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SENIOR THESIS.

DISCUSSION OF CHRONIC PARANASAL SINUSITIS.

F.I. Gilliland.

1933.
Introduction.

Discouragingly little is known about sinuses. One becomes so accustomed to the collection of facts, theories and fetishes which are repeated from one textbook to the next that they are seldom reduced to the few simple elements of which they really consist.

It is known, briefly that a sinus is an air cavity, communicating with the nose, that it is capable of infection and that when its ventilation and drainage are impaired trouble ensues. It is recognized in a general way what are the symptoms of such infections and blockades and too often it is mistaken. A dozen of more or less ingenious ways of opening these cavities have been devised, all for one purpose, to let out infectious material, which sum up virtually the whole of sinus surgery and cannot be considered a step ahead of the elementary surgical principle of draining an abscess anywhere in the body. Non-surgical treatment plays an important part also but the results are equally discouraging.

There are many exceedingly elementary matters about sinuses of which we know little. To begin with, we do not know why they exist at all. We do not know exactly why they are normally sterile and why they presently become infected. We do not know why once infected, they may readily recover, or why just as often, they do not.

As far as their symptomatology, we know that some persons suffer intensely from sinus infections which by our present standards of observation appear insignificant.

We know also that from a shocking percentage of sinus operations no relief is obtained, in fact the operation often aggravates the symptoms or produces new ones. We are still progressing by the
unscientific route of trial and error to determine which cases are amenable to surgical measures and which are not.

Conservative treatment is scarcely better off. It appears that the whole sinus question demands reconsideration; that only a new and better understanding of sinus physiology and pathology, leading to a new conception of treatment, can accomplish any definite advancement.

In this discussion an attempt will be made to bring together the information we have, and that is generally accepted. It would be almost an impossibility to compile even briefly (all of) all of the information that has been presented in the literature.
Anatomy.

In order that the clinical phenomena met with in cases of inflammatory affections of the accessory nasal sinuses may be readily understood, it is necessary to possess a thorough knowledge, not only of the air cavities but of the anatomy of the outer wall of each nasal chamber.

The nose consists of two chambers which open anteriorly on the face at the nostrils, and which communicate posteriorly through the posterior nares or chomae with the naso pharynx. The two chambers are separated from each other by a mesial vertical septum, composed in its greater part of the central plate of the ethmoid bone, the vomer and the septal cartilage. The septum which forms the inner wall of each chamber, is frequently deviated to one or other side of the mesial plane, sometimes to a considerable degree, more especially in its anterior cartilaginous part. The septum is covered by the nasal mucous membrane.

The roof of each cavity which is very narrow, is formed anteriorly by the nasal bone, and the nasal spine of the frontal bone, both of which are directed downwards and forwards, its central portion consists of the cribiform plate of the ethmoid bone, which lies horizontally, while posteriorly the roof has a downward and backward inclination, and is formed partly by the sphenoidal bone.

The floor of the nose is formed from before backwards by the palatal plates of the superior maxillary and palate bones.

The outer wall of each chamber is very irregular and opening on it are the frontal, ethmoidal, superior-maxillary, and sphenoidal air sinuses. In front the bony wall is composed of the nasal process of the superior maxilla with the posterior margin of which the lachrymal
bone articulates. In the middle region is the lateral mass of the ethmoid bone above, with the inner surface of the body of the superior maxilla and the inferior turbinated bone at a lower level. Posteriorly the vertical plate of the palate bone and the internal pterygoid plate of the sphenoid complete the outer nasal wall. Its surface is covered by mucous membrane.

The irregularity in the outer wall of the nasal cavity is due to a convoluted arrangement of bone known as the superior, middle, and inferior turbinated bones. The first two constitute the inner surface of the lateral mass of the ethmoid and hence are designated the ethmo-turbinate bones. The inferior turbinated, on the other hand, is a distinct bone articulating mainly with the superior maxilla, for descriptive purposes it may be termed the maxillo-turbinated bone. When the turbinated bones are considered in association with their mucous covering, they are frequently spoken of by clinicians as the turbinated bones, or turbinals.

