an antrum contains pus it should be treated as an infected cavity no matter how it came to contain the pus. It should be given drainage because the fact remains that if an antrum contains pus it cannot completely drain itself and that the residue may in time become a menace to the health of the patient.

Frontal.

Attention is usually attracted to the frontal sinus by pain over the corresponding eye accompanied by tenderness on upward pressure at inner canthus. The appearance of nose by anterior rhinoscopy is usually very characteristic, and one very often finds almost complete nasal obstruction, caused by a high deflection of septum accompanied by hypertrophy of middle turbinate and perhaps polypoid degeneration of its anterior end. If the antrum has been excluded and pus still appears high up in the middle meatus after having been wiped away with patient in the upright position, the frontal is strongly suspected. The diagnoses of frontal

sinusitis will be advanced by resorting to catheterization when after a few cubic centimetres of sterile boracic solution have been instilled into the sinus, pus will exude from ostium. (A note on catheterization will be made under treatment). It is observed that pus when present is nearly always discovered by anterior rhinoscopy.

Anterior Ethmoidal Cells.

An acute ethmoiditis may be regarded as synonymous with a severe cold in the head and cannot definitely be recognised in early stage by anterior rhinoscopy on account of the acute hyperaemia and swelling of the parts and it is only recognisable in the chronic state.

Although polypi do not always arise from the anterior ethmoidal cells I take it as presumptive evidence suggesting ethmoiditis when I find polypi associated with pus in the middle meatus.

. When polypi are present it is difficult and often impossible to obtain a view of the middle meatus therefore it is advisable to remove them by snaring and then to examine middle meatus with the help of a Killian nasal speculum which is inserted into middle meatus; probing gently in anterior ethmoidal region will often disclose presence of diseased bone.?

Pus, if seen in olfactory sulcus may be taken to originate from the posterior ethmoidal or sphenoidal either separately or together and as the posterior group may be affected with the anterior, this sign should always be looked for. I have never seen the ostia of post ethmoidal or sphenoidal by

anterior rhinoscopy, therefore I am unable to say at this stage when the pus is definitely exuding from either of these sinuses.

When infection of sphenoidal sinus is suspected it is advisable at this stage to probe the sinus. The method will be described under treatment.

Now having disposed of the source of the pus by anterior rhinoscopy I proceed to examine by posterior rhinoscopy as a matter of routine, especially when by a history of post nasal discharge, laryngitis or bronchitis my attention is attracted to the probability of an infection of posterior group.

By posterior rhinoscopy pus will be seen on the posterior end of middle turbinate having drained from the superior meatus. The pus may be seen to be adhering to choanal margin in a dried and crusted state and the sign is almost diagnostic of sphenoidal suppuration where a scanty secretion is the rule. Owing to the position of the posterior ethmoidal and sphenoidal it is impossible to differentiate, and as they are so often infected together it is unnecessary to do so.

It will be seen that rhinoscopy is made use of first of all to recognise pus and then to trace it to its infected source or sources, and that in itself is not an infallible means of diagnosis.

3. Transillumination.

The rationale of this test is based on the fact that a hollow bony cavity conveys light, while a diseased cavity

does not, but there are certain difficulties which crop up to upset this theory, as will be shown later and therefore the test is not by any means of diagnostic value in every case. In my opinion the test is not to be regarded as anything more than a doubtful link in the chain of evidence.. The investigators of an older school attached great importance to the results of transillumination but as it sometimes breaks down altogether the modern rhinologist will frequently make the test and be sceptical of his findings.

Transillumination had at one time a good reputation for detecting ethmoiditis but it is now only applied to the antrum and frontal sinus.

For the purpose of thistest a small four volt lamp covered by a test tube which can be sterilised is used. A rheostat should be incorporated because it is often helpful to start off with a weak light increasing the illumination until a satisfactory result has been obtained. If a dark room is not available the patient and examiner should be covered in a black cloth so that the delicacy of the test maybe appreciated. The lamp with its protecting test tube is inserted in the mouth and kept in the middle line, taking care not to touch the palate. It should be compressed by the lips, and not by the teeth. On one occasion I arrived at a faulty conclusion by omitting to ask the patient to remove an upper dental plate.

A normal, healthy antrum, when transilluminated, should show a bright area in the corresponding cheek and also a crescentic area under the eye. The pupils should also show a glow and the patient will be aware of the light in both eyes, if both antra are uninfected. If both sides are clear it may be presumed that the antra are healthy, but if one is dull, having no crescentic illumination that side is regarded as presumably being infected. There is a fallacy to be noted here. A little pus in floor of antrum will not affect the illumination and therefore misleading results may be thus obtained.

Brown Kelly has tabulated the conditions affecting transillumination:-

A. Brilliancy is increased by:-

1. Cysts with clear contents distending and thinning antral walls.

B. Brilliancy decreased by:-

1. Mucus, pus, or blood in antrum.
2. Thickening of mucosa.
3. New growth.

Frontal.

In the frontal sinus a shield is used so that light from the end only is allowed to come from the lamp which is approximated to the lower surface of frontal at the inner canthus. Only on one occasion has this test been of help to me in diagnosing frontal sinusitis.

4. X-ray.

With an improving technique the diagnostic value of X-ray is increasing but even now this important aid to diagnosis has its limitations especially for the deeper sinuses. An X-ray plate is a necessity before surgical treatment of frontal sinus is undertaken because frequently the sinus has been suspected of infection when a skiagram has shown the frontals to be entirely non existent. The X-ray may decide the type of operation required as is shown in the frontal where a deep antro posterior sinus is best treated intra nasally while a shallow sinus if treated by the external method will leave little deformity.

It is also useful to employ X-rays for the detection of septa and pockets so that they may be broken down at operation to ensure permanent success.

X-rays are of great assistance in confirming diagnosis of infection in antrum and frontal sinus and in a lesser degree in ethmoidal and sphenoidal suppuration. I think it is unfortunate that the greatest help of X-rays should be in disease of frontal and antrum because there are usually signs which make the diagnosis clear or at least very suggestive, but I would repeat, improved methods will increase the value of X-ray in ethmoidal and sphenoidal sinusitis.

An X-ray plate may be clear, cloudy or opaque and it is on the presence of opacity that a positive diagnosis

rests especially if the opacity is unilateral. The fluid level of pus, muco-pus or blood is sometimes observed in the antrum, but in my opinion the indication for treatment most frequently encountered is a blurring of outline of the sinus, caused by thickening of the sinus mucosa. This blurring of outline is very well seen in chronic frontal sinusitis. In the antrum the presence of perforating teeth or dental cysts is frequently disclosed by X-ray and in this respect is of great value and should not be omitted if infection of dental origin is suspected.

Unfortunately there are several conditions affecting X-ray findings and of these perhaps asymmetry and thickening of facial bones are the conditions most likely to lead to misinterpretation. It is also noted that extensive polypoid degeneration of mucosa of antrum may escape detection by X-ray.

Anterior ethmoiditis is quite frequently diagnosable by one of limited experience, not so much by the shadow as by the indistinctness of the cell walls themselves but diagnosis of posterior ethmoidal and sphenoidal sinusitis requires a flawless plate carefully exposed at the correct angle. Graham Hodgson's method of exposure gives the most reliable results in sphenoidal disease.

The patient lies prone with extended head, chin resting on plate, mesial plane of head vertical to plate, tubes centred on the mid point of a line between outer canthus

and external auditory meatus.

The X-ray is often of value in estimating the size of sphenoidal sinus and in determining the thickness of anterior wall prior to operation.

Consideration of X-ray finding should not be undertaken in any dogmatic spirit because it should be remembered that seemingly positive results may be due to bone thickening and also that a latent sinusitis may not be disclosed at all on the plate. The results should be taken in conjunction with the other signs weighed up and put in their proper place for or against sinusitis.

5. Endoscopy.

Nasal endoscopy is a valuable means of localising the source of discharge especially where in latent cases the discharge is scanty and irregular and consequently not easily detected by posterior rhinoscopy. In my opinion it is more reliable than posterior rhinoscopy where very often the soft palate shows such intolerance as to prevent anything further than a fleeting glance at the naso pharynx. The technique is simple and under a local anaesthetic is less troublesome to the patient. After cocainising the floor of nose the endoscope is passed backwards with lamp uppermost until the posterior ends come into view. By rotating slightly inwards and outwards a good view of the vault of naso pharynx can be obtained and as the Eustachian canal is plainly seen. It is useful as an aid in difficult

inflation of that structure. The only difficulty I have encountered is obstruction to the passage of endoscope by a septal spur and this can be overcome by passing the instrument through the other side and rotating inwards, until posterior ends come into the field, remembering of course that the view obtained will not be so magnified as that obtained in the usual way. Pus can easily be detected coming over the posterior end of middle turbinate from the superior meatus thereby greatly assisting the diagnosis.

Of course pus in the middle meatus and running over the inferior turbinate may be also seen and is usually due to a backward flow from an accessory antrum ostium.

Exploratory puncture.

To my mind this test affords the greatest satisfaction to the investigator especially in sinusitis of a latent type in the antrum, posterior ethmoidal and sphenoidal, where so many of the diagnostic points may be based on presumptive evidence, but the technique is exacting and the method not without risk especially in unskilled hands. However the fact stands that one is certain of obtaining a reliable specimen of actual sinus contents which can and should in all cases be submitted to bacteriological examination.

It should be used in all cases of sinusitis whether obvious or latent but especially in the latter where nothing suggestive is seen in the nose and where only the general condition of patient leads one to suspect focal sepsis.

It is by the use of this test that the importance of chronic sinus infection as a focus of infection will be demonstrated.

I use a Watson Williams type syringe with curved wide bore needle and enter the antrum by the middle meatal route at pars membranacea after washing out anterior nares with boracic solution to ensure non pollution of entering needle. The middle meatus is then anaesthetized by applying pledgets of cotton wool soaked in equal parts, ten per cent. cocaine and adrenalin. The adrenalin minimises haemorrhage and greatly assists the cocaine in shrinking the mucous membrane, thereby allowing a better view of meatus to be obtained. Anaesthesia is usually complete in about ten minutes and pledgets are removed. The needle is then inserted under the middle turbinate under inspection, with the point downwards. When the distal end is about half an inch beyond the anterior end of middle turbinate and lying horizontally the point is turned outwards and downwards and proximal end of needle is raised as needle enters the antrum. The syringe, full of tepid boracic solution is now fitted to the end of needle and with the head slightly forward and turned over to the side under investigation a few ccs. are syringed into antrum and quickly sucked back. If nothing returns to syringe and fluid runs down nose the antrum has not been properly entered or pus may be too thick to aspirate or antrum may be full of polypi. Using a fresh syringe but leaving needle

in position a few ccs. of argyrol may be instilled into the antrum either with or without previous lavage.

The antrum may be punctured through the inferior meatus and Watson William's syringe used for aspiration but as bone is sometimes thick I do not regard this as the method of choice and I only resort to inferior meatal route when the middle turbinate is so hypertrophied as to make insertion of needle difficult; owing to the fact that the floor of antrum in children is above the level of floor of nose this route should not be taken in children.

Another diagnostic method of entering the antrum is by means of a Lichtwitz trocar pushed through the lateral wall of inferior meatus, below the insertion of the inferior turbinate. Boracic solution is syringed into the antrum, precautions having been taken that point of trocar is actually in the antrum and not in tissue of cheek or endangering the orbit. The solution emerges from the ostium and with head bent forwards runs from the nose into a dark coloured basin so that presence of pus may be more easily ascertained. The disadvantage of this method is the difficulty of cleansing the nose sufficiently to eliminate the possibility of contamination of fluid by nasal discharges. It is a good method of performing lavage but in my opinion is not a reliable diagnostic measure.

The old method of exploration through a drilled tooth socket is now condemned on account of the risk of carrying

infection into the antrum and also because of the difficulty of preventing the opening becoming permanent. I have observed the persistence of a "sinus" following extraction of a carious tooth which has infected an antrum.

The sphenoidal and posterior ethmoidal cells may also be entered and contents aspirated by Watson Williams method, but this is a procedure requiring considerable lightness and sense of touch and in my opinion not to be undertaken before skill has been obtained on cadaver.

Two methods of entry into the sphenoidal sinus are possible for diagnostic purposes, and the ostial route although it has disadvantages is the safer. A no. 1 Eustachian catheter is gently inserted between the middle turbinate and septum and kept closely to the roof of olfactoryfissure until it meets the anterior sphenoidal wall. If the end is turned slightly outwards it should meet the ostium and through which it may be gently passed. But the ostium may be blocked or difficult to find and puncture of the anterior wall must be resorted to.