Immediately external to the two ethmo-turbinals is a number of air filled spaces or sinuses which make up a large portion of the lateral mass of the ethmoid, and which are named the ethmoidal air cells. The inferior ethmo-turbinal, the middle turbinated body, has a free lower border and the anterior end of the free portion is sometimes hollowed out into a small air space called the turbinal cell which communicates with the middle meatus. This cell however may be absent upon one or both sides of the nose.

Each turbinated body overhangs a well marked channel or meatus named according to the bone which lies immediately above it, the superior or middle or inferior meatus of the nose.

The channels correspond in length to the turbinated bodies
which they are situated. The superior meatus is confined to the posterior third of the outer nasal wall. Its anterior end terminating in a culdesac. The middle meatus commences at the posterior nare and runs forwards for about two thirds of the extent of the nasal wall, although it does not reach the anterior naris, it is visible from that opening. The inferior meatus, in relation to the floor of the nose, extends from the anterior to the posterior naris. Not infrequently a fourth and smaller channel lies above and parallel to the superior meatus.

Considerable importance must necessarily be attached to meatuses, from the fact that the accessory nasal sinuses communicate through them with the nasal chamber. Before considering the manner in which these communications are affected, it is necessary to describe the situation and general relations of the following cavities, the maxillary sinus, the frontal, the anterior and posterior ethmoidal cells and the sphenoidal sinus. These air spaces both on anatomical and clinical grounds may be conveniently considered as forming two groups, first, the anterior group, consisting of the maxillary and frontal sinuses and the anterior ethmoidal cells, secondly the posterior group containing the posterior ethmoidal cells and the sphenoidal sinus. This anatomical grouping, the clinical significance of which will be afterwards apparent, is based upon the relative positions of the orifices of the cavities. The air sinuses of the anterior group communicate with the middle meatus below the line of origin of the middle turbinate body, while those of the posterior group open into or above the superior meatus, that is above the level of the middle turbinate.
We will now discuss the anatomy of the sinuses beginning with the maxillary sinus. It is the largest of the paranasal sinuses. It is situated in the body of the superior maxillary bone beneath the orbit and to the lateral side of the nasal fossa. The antrum has its origin in a pouching or evagination of the mucous membrane of the lateral nasal wall of the infundibulum ethmoidal. This may be observed in the seventy day foetus. It presents the form of a three cornered pyramid and varies in size with different individuals. It communicates with the middle meatus of the nose by a small slitlike aperture known as the ostium maxillare beneath the middle turbinate about the center of the middle meatus and approximately twenty five mm above the floor of the sinus.

The floor of the antrum is situated below the level of the floor of the nose and apices of the teeth situated directly beneath, may actually perforate its floor. The antrum walls are extremely thin and for this reason tumors, exudate or pus under pressure cause a bulging either forward, producing a protrusion of the cheek, or upwards causing ocular disturbances or medially causing partial obliteration of the nasal fossa.

The sinus is lined by muco-stratified, columnar ciliated epithelium, ciliated in type and known as Schneiderian membrane and the mucous layer of the tissue contains many mucous glands which may become infected with development of polypi or cysts. The tissue is continuous with the covering of the lateral wall of the nasal fossa by invagination of membrane into the air spaces.

At birth the antrum is about the size of a small bean with long axis anteroposteriorly. It continues to grow in size and assumes the adult form by the age of fifteen. The antrum varies in
in size in different individuals, but the average capacity is about twelve cc.