A blunt trocar and cannula is carefully inserted between the middle turbinate and septum, and pushed gently upwards and backwards in a line, the aim of which is about one inch behind the centre of orbit. The proximal end should now be raised when distal end impinges on anterior wall of antrum and the cannula pushed gently into the sinus and allowed to go backwards until posterior wall is reached thus obtaining an idea of the size of the sinus. The

syringe is then fitted on and a few ccs. syringed into the sinus and sucked back. This will provide the material for bacteriological examination.

Force should not be used and the instrument should be directed along side the septum so as to avoid perforating the lateral wall of sinus into the cavernous sinus.

The same type of trocar may be used for puncture of posterior ethmoidal cells which may be reached through the middle or superior meatus.

The trocar and cannula is gently inserted into the middle meatus between the bulla and middle turbinate and directed to the roof; again the proximal end is raised and brought a little centrally to prevent penetration into orbit or cranium and pushed gently into cell before aspirating as before. The superior meatal route may be used when obstruction is negligible by pushing cannula into the cell through the roof of superior meatus.

Bier's suction used to be applied to the diagnosis of sinusitis but the method is uncertain and not in favour now. I have not used the tuning fork method, but it is applied by putting a vibrating fork to bridge of nose and noting which side receives the sound. It has been found that the sound is heard first on the diseased side.

Having described the various diagnostic methods and the significance of each it is necessary to collect the findings

as applied to each sinus and thereby to indicate which sinus is affected.

Antrum.

In an infected antrum one expects to find unilateral discharge which may have unpleasant odour showing periodicity and affected by posture. Pus in the middle meatus, dullness in that side by transillumination and a positive X-ray picture confirmed by pus in the exploratory puncture.

Frontal Sinus.

When the antrum has been excluded and washed out if infected and pus still appears in middle meatus especially in the upright position, after having been wiped away, the frontal should be suspected. There is tenderness on pressure at inner canthus, a skiagram showing blurred outline and a free flow of pus when sinus is sounded, fixes the diagnosis.

With the Anterior ethmoidals the posterior ethmoidal cell is usually infected so pus will be seen in middle meatus and olfactory cleft. An important diagnostic feature is the presence of polypi associated with pus and when these have been cleared away by snaring it is possible to get a better view of middle meatus. By this time the antrum and frontal have been excluded and pus still remaining in middle meatus indicates infection of anterior ethmoidal cells. A good X-ray plate will help the diagnosis.

Posterior Group.

Evidence suggesting suppuration in this group is

obtained from the combination of post nasal discharge, pus in olfactory sulcus and in superior meatus posteriorly and in defects of sight with characteristic pain.

A good view of the ostium is rarely obtained but of course it is diagnostic when pus is seen emerging therefrom. The X-ray has to be without a fault to be of value here, and the deciding point is a positive proof puncture especially in latent sinusitis.

One frequently meets cases where more than one sinus is affected and in these cases it is necessary to make certain of a thorough diagnosis for one untreated cell will mar the success of otherwise thorough treatment.

It is in pansinusitis that one meets most often with failure and it is because of this that sinus work is regarded with suspicion by the laity, and by some members of the profession.

----------oOo----------

TREATMENT.

The object of treatment in sinusitis is primarily to re-establish drainage and thereby relieve pain and discomfort caused by tension and toxaemia. It should also be borne in mind that the efficient treatment of nasal sinusitis is good preventative medicine in so much that it will lessen the incidence of many diseases owing their origin and continuance to focal infection.

The general treatment is the same for all cases of acute sinusitis irrespective of the sinus affected, and it is my practice to commence by advising rest in bed in a warm room until the temperature has become normal and the pain has been alleviated. Alcohol and tobacco are forbidden. For the pain, prescribe aspirin gr. X either alone or with Dover's powder gr. X tds., or if sleeplessness is marked morph. gr. ¼ at night. Hot fomentations are helpful but the heat bath is most comforting and usually induces sleep if used at night. I have obtained satisfactory results in my private practice with a radiant heat lamp of the open type which I ask the patient to use in the morning before the attack of pain is due.

Menthol Gr. XXX to ℥i Spirit Vinis Rect. of which ℥i is added to one pint of boiling water which has been allowed to cool for five minutes is an excellent remedy for encouraging drainage and should be inhaled several times a day. I consider that steam from boiling water is an irritant to the nasal mucosa and therefore I remind the patient to let

water cool slightly before adding menthol and spirit. A pledget of cotton wool soaked in five per cent. cocaine is a good remedy but it has the disadvantage of having to be carefully applied, and I think it is unwise to allow the patient to handle cocaine in a condition which might become chronic if patient does not return for treatment. Adrenalin (1-1,000) has yielded its place as a topical application to inflamed mucous membrane to ephedrine, the effect of which I have noticed lasts longer and is without the uncomfortable reaction of adrenalin. Ephedrine is not habit forming and can be prescribed to be used as a nasal spray. I do not advise the use of nasal douches in the acute stage because primarily the infection may be carried to a healthy sinus, and also because the douching fluid cannot reach an infected sinus when the ostium is blocked. Sonderman's suction pump or suction caused by patient inflating lung, while holding nostrils may help drainage but I have found it to be a painful procedure. Extraction of suspected teeth should be performed when antrum is infected.

If the above remedies are not successful in promoting drainage it is essential to employ conservative surgical methods if the case has to escape chronicity with all its attendant evils. It is difficult to put a time limit on an acute sinusitis but I do not think more than a fortnight should elapse before abandoning expectant measures. Of

course at any time, even within a few days of onset it may be necessary to interfere on account of an external inflammatory complication or threatened intra cranial conditions.

In my experience an acutely infected antrum will on account of the difficulty of drainage, resolve but slowly and become a chronic infection unless something further is done to assist the natural process of recovery, in short it should be subjected to treatment by lavage. Entry may be made by the infra meatal route for which a Lichtwitz trocar is used, or by the middle meatal route as described for diagnosis. Two pints of warm water or boracic solution should be slowly syringed through the antrum by the Higginson syringe, the operation being repeated daily until the returned fluid is pus free. Air should then be blown through to expel the remainder of irrigating fluid and I always make a point of leaving a few ccs. twenty per cent. argyrol in the antrum.