The blood vessels in immediate relation to antral cavity are, the alveolar branch of the second division of the internal maxillary, infraorbital artery which lies in a canal in roof of sinus, terminal branches of infraorbital and pterygoid plexus of veins which carries blood from the part. The fifth cranial nerves innervates all of the walls of the maxillary sinus. (2)

The frontal sinuses are two cavities with an intervening bony septum lying immediately above the root of the nose between the two tables of the frontal bone. These sinuses extend vertically upwards for a varying distance and in many cases also horizontally backwards between the two tables of the orbital plate. The sinuses are not present at birth. It is generally held that the frontal sinus commences to develop at the end of the first or at the beginning of the second year of life, as an upward expansion of the ethmoid cell labyrinth. The diverticulum of mucous membrane from the ethmoid air space gradually invades the diploe upon the nasal aspect of the frontal bone. As it extends upwards and outwards expanding the frontal table in its growth. It reaches in the sixth or seventh year above the fronto nasal suture and supra orbital margin and can be recognised at that age as a distinct cavity above the root of the nose. It is conceivable that the maximum growth is reached in early adult life, when the facial and cranial bones have become fully formed though some anatomists affirm that the sinuses continue to increase in size up to old age.

Although the frontal sinus in the adult varies in size and
and to a lesser extent also in shape, we are able to recognise, for descriptive purposes, three walls: an anterior, a posterior, and an inferior wall or floor. The two cavities are separated from each other by an intervening bony septum, sometimes described as the internal wall of the sinus.

The anterior wall is formed by the convex outer table of the frontal portion of the bone and lies therefore in the vertical plane. It consists in part of the glabella and supra ciliary ridge and in part of the bone above and below these prominences. The posterior wall of the sinus, which is slightly convex forwards is formed by the inner table of the frontal portion of the bone. Superiorly it approximates at an acute angle to the anterior wall of the cavity. Inferiorly however it becomes continuous with the upper of the two laminae which constitute the orbital plate of the frontal bone. The inferior wall of floor is formed by the lower of the two bony laminae which make up the orbital plate of the frontal bone, and corresponds mainly to the upper and inner angle of the roof of the orbit. It is concave upon its inferior or orbital aspect and convex towards the sinus. The frontonasal opening lies in relation to the septum of the sinus and is situated in the lowest part of the floor. In this respect it differs markedly from the opening of the maxillary sinus, which lies immediately below the roof of that cavity. The dependent position of the frontal opening undoubtedly favours the drainage of inflammatory products from the cavity and therefore explains the greater readiness with which cases of acute inflammation of frontal sinus undergo spontaneous cure.

The cavity varies considerably in size, these variations are met with, not only in different skulls but on the two sides of the same skull. In a series of skulls in which examination for the
sinus was made and the measurements taken, the average size was found to be: height one and quarter inch, breadth one inch, depth three fourths of an inch.

A number of recesses or bays may also be found in one sinus and cases are reported in which unsuccessful surgical treatment was due to failures in recognising these recesses. One or both sinuses may be absent.

The frontal sinus is lined by a very thin muco-periosteal membrane continuous through the ostium frontale with the lining membrane of the nasal chamber. Its surface is covered by a layer of ciliated epithelium, and contains a number of mucous glands.

The ethmoid air cells vary in shape, size, and number. They have been grouped by some anatomists into an anterior, middle and posterior series. Others again have subdivided them into two groups, the anterior and posterior ethmoid cells based on the position of their ostia. The latter anatomical division of the cells provides us, at the same time, with a satisfactory clinical basis. All the cells which communicate with the middle meatus of the nose below the line of origin of the middle turbinate bone are anterior ethmoidal air cells, which those which communicate with the superior meatus above the origin of the middle turbinate are posterior ethmoidal air cells. The relative space occupied by each group in the lateral mass is not constant nor is there any regularity in the number of cells which each contains. A single large air cell, or two or three smaller ones may represent the posterior group, while as many as seven, eight or nine anterior ethmoidal cells may sometimes be counted. The plate of bone which intervenes between the two cell groups is diagonally placed between the two cells-
groups is diagonally placed between the outer and inner walls of the lateral mass and does not admit normally of any communication between them. It is not however uncommon to find incomplete septa between the cells, so that a single ostium serves as a common orifice for the whole group.

While the ethmoidal air spaces are bounded externally by the os planum of the ethmoid and internally by the two ethmo turbinals, it is otherwise with the remaining four boundaries of the cells-labyrinth. Thus superiorly, the ethmoid air cells are completed by the depressions or foveae on the ethmoidal edge of the orbital plate of the frontal bone. Inferiorly, on the other hand, they are closed in by the ethmoidal edge of the orbital plate of the superior maxilla. Anteriorly and externally the cells are walled in by the lachrymal bone situated immediately in front of the os planum, and by the nasal process of the superior maxilla. As these two last named bones complete the inner wall of the orbit in front, it follows that the ethmoid labyrinth is intimately related to the whole inner boundary of that cavity. Posteriorly, the ethmoid cells are completed by the articulation of the lateral mass with the sphenoidal spongy bone.

The ethmoid labyrinth is lined by a thin mucoperiosteal membrane containing mucous glands and covered, by a layer of ciliated epithelium.

The sphenoidal sinuses are two in number and occupy the anterior portion of the body of the sphenoid bone, a mesial bony septum intervenes between the two cavities. The sinuses are not present at birth. They begin forming about the age of three and are fairly well developed in a child of six. As a rule two sinuses are present, but one or even both may occasionally be absent. The size of
the cavity is subject to a certain amount of variation in different skulls, and inequality in its dimensions on the two sides of the same skull is not infrequently seen.

Each cavity possesses six walls, a roof, floor, an anterior, posterior, internal and external boundary. The roof of the sinus is formed by the root of the lesser wing of the sphenoid, the olivary process and the sella turcica. The following important intracranial structures may lie in relation to the superior wall of the sinus, the olfactory peduncle, the optic commissure, the pituitary body, and at the junction of the roof of the sinus with its external lateral wall the optic nerve and ophthalmic artery pass forwards to the orbit. The floor of the sinus forms the most posterior part of the roof of the nasal chamber. The bone is not of the same uniform thickness throughout and may vary from less than half a millimetre to rather more than two mm. The anterior wall is formed by spongy bone and is extremely thin. It is of considerable surgical importance, mainly from the fact that it contains the nasal opening of the sinus. The sphenoidal opening is situated in the internal or nasal portion of the anterior wall of the sinus, and communicates with the spheno-ethmoidal recess. It lies nearer the roof than the floor of the sinus and consequently cannot serve as an efficient drain. The internal wall or septum lies vertically between the two cavities, and occupies the mesial plane. Deviations from the mesial plane are sometimes met with, and when marked give rise to considerable inequality in the size of the two cavities. The clinical symptoms of sphenoidal sinus suppuration which are due largely to the implication of the various important structures which lie contiguous to the bone which bounds the sinus, depend to a considerable extent upon the size of the cavity, and consequently upon the thickness of its walls.
The openings of communication between the accessory sinuses and the nasal chambers have previously been noted, but due to their importance they require further discussion. The superior and middle meatus acquire considerable importance, from the fact that through them the various air sinuses just described communicate with the cavity of the nose. The inferior meatus on the other hand receives the lachrymo-nasal tear duct, which opens into that channel under cover of the anterior end of the inferior turbinate body. In the middle meatus are the ostia communicating with the maxillary antrum, the frontal sinus and the anterior ethmoidal air cells, that is to say, the air sinuses of the anterior group. On the superior meatus, and frequently in a smaller channel the incisura ethmoidalis superior, lying above it, are situated the ostia of the posterior ethmoidal cells, while in the sphenoid ethmoidal recess is the opening of the sphenoidal sinus. These constitute the posterior group of sinuses. (1)
Histology.