I regard this as an excellent measure for treatment, and have frequently found it successful in treating recent cases without polypoid degeneration. It is in my opinion the best measure for adults over sixty-five years of age where an anaesthetic might be borne badly.

In a case of a young adult male with double antritis seen by myself, one antrum was treated successfully by lavage while the other, untreated at the time required an

antrostomy to clear it of infection later.

Lavage is also trustworthy in treating infection of the antrum in children after removal of tonsils and adenoids has failed to effect a cure, and during almost two year's experience in an ear, nose and throat clinic no other operation except an occasional anterior turbinectomy has been necessary for children under twelve.

Recently I have been using ephedrine as a spray followed by a few drops of ten percent. argyrol into the nose with encouraging results in antrum infection of children, but as my experience in this connection does not extend beyond three or four cases it is too early to say whether lavage will be superseded.

If in acute frontal sinusitis the pain does not lessen within forty-eight hours of commencing general treatment, other steps should be taken to relieve the tension. As it is often the case that the antrum and frontal sinus are infected together, it is advisable to irrigate the antrum first in the hope that the lessened hyperaemia of middle turbinate consequent upon improved antrum condition, will allow the frontal sinus to drain without further surgical interference. But if improvement does not quickly follow, the anterior end of middle turbinate may be removed by scissors and snare and a cannula passed into the sinus for the purpose of lavage in the following way. Engage the point of cannula in infundibulum and depress the lower or outer end. The

instrument should then enter the sinus easily and the straight ~~position~~ portion should be in contact with upper lip of patient. It is well to make sure by gentle inflation of the presence of pus in the sinus before irrigation is commenced.

It is well to note here that force should not be used and that the cannula may have to be bent slightly to enter the sinus easily.

However, modern opinion on this point is inclined to the view that it is doubtful treatment to try to pass a cannula in an acute frontal sinusitis because of the risk of increasing the infection and that surgical steps should be taken in preference. Very often a high submucous resection of septum is all that is required and this is in my opinion the operation of choice in suitable cases. The following case record will illustrate the value of treating a frontal sinus by methods other than direct.

P.D., female, age eighteen, had nasal obstruction and discharge with deafness and giddiness for twelve months before treatment. There was pus in the middle meatus and X-ray disclosed an infection of left antrum and left frontal sinus. The inferior turbinate was removed, antrostomy performed and the frontal infection cleared up in a few days.

Skillern says that in the acute stage, catheterization irritates an already inflamed surface and should not be tried until his method of depletion by Turkish baths has been used unsuccessfully.

The patient should remain in the hot room of Turkish bath to the point of weakness and then wrapped in a blanket, should go to bed to remain there until a cure has been effected. Aspirin grs. XX should be taken before the bath and repeated afterwards and again every two hours in the following morning until a total amount of two drachms has been taken. Calomel gr. 1V, Sod. Bicarb. gr. 1V, Sacch. Lact. gr. 1V, should be taken before going to sleep. It is claimed for this treatment that it cures the average case but that if it fails, an intra nasal operation should be performed to lessen the risk of intra cranial sequelae.

I think this would be an excellent preliminary remedy provided one chose suitable cases for Turkish baths. Otherwise it would seem to me to be almost necessary for the medical attendant to accompany his patient to the warm room, for a patient with acute frontal sinusitis is not the safest subject for shock tactics.

Acute ethmoiditis is dealt with by rest, menthol and other general methods as mentioned in first paragraph of section on Treatment.

Acute Sphenoidal sinusitis.

I am of the opinion that this condition is rarely diagnosed and that when the sphenoidal sinus does come for treatment the condition has become chronic. However I have seen the record of a woman L.C. forty-one who had acute sphenoiditis

for fourteen days and was cured in fourteen days with ung. chloretone sniffed up the nose. She had caught cold and had loss of taste and pain at the root of nose which was worse on stooping and easier at night. There was slight deafness but no nasal discharge.

Chronic sinusitis.

Before discussing the operative measures necessary for chronic sinusitis I propose to say something of the forms of treatment which have from time to time been recommended as substitutes for surgery. Many of the lines of treatment are of value but have their greatest success when used in conjunction with surgical procedure designed to assist drainage.

The theory has been advanced that sinusitis may be due to a lowered resistance of mucous membrane caused by calcium deficiency and that when this deficiency has been made good following drainage operations the patient is in a better position to regain his normal resistance to infection. (E. V. Ullmann. North West Med. May 1932. Taken from Ear Nose and Throat Year Book. 1932).

The patient is started off on a salt free diet consisting of fruit and vegetables and water. Calcium is given between meals because if taken within an hour of oranges, lemons or grape fruit it will be precipitated by citric acid. After about five days of this diet the

patient will have improved and a gradual return to normal diet with only a very small intake of salt is allowed. Every week for four weeks he should return to salt free diet for two days, and a fresh cold is an indication for a return to restricted diet at any time.

I think it may be claimed that a vitamin poor diet does predispose to sinusitis and I have frequently noticed the improvement when cod liver oil and fresh fruit has been advised for patients awaiting surgical treatment.

Watson Williams advises the intra muscular injection of colloidal manganese in doses varying from•5 ccs. to 2 ccs., the smaller dose to be given in a recent case, at intervals of two days until the symptoms abate. He emphasises the necessity of keeping a look out for renal failure.

I have used this injection in a woman M.G. thirty-six who had one lavage of antrum and who refused any further intra nasal treatment. After six injections of 1 cc. every other day there was a marked improvement in purulent discharge and nasal obstruction was considerably lessened.

Of vaccine treatment I have nothing very hopeful to say. The literature on the subject is not encouraging although Skillern gives the following indications for the use of vaccine therapy as follows:-

1. In chronic sinusitis resisting ordinary treatment and which gives a pure bacteriological culture. (In my experience a pure culture is not a common occurrence.)

2. Chronic frontal sinusitis resisting intra nasal treatment, and yet not bad enough for external operation.

3. Ethmoiditis which still shows a purulent nasal mucosa after radical operation.

In five cases given vaccine I have found no appreciable improvement but I have details of one case which did actually improve after vaccine treatment.

A.D., male, age sixty-four, with long standing right nasal discharge. X-ray pointed to a chronic infection of right sphenoidal sinus and ethmoidal cells and vaccine was given. The first dose was followed by marked reaction and consequently the second dose was reduced to three quarters of original dose. Six doses in all were given at weekly intervals and at the end of the course, the discharge had lessened considerably without quite disappearing.