The paranasal sinuses are lined by mucous membrane directly continuous with that of the nasal fossa including the maxillary, the frontal, and the sphenoidal sinuses and the ethmoid labyrinth. The mucous membrane lining the several paranasal sinuses and cells resembles that of the nasal fossa save that it is much thinner and contains fewer glands. Moreover it does not assume the characteristics of an erectile tissue.

The mucous membrane of the paranasal sinuses and cells is composed of a stratiform ciliated columnar epithelium, invaded by numerous lymphoid elements resting on a very delicate basal membrane, and tunica propria. Indeed the latter is firmly adherent to the underlying periosteum, especially so in the frontal and maxillary sinuses, less in the ethmoidal labyrinth and still less in the sphenoidal sinus. Unlike the mucous membrane of the nasal fossae, that of the paranasal sinuses is poorly supplied with elastic fibers. Moreover the glands, mucous in type are few and scattered as compared with the glands of the nasal cavity proper. In the maxillary and sphenoidal sinuses the glands are most plentiful in the vicinity of the ostia of the cavities.

In spite of the extreme delicacy and thinness of the mucous membrane of the paranasal sinuses and its firm adherence to the periosteum, it is readily influenced and greatly thickened by pathologic processes. It is particularly prone to thickening, rapidly so, in the vicinity of the ostia of the maxillary and sphenoidal sinuses owing to the greater looseness of structures at these points.

The current produced by the cilia of the epithelium of the paranasal sinuses is toward their respective ostia or apertures of communication with nasal fossa. (3)
Function.

It is impossible to make any positive statements in regard to the functions of the sinuses. Numerous theories have been advanced but only those which appear most feasible will be mentioned here.

They may serve to lighten and strengthen the bones which contain them, as most of these bones will crush before they break. They also separate the nose from the delicate structures of the eye behind, and from the cranial cavity above. Because of the large number of cells which go into their make up the sinuses provide a means whereby the air is gradually moistened and heated by a slow interchange. They are also of prime importance in voice production, and may be likened to a sounding box of a musical instrument, thus giving resonance, the essential element of a good carrying voice. (4)
Etiology.

The normal secretion of the sinuses is a grayish viscous fluid, that bathes the entire lining membrane protecting it and assisting the ciliated epithelium in the removal of foreign substances.

Bacteriologic observation by many investigators indicate that the normal nasal sinus is usually sterile. The important role played by the ciliated epithelium in producing this result is recognized, however it has been suspected that some antibacterial substance in the secretion is a contributing factor.

After study of the various types of glands and secreting cells which are found within the epithelial lining it is very evident the secretion may vary in consistency depending on the relative activity of the various glands. Under normal conditions variations is slight. The principle constituent is the mucous as secreted by the goblet cells and mucous cells of the glands in the submucosa, The term mucus is applied to the secretion and it consists of water, mucin inorganic salts, epithelial cells, leukocytes and granular matter.

The natural immunity of the mucous membrane to infection has long been noted. It has been proven that the germicidal power of the saliva is of little consequence and that freedom from infection of wounds in this part of the body is due to active phagocytosis induced by the power of the saliva to stimulate migration of leukocytes. The continuous degeneration of the superficial layers of epithelium was an important mechanical factor in prevention of bacterial invasion. (5)
The etiology of the disease of the sinus still remains an unsolved problem. It is true many cases present undisputable evidence of insufficient ventilation and drainage due to structural abnormalities in the nasal passages. Deflected septums, anomalous development of cells in the middle turbinates, unusually large inferior turbinates etc, unquestionably predispose to this disease. Yet often times inspection shows an apparently normal nasal cavity suffering from disease of the sinus, while in other patients one is unable to understand how any of the sinuses could be properly drained and ventilated, yet patient gives no history of any nasal disease or discomfort. There remains much to be done in experimental investigation regarding the underlying causes, deficiency in calcium, endocrine disturbance; the relation of the disease to metabolic disorders, changes in the blood chemistry from normal and other factors. All may be predisposing factors, there is however something more than acute infections and contact, for the nasal cavities are never free from bacterial content. What makes them more virulent at one time then another remains a mystery.(6)

It is true we encounter more sinus infections in the winter than in summer, for the predisposing causes are more prevalent in winter months, due to extreme and rapid changes in temperature resulting in increased number of common colds and other acute respiratory infections. In the cities increased by exposure to hardships and cold, overcrowding and bad ventilation. It is also believed diet plays an important role especially in vitamin deficiencies, more important in children. There must be something to lower resistance either general or local to give the bacteria a chance to get a foothold, colonize and produce there deleterious effects. Anything tending to lower general resistance, increase the number and virulence
of prevailing organisms, or break down local resistance will predispose to sinus infection (6).

The organisms present are many but the pyogenic cocci are more responsible than bacilli for suppuration of the sinuses. The predominating organism varies with different investigators, the majority agree that the streptococcus is the one usually present. Others are the staphylococcus aures, Micrococcus catarrhalis, and pneumococcus. Micrococcus erassus was found in nearly 50 percent of two hundred cases studied by Hays. Other organisms occasionally found are those of the Baccilus coli group, B. Protius, B. diphtheriae, B. influenza, B. gangrene pulpa, B. perfringius, and B. ramosus. (7)

We also have the infectious diseases such as measles, scarlet fever, diphtheria, pneumonia, influenza, in fact all of the upper respiratory infections attack the sinuses, and they may and may not clear up after the abatement of acute infection. (8)

On the basis of 236 histories and 379 maxillary sinuses on which operations had been performed Tomdorf arrived at the following conclusions. The disease of the maxillary sinus is the most frequent among the chronic diseases of the accessory sinuses. If disease of the maxillary antrum are eliminated other slightly affected sinuses heal spontaneously. Diseases of the frontal sinus are far less frequent than diseases of the maxillary sinus. Isolated diseases of the ethmoid or sphenoid are still less frequent. In a large percentage of cases a bilateral disease of the maxillary sinus is present. (9)

Tuberculosis of the sinuses may simulate chronic infection of another nature.
Carmody and Green expressed the belief that without sinus infection or without pathologic membranes, irritants such as dust, pollens, bacteria, foods and emanations of sorts do not produce the so-called allergic coryza or hay fever. Most investigators however disagree as to this statement, they contend, it is due to the changes which take place in the mucus membrane lining, following an allergic reaction, which makes them susceptible to invasion by pathogenic organisms. (10)

Vitamen deficiencies have been mentioned and it is in this field which perhaps more for the alleviation of sinus infection in the future will be done than any other. It is a well known fact without proper nourishment, the child will not develop normally. Perhaps the child may not be afflicted with sinus disease until he reaches puberty. This however does not exclude the fact that he does not have properly formed sinuses and has not had them all of his life, but the infection had not manifested itself until this late age. (11)

In summing up the etiology we find the various distinct processes by which the mucous membrane of the accessory sinuses may become diseased.

1. Through direct invasion of the healthy sinus by pathogenic bacteria
2. Through extension of inflammation from neighboring parts.
3. Through the blood and lymph.
4. Through traumatism, exposure to cold, sea bathing, auto riding etc
5. Through foreign bodies.
6. Through contamination from the pus of overlying sinuses.
7. Through vitamen deficiencies.
8. Allergic reactions.
9. Tuberculosis, syphilis, Malignant neoplasms and latent empyema.
Disease of the sinus does not mean that it will become a chronic process, but it is impossible to have a chronic affair without having at some time or another an initial invasion. The sinuses exhibit a marked tendency toward resolution after having become infected, however in a certain number of cases the infection overcomes this tendency and the disease becomes chronic. This may be due to a number of conditions, the following of which are the most important.

1. Interference with normal drainage, congenital or acquired.
2. Especial virulence of the infecting organism.
3. Inflammatory changes occurring in the mucous membrane.
4. Recurrence of the attacks.
5. Continuation of the irritation.
6. Consistency of the secretion.
8. Secretion flowing in from another sinus.
Pathology.