Radium is sometimes of definite value following incomplete success of surgical treatment and will be referred to later.

Operative treatment.

Nasal antrostomy is the operation used for a mild type of chronic antritis before polypoid degeneration has become established and should in my opinion be strictly reserved for that type of case. The operation may be performed under local anaesthesia of cocaine twenty per cent. and adrenalin applied to the inferior meatus but more satisfactory results are obtained with a general anaesthetic administered through a Junker's inhaler.

The anterior third of inferior turbinate should be

removed by scissors and snare and through the area laid bare a burr is pushed into the antrum and taking care to remove the fragments, Grunwald's forceps are then used to enlarge the opening. A Watson Williams frontal sinus rasp is then used to smooth off the anterior edge of opening. The mistake of making too small an opening will negative the result, because granulations may close over and prevent efficient drainage and washing out of antrum later on. I have seen one instance of this return of symptoms due to granulations which had to be broken down to permit lavage being done.

Lavage is performed by means of a curved cannula not unlike a Eustachian catheter fitted to a Higginson's syringe. The antrum is washed out morning and evening until the washing is free from pus and a few ccs. of twenty per cent. argyrol may be left inside after each irrigation.

In this case, J.B. age twenty-nine, the history of nasal discharge and obstruction for two years, with bilateral discharge and post nasal catarrh, frontal headache and occasional vomiting is fairly common. X-ray showed opacity in both antra but blood and mucous rather than pus was obtained by exploratory puncture. The antra were washed out and right and left inferior turbinectomy was done with satisfactory results. Two months later the patient was better and had had no vomiting since operation.

In view of the fact that blood in the antrum very

often indicates the presence of polypoid degeneration it is somewhat surprising to note that satisfactory results were obtained by intra nasal antrostomy.

The next case, Mrs. L. age thirty, who had headache for two years associated with nasal discharge and cacosmia illustrates the point that antrum proof puncture is not an infallible aid to diagnosis.

There was a cicatrix of right tympanic membrane and pus in right middle meatus. Right and left antrum punctures gave negative results but as it was felt that puncture had been made in a quiescent period a large opening was made in right antrum with satisfactory results. The headache and discharge had disappeared three months later.

A record of a peculiar complication of operative treatment is perhaps worthy of note. Two years following right and left middle turbinectomy done for antrum infection in a man age fifty-seven it was noticed that the left ala nasi had collapsed thus preventing free entry of air. The use of [illegible] nasal props was sufficient to give a satisfactory functional result.

Caldwell-Luc Operation.

The indications for this operation are a failure of antrostomy to stop discharge, a diagnosis of polypoid degeneration in antrum, presence of a foreign body or infection caused by teeth.

The operation is more radical than antrostomy in that it aims at removal of diseased mucous membrane although it has been found that if only the lowest part of mucosa i.e. that of the antrum floor is removed the remainder revitalises and throws off the infection in time through improved drainage.

The operation should be performed in two stages:-

1. The opening through the canine fossa.
2. The opening through inferior meatus.

Before beginning it is advisable to have all carious teeth extracted and to irrigate the antrum by Lichtwitz cannula so that the risk of sepsis and post operative pneumonia is reduced to the minimum.

With general anaesthesia and cocaine and adrenalin to inferior meatus and inferior turbinate to reduce haemorrhage the upper lip is retracted and sponges or swabs are inserted between the cheek and the last molar tooth and in posterior nares. The gingivo labial fold is then cut down to the periosteum which is reflected from the zygoma to the canine crest, care being taken to avoid cutting the infra orbital nerve, which if damaged will cause severe post operative pain. A small piece of bone is then gouged out of canine fossa and the opening enlarged by bone cutting forceps, care being taken with the spicules. The mucosa is then cut to a size corresponding to bone opening which is then enlarged in an anterior direction and the edges smoothed

off with a rasp to promote healing. The diseased mucosa is then removed from the floor of the antrum, polypi when present are picked out, and the whole interior wiped out with gauze and peroxide. The anterior third of inferior turbinate is now removed and a window into the nose is gouged out at the site of inferior turbinate. This opening is also carried well forward to facilitate washing out by the patient afterwards. The nasal mucosa may then be perforated and cut off or may be carriedinto the antrum as a flap. The sponges are now removed and canine periosteum is returned to its former position, and sutured after bleeding has been arrested by packing ribbon gauze into the antrum an end being taken through the nasal opening. The gauze is taken out after a few hours and the antrum is washed out twice daily at first and then at longer intervals until the fluid returns clear. Chloretone ointment is prescribed to be sniffed up the nostril night and morning.

The discharge in a successful operation should have abated in from three to six weeks, but as already mentioned I have had to break down granulations if drainage has not been properly established.

In comparing the two operations, nasal antrostomy and the Caldwell Luc, it is often difficult to say which should be performed but if there is any doubt I would always advise the latter. It is a safe operation and has good results provided the operator does not treat the

mucosa too radically. Too much of the inferior turbinate should not be removed, a too free curettage of antrum lining is to be deprecated as leading to formation of granulations which may fill the antrum and produce a very persistent discharge. The great advantage of the operation is that the field can be seen and treated under inspection.

Watson Williams does not frequently perform a Caldwell Luc, but relies for free drainage and removal of diseased mucosa through an antro meatal opening which is made as near the floor of the nose as possible and continued backwards as far as is necessary for complete inspection of antrum. He does this operation to avoid injury to dental nerves and to avoid removal of turbinate.

The Denker modification of Caldwell Luc carries the canine fossa opening further forwards to include removal of lower part of antro meatal wall with a muco periosteal flap turned in to the floor of antrum. This is a very complicated operation and although it provides a good view it has nothing more to recommend it.

Illustrative Cases.

On survey of the records of fifty consecutive cases of antrum suppuration it was found that Caldwell Luc operation was done in two, a description of which will illustrate the type of case to which the operation is best suited.

A.A., male, fifty-eight, had pain over left eye of one week's duration; no nasal discharge, but left side of nose was stuffy. There was a fleshy swelling in left nostril the nature of which was doubtful at first sight.

A Caldwell Luc operation was done and part of swelling which was polypoid in nature was sent for pathological section, and report which was to the effect that it was chronic inflammatory granulation tissue.

The patient did well and was discharged free from pain. The other case, E.E., female, age, fifty-one is an example of the dental type of antrum infection.

Eighteen months ago she had some teeth removed from upper jaw and complained of having shortly after some discharge from a tooth socket and purulent discharge from right nostril. This discharge stopped for a year but again returned shortly before she was seen at Bristol General Hospital. She had a discharging alveolar sinus with pus in middle meatus.

A Caldwell Luc operation was done and sinus curetted and patient was well one week later. One month later there was a small fistula from scar to antrum which healed up.

Frontal Sinusitis (Chronic).

There is a choice of two operations for frontal sinusitis, an intra, or per nasal, and an external route, and one requires very clear indications when deciding on the most suitable procedure for each case. I am of the opinion that if there is no pain or tenderness with discharge, operation

is contraindicated as being unnecessary and that no surgical interference on the frontal sinus should be undertaken if the condition does not absolutely demand it.

The intra nasal route is used when there is pain and tenderness with discharge associated with toxaemic effects such as failure to concentrate or mental depression. The suitable sinus as determined by X-ray for this operation is small and should not be encroached upon by ethmoidal cells. The nose should provide sufficient space for the necessary intra nasal work.

The external operation is reserved for the case in which there is evidence of a spread of infection beyond the sinus limits and when intra cranial involvement is imminent as in the following instance.

L.P., male, eighteen, had severe frontal headache for three weeks with swelling of forehead. The nose was stuffy and there was nasal discharge. X-ray showed opacity of left frontal and antrum.

The frontal sinus was exposed and pus and engorged mucous membrane was found. The anterior wall of fronto nasal duct was chipped away and the swollen anterior end of middle turbinate removed. A bougie was passed into the frontal sinus.

Left antrum was opened and drained and a small drainage tube was passed up left nostril into frontal sinus.

One year later there was occasional frontal neuralgia and but for slight discharge the condition of patient was satisfactory.

The indications in this case for external operation were in my opinion the external swelling and the severity of pain.

The intra nasal operation is performed lateral to the middle turbinate and consists of breaking down the agger cells and widening the ostium by the passage of bougies and rasps.

Firstly the agger cells are opened and removed by a mastoid curette placed anterior to and just above the anterior end of middle turbinate. A cannula is then passed up the duct and removed, and the smallest size of rasp smeared with B.I.P. is passed up and moved gently up and down so that its anterior surface wears down the angle formed by the floor of the sinus and nasal process of frontal bone. No force should be used and when the opening has been patiently enlarged the next size of rasp is employed to still further widen the ostium to provide free drainage. This operation is not without danger and care should be taken to work laterally to middle turbinate so that the cribriform plate may be kept intact. The patient should be kept in bed and nose and sinus syringed out occasionally.

If much pain follows it may then be necessary to proceed to perform the external operation.

Watson Williams has devised a very simple technique for intra nasal drainage of the frontal sinus and it has the advantage of eradicating the ethmoid labyrinth the continued infection of which so frequently brings failure to a less extensive operation. With angular punch forceps he cuts through the attachment of the anterior end of middle turbinate and proceeds to remove the ethmoidal cells piece meal until the ostium is reached where the rasps are used to widen the ostium. He claims greater safety for this method in that it lessens the danger of injury to the cribriform plate.

As already stated the external operation is reserved for cases showing intra cranial extension or infection of soft parts or extreme pain with retention of pus in the sinus.

The Ogston Luc operation consists of opening frontal sinus along the supraorbital ridge after reflecting the periosteum and making as small an opening as is consistent with thorough removal of carious bone if present. Polypi are removed and the sinus is mopped out with dry gauze. The sinus walls should not be curetted and when the ostium has been opened up by a probe a tube is gently passed down into nose as far as the vestibule. This is the acme of conservatism and will be successful only if the ethmoidal cells are sound but in my experience they seldom are free from infection when frontal sinusitis of some months duration is present.

Howarth's operation provides the necessary drainage for ethmoidal cells when associated with frontal sinusitis.

The incision for this operation extends from the outer canthus, underneath the supra orbital ridge and down the side of nose. The pulley of superior oblique is cut and lacrimal sac raised from the bone and sinus opened from the roof of orbit, removing the whole floor in the process. Polypi are removed when present and the mucosa is left untouched. A tube is passed up the fronto nasal duct so as to help in the identification of the ascending process of maxilla which is removed. The ethmoidal cells are then opened and removed through the lacrimal groove and when the fronto nasal duct has been freed from obstruction a tube is inserted into the sinus and passed into the nose for drainage purposes.

A method of drainage for all cases that cannot be cured by intra nasal method is described by Harmer and Russell (Journal of Laryngology and Otology 1931). The object is to draw a catheter into the sinus and out by nose where it may remain until suppuration has ceased. First of all a small opening is made into the sinus in the usual way and a gold wire probe to which is attached a thread is passed into the sinus. A soft rubber catheter is then tied to thread and pulled down through the infundibulum and anchored at the sinus.

When it becomes imperative to interfere in acute frontal sinusitis, the external operation of Ogston Luc or Howarth

is indicated. Either of these procedures provides a field under observation and prevents the unsuspected spread of infection. But, in chronic frontal sinusitis the intra nasal operation is the one of choice, unless there is evidence of extra or intra cranial spread of infection, when the external method should be used.

This case is I think worth recording as illustrating the fact that frontal headache is not always due to frontal suppuration.

E.V. female, twenty-seven, had severe frontal pain of three month's duration diagnosed on X-ray finding to frontal sinusitis and owing to the narrowness of nasal passages an external operation was performed. Nothing was found in sinus which was apparently healthy but the patient lost her headache and made a complete recovery. It is possible I think that this might have been an example of vacuum headache. Another case illustrating contrasting treatment to the above with similarly successful result.

R.C., male, sixteen, received a blow on nose causing pain and bleeding and nasal obstruction.

An X-ray photograph indicated acute frontal sinusitis. Menthol and steam was all that was required to produce satisfactory results and the boy was free from symptoms in fourteen days.

Chronic Ethmoiditis.

Conservatism in this condition is seldom rewarded unless one can be positive that the polypoid degeneration is

not accompanied by purulent discharge. When polypoid degeneration is not associated with pus the polypi should be snared under local anaesthesia of cocaine and adrenalin and there is a possibility that they may not return. But if the polypi do return quickly and repeatedly after snaring as they often do, especially when associated with pus my practise is to advise destruction of ethmoidal cells which may be done by Sluder's method.