The pathological changes which take place in the course of the inflammation depend upon several conditions; the length of time the disease has progressed, the virulence of the attacking germ or germs, resistance the sinus has shown toward the disease, favorable or unfavorable drainage condition. The maxillary sinus usually shows the greater pathological changes. This is due to the unfavorable situation of the ostium for drainage, as a consequence, the mucous membrane at the inferior portion is constantly bathed in the purulent secretion.

When the mucous membrane becomes first infected, there results an intense hyperaemia and swelling, due to the outpouring of serum into the submucous connective tissue layers which may be so great as to occlude the lumen of the sinus. The swelling encroaches more and more on the cilia, causing them to wave more and more slowly until, if the pressure is sufficient, they cease altogether. During this stage no secretion is formed, because the lining membrane has not been penetrated by the exudate. The stadium is followed by oedema, caused by the pressure on the blood vessels.

As the cilia have become motionless, the mucosa is no longer able to throw off the secretion which is continually forming within glands and by osmosis through the epithelium, in the event of inflammation. This inflammatory exudate is composed of serum, mucus, leucocytes, and exfoliated epithelium, micro-organisms may or may not be present. The exudation in the beginning is scanty-becoming serous or serous bloody, depending on the infection.

Resolution may now set in with gradual reduction of the hyperaemic and oedematous swellings, the cilia again being set in motion, and the secretion either ceases entirely or assumes a mu-
coid or serous mucopurulent and finally a watery character with
restitutio ad integrum. If however the inflammation continues and
micro organisms find their way into the cavity, the cilia being
overpowered by the swelling and secretion they may find suitable
soil for their propagation in the areas where punctiform hemorrh-
hages and areas of desquamation of the epithelium have occurred.

Chronic sinus inflammation exhibits two distinct types; many different names have been applied to name them, but they will be considered here under hyperplastic and ulcerative.

In the hyperplastic type the mucous membrane is of a
grayish color often wrinkled and papillomatous and more or less
loose from the underlying bone. Hyperemia while present is not so
marked as in the acute inflammation. Edematous changes occur in the
mucous membrane which are similar to the ordinary nasal polyp.
The connective tissue is thickened. Retention cysts often occur
from constriction of the necks of the glands, due not only to the
pressure from the round cell infiltration but to the formation of
connective tissue, as the glands and vessels may be atrophied or
vessels may be numerous and more or less dilated.

The ulcerative type is probably not a true ulceration, but rather a hyperplastic condition associated with ulcerous. The
relative extent of the pathologic process depends as much upon the
pressure upon the mucosa as upon the action of excessively virulent
micro-organisms. (3)

The changes in the mucosa are often spoken of as catarr-
hal and suppurative. In the catarrhal condition the exudate takes place
most often into the tissue of the mucosa, and the nasal or post
nasal discharge is relative meagre in comparison with the discomfort.
In the suppurative type, a true empyema exists, but the mucosa is less swollen and the pure pus or mucopurulent pus is discharged. (11)

Unusual pathological complications of chronic inflammation are occasionally found, such as new formation and ulceration of bone, caries, and necrosis. When the inflammation first meets the periosteum the blood vessels supplying the osteoblasts become dilated. If irritation does not progress beyond this point, on account of the excessive nutrition brought to the part new bone is deposited in an irregular fashion on the internal walls of the sinus giving it a roughened appearance. This has no pathological significance. Ulceration of the bone seems to be dependent upon an especially virulent infection, being always accompanied by ulceration of the superimposed mucosa. Actual destruction of a portion of osseous wall is relatively rare. This is usually due to infection through the circulatory system.