Under general anaesthesia Sluder's knife is inserted laterally to the anterior end of middle turbinate and gently pushed up as far as it will go. The blade is then turned outwards and pulled sharply downwards and forwards to cut the attachment of anterior end. The blade is then insinuated between the turbinate and septum and when it has been gently pushed up to the cribriform plate it is turned inwards and pulled down. This is repeated until all but the posterior end has been removed and this may be completed by snaring. The knife is then used to break down the cells and pieces are removed by forceps.

Douches should not be employed and the patient should not blow his nose for twenty-four hours. Menthol inhalations or liquid paraffin spray will hasten the process of healing.

It is seldom that chronic ethmoiditis exists alone and this case will illustrate the point.

C.A., male, thirty-one. This man had recurrent colds, sore throat, bronchitis and frequent attacks of asthma. Three months after the following extensive operation treatment had been carried out he was free from colds and had not had an attack of asthma.

A submucous resection of septum with left anterior middle turbinectomy and removal of polypi was first performed. The anterior ethmoidal cells were opened and curetted. Right antrostomy and right anterior middle turbinectomy done later completed the surgical treatment with the above satisfactory result. Another instance of relief to asthma was seen in F.C., thirty-one who had asthma for five years before operation. The patient had frontal headache in the morning with nasal and post nasal catarrh but without nasal obstruction. A submucous resection of septum and removal of both middle turbinates sufficed to clear up ethmoiditis and six months later had not had an asthmatic attack since operation.

The posterior ethmoidal may be entered in the same way by penetrating the capsule further back. If it is decided to save the turbinate and I think the modern tendency is to take this course the operation for destruction of ethmoidal cells is that described under frontal sinusitis as practised by Watson Williams.

The external operation practised by Howarth is indicated when infection is spreading to orbit or when a fistula communicating with the ethmoidal labyrinth is found in the region of inner canthus. The case now to be described illustrates this point and also points to the need for early radical treatment when the infection has left the confines of the sinuses and cells.

F.S. female, age fifteen. The patient had pain and swelling in right eyelid for fourteen days before she was examined. When seen at Bristol General Hospital right eyelid was red and oedematous, and painful and there was purulent discharge from the eye.

A curved incision was made around the inner margin of the orbit when pus was seen to be coming from ethmoid cells. A drainage tube was inserted when ethmoidal cells had been curetted. A week later left anterior ethmoidal cells were curetted and removal polypi with right middle turbinectomy, was performed but three days later projectile vomiting commenced and the patient felt drowsy and had a slow pulse. An incision was made over frontal sinuses and trephine opening was made through the posterior wall of right sinus; pus welled out and a tube was put into the trephined area. Five days later the incision and trephined area were enlarged and more pus was found. Cheyne-Stokes breathing and patient died two days later. Post mortem examination revealed diffuse meningitis in frontal area with pus in all the accessory sinuses.

Untreated ethmoidal infection as already stated will often prolong suppuration after a too conservative method of treatment has been adopted and I am of the opinion that unsuspected ethmoiditis was responsible for a peculiar condition seen in this patient.

D.M., female, twenty-four had colds in head and epistaxis with severe headache and discharge on both sides. On examination there was a swelling in right cheek with dull aching above and below the right eye. There was no pus in the nose but the patient was slightlytender in floor of right frontal sinus. Right antrum was not so clear as the left but X-ray did not reveal sinus infection and as teeth were septic they were thought responsible. Two months later the patient came up again with discharge from right nostril and a ruptured abscess in right cheek. The condition cleared up and nothing more has been seen of the patient.

When dealing with the posterior ethmoidal cells it is often advisable to open the sphenoidal because the two are very often infected together.

Sphenoidal Operation.

The Sphenoidal may be opened by external method of Howarth described above, but the usual and safest way is by the nasal route; when the operation should be conservative

with the sole object of providing drainage. The sinus should never be curetted on account of the close relationship of vessels and nerves and also because of the frequent imperfections of the sinus walls the cranium may easily be entered.

The operation may be performed under inspection or by the sense of touch, each method having its good points. By the first method the middle turbinate is removed and Hajek's hook passed into the sinus through the ostium and pulled out to enlarge the opening.

The second method has the advantage of saving the turbinate but it requires experience to find the ostium without inspection. Through the opening made by the diagnostic cannula the cutting forceps are passed closed. They are then opened and pulled out slightly until the upper blade touches the anterior wall. The anterior wall is then removed piece meal but care should be taken when cutting in the direction of the roof lest the cranial cavity be entered and again the cavernous sinus may be endangered unless care is exercised. When cutting in a lateral direction the inside of sphenoidal sinus should be treated with the greatest respect and no sharp instrument should ever be used. The walls are always thin and may become softened with chronic suppuration. Of course the relationship of optic nerve should always be borne in mind because neglect of this point will surely cause permanent blindness if the nerve is injured.

The following case illustrates what is commonly found in sphenoiditis.

R.G., female, thirty-seven. Pain between the eyes and post nasal discharge for years; narrow nasal cavities, X-ray disclosed nothing. There was diminution of left visual field and pus was found in left sphenoidal sinus. The anterior wall was cut away and vision improved.

Another case, W.R., male, forty-seven, had loss of vision in left eye due to left axial optic atrophy. There was pus in left sphenoidal sinus and ethmoidal cells. Anterior sphenoidal wall was broken down and Sluder's operation performed on ethmoid without improvement. The patient had too long denied himself treatment and had suffered accordingly.

When surgical treatment has failed to effect a cure in nasal sinusitis radium may often be used successfully especially when the trouble is seated in the ethmoidal labyrinth.

In one case a girl of eighteen who had double chronic ethmoiditis characterised by pus and polypi and who had been treated unsuccessfully by surgery, 5 mgm. unscreened radium was inserted in one nostril at a time and left for four hours. One week later reaction was still marked but there was less discharge. After another week, obstruction was less and four months later no pus was seen. A similar result was obtained in another case but in a man who showed excessive hyperplastic polypoid formation without pus to

the extent of bulging at bridge of nose, No improvement was obtained after two applications of a similar dose. Ionization has from time to time been brought forward as a cure for chronic sinusitis but it is only suitable for cases in which there is no bony lesion and this to my mind is not always easy to determine. The method does not hold any advantage over surgical drainage except when operation is refused. It might be tried more often I think in the type of case to which radium applies if enough of the sinus to hold fluid has been left.

Friel (Practitioner, December 1919) advises the following dosage - Antrum 15 M.A. for 10 minutes.

Frontal 10 M.A. for 10 minutes.

Sphenoidal 7 M.A. for 10 minutes.

A.A. Trotter (Archives of Otolaryngol July 1930) has devised a method of treating chronic suppuration of antrum by diathermy through an opening in canine fossa the field being illuminated by an antroscope. Ten cases have been treated successfully but he says nothing of the result of following up the cases.

As a final urge for the necessity of diagnosing and treating sinusitis I am impressed by the statement of J. Wright (Journal of Laryngology and Otology. 1930) who says that in many instances chronic sinusitis is a precursor of malignant disease and might well be regarded as a predisposing cause.

----------oOo----------

SUMMARY AND CONCLUSIONS.

In summarising the various points brought out in a consideration of sinusitis one feels it necessary to emphasize the importance of an accurate diagnosis based on the combined findings of the various methods and that even when all the findings have been negative the possibility of latent sinusitis must still be kept in mind. The agreement of Harper and Watson Williams on the point that latent infection may be produced by non pus forming organisms is impressive and one feels that a strict scrutiny must be made of the nasal mucosa, if latent sinusitis has to be discovered.

It has been established that sinusitis may be and very frequently is associated with conditions due to focal sepsis, but however, balance must be maintained and it should not be thought that an infected sinus must be followed by a secondary illness, but that it is nevertheless a potential cause of such conditions as rheumatoid arthritis, gastritis, asthma and bronchitis. The treatment of sinusitis is not be regarded as a cure altogether, but rather as an honest endeavour to lessen chronic invalidism.

The etiology is fairly clearly cut, the common causes being coryza associated with intra nasal hypertrophies and influenza in adults, and in children diseased and hypertrophied tonsils and adenoids with measles taking a part as

a causative factor. My experience of treatment in children is that attention to tonsils and adenoids, is in most cases sufficient but that lavage may be necessary in the cases which fail to respond, and that there is cause to hope that a few early cases may react satisfactorily to intra nasal medication and general treatment aimed at raising the resistance to infection.

The treatment of adults is at the present time greatly influenced by surgery and that is favourable because in no other way can satisfactory drainage be established. But it is borne in mind that there are two schools of thought the conservative which although believing in the free opening of an infected sinus stops short at the actual wholesale removal of mucosa.

Watson Williams and John Wright of Bristol are representatives of the "moderate" school as opposed to J.G. Hunt of Canada who believes that the thickened degenerated mucous membrane of chronic infection of the antrum can be removed through the canine fossa with complete regeneration. This theory is to my mind revolutionary and if borne out by satisfactory results will alter our conception of the regrowth of nasal mucosa. At the present moment I am investigating the regrowth of the turbinates in the following manner. All cases of deflected septum are having the mucosa of hypertrophied turbinates cauterised at the first

examination and then following turbinectomy done with submucous resection, several months later the turbinate is sectioned and a report made on the type of mucosa found. Enough data for a report on the investigation has not, however been so far collected.

I agree with radical eradication of ethmoid cells as being the most satisfactory method of dealing with a chronic infection, but the sphenoidal should be regarded as having but one wall, the anterior, accessible for treatment.

An acute frontal sinusitis may often be satisfactorily treated by attention to co-existing nasal obstruction and antrum infection. This fact has been illustrated in several of the cases quoted and yet a close look out for spreading infection should be kept and the external operation reserved largely for this type.

The operation of Harmer and Russell in offering constant drainage without much damaging interference is, I think to be recommended as a safe and efficient procedure for chronic cases which are not severe enough to warrant the external operation. The frequent use of this operation in St. Bartholomew's Hospital, without ill effect or fatality has placed it on a sound foundation.

Of the accessory aids to treatment, it should be said that in themselves they are not satisfactory, but that their limited field of usefulness may be exploited when other methods have failed.

----------oOo----------

BIBLIOGRAPHY.

Skillern.	"Accessory Sinuses of Nose". 1923.
Dan McKenzie.	"Diseases of Throat Nose & Ear". 1927.
A. Logan Turner.	"Diseases of Nose, Throat & Ear". 1927.
St. Clair Thompson.	"Diseases of the Nose & Throat". 1921.
Watson Williams.	"Chronic Sinusitis". 1932.
Gray.	Anatomy.

Webb & Gilbert.	J.A.M.A. March 1921. Page 714.
Mollison.	Guy's Hospital Report. April 1922. Page 225.
Dean & Armstrong.	Annal of Otology Rhinol. & Laryngol. 1919. Vol XXXVIII. Page 452.
Fish.	Medical Record. 1906. Vol. LXX. Page 689.
Logan Turner.	Edinburgh Med. Journ. May 1909. Page 423.
Gavin Young.	B.M.J. 1922. Vol. 11. Page 1,258.
Tunis.	Laryngoscope. 1910. Vol. XX. Page 931.
Grunwald.	Quoted from Skillern. Page 56.
Tilley.	B.M.J. Vol. 1. April 1933. Page 549.
Cleminson.	J.O.L.O. November 1921. Vol. XXXVI. Page 505.
Wood & Dunn.	J.A.M.A. April 21st 1923. Page 1,113.
St. Clair Thompson.	B.M.J. 1906. Vol. 11. Page 768.
Watson Williams.	J.O.L.O. 1932. Vol. 47. Page 410.
Sir Wm. Wilcox.	Practitioner 1926. Vol. CXVII. Page 137.

Pickworth. J.O.L.O. 1930. Vol. 47. Page 797.

Harper. J.O.L.O. 1930. Vol. 45. Page 841.

Brown Kelly. (Quoted from Dan McKenzie.) Page 339.

Graham Hodgson. (Quoted from Watson Williams.) Page 131.

E.V. Ulmann. North West Med. May 1932. Quoted from Ear Nose and Throat Year Book. Page 478.

Harmer & Russell. J.O.L.O. 1931. Vol. 46. Page 384.

Friel. Practitioner. December 1919. Vol. C111. Page 449.

Trotter. Archives of Otolaryngol. July 1930. Vol.X11. Page 18.

Wright. J.O.L.O. 1930. Vol 45. Page 545.

Hunt. Canad. Med. Assoc. Journ. 1930. Vol. XX111. Page 386.

----------oOo----------