Absolutely no reliance can be placed upon the character of the secretion as an indication of the pathological condition of the sinus mucosa. It may be profuse, foetid, and of a greenish color, yet the mucosa shows but few and even insignificant, pathological changes and again it can be thin, serous, and scanty, yet the entire sinus will be filled with hyperplastic and cystic degenerated mucous membrane. These apparently anomalous conditions are explained by the kind and virulence of the infection, for it appears that the infecting organisms act principally on the epithelium and do not penetrate into the depths of the mucosa. Hajeck says the secretion in acute and chronic inflammation can be differentiated by the fact that the pus in acute inflammation appears to mix with infected fluid, while in chronic empyema the secretion
shows a great tendency to segregate into masses.

As a rule when the drainage is not good saprophytic organisms find entrance into the sinus and cause the secretion to become malodorous. If no apparent interference with drainage is present and the secretion becomes foetid, it is usually significant of some deep seated tissue involvement.

In latent empyema, by which is meant a suppurative process within a sinus, which continues without giving rise to appreciable symptoms and being probably due to infection from microorganisms of slight virulence. This condition is in reality a mild catarrhal process, which nevertheless may become virulent and even fatal under the influence of certain forms of irritation, by quickening the dormant bacteria or reducing the resisting powers of the sinus mucosa.
Symptomatology.

In discussing the symptoms it is impossible to state any definite order of symptoms by which a diagnosis of chronic sinusitis can be made without a thorough examination. Probably no two cases will exhibit the findings or give the same history. A classical case however can be described as follows.

A catarrh, dryness of the nose and throat, sensation of something in the throat, frequent clearing of the throat, hawking to obtain a mass of tenacious, yellow, gelatinous material, hoarseness with a dry non-productive cough, morning house clearing of the naso-pharynx, accomplished by various sprays, gargles and irrigations, gagging and occasionally vomiting, bad breath, scabbing of the nose and naso-pharynx, redness and discharge in the eyes, with visual disturbances, headaches, neuralgic pains, in face and teeth, aching in back of neck and shoulders; drowsiness, dizziness; lack of ambition; mental depression and exhilaration; stupidity; nausea, and loss of appetite; asthmatic attacks. These and many other complaints are the common story of patients suffering sinusitis.

The objective findings are, turbinates swollen and red, glazed, later enlarged and red, but membrane becomes dull and lustreless. Finally turbinates become atrophied, dried and covered by hard scabs. The result is at first an obstruction then an opening which is too large.

The discharge in the nose is at first mucopurulent and profuse, later reduced in amount but thicker in consistency. When the nasal membranes have atrophied and ability to expel the pus from the nose is gone, it is usually found resting in floor of nose or collected in naso-pharynx.
Examination of the throat reveals a pathology of the posterior pharyngeal wall which closely resembles the pathology of the nasal membrane. There is a significant swelling of lymphoid tissue behind the posterior pillars extending upwards to disappear in the nasopharynx. Discharge may be seen covering these lateral walls following the course of the hypertrophied tissue. Enlarged lymphoid nodules are also present in posteriorpharyngeal wall. Dried glassy tenacious pus may be seen adherent to the surface.

Larangeal examination reveals same dried surface of the membranes. Secretion may be seen around the true vocal cords. The cords are thickened, infected and dry. (12)

Headache is mentioned as one of the chief symptoms. Some look ill, run down and toxemic, others have violent periodic attacks with intervals of freedom, some suffer in silence and many attempt cures from cultists and charlatans. In determining the source of the headache, examination of the bowels, errors in refraction, foci of infection etc, must not be overlooked.

Pain is a reaction manifested by an infected sinus and it is transmitted by an afferent nerve, and this nerve is the trigeminus as this nerve supplies the nose and face. The headache is rarely typical as to location, time of appearance or severity. The diagnosis of acute pathology is rarely difficult. It is the atypical chronic conditions where the location and character of the pain is inconstant. (13)

The symptomatology of chronic infection of the maxillary is peculiar in the wide range of degree from mild to severe, which it may assume, as an example, the symptoms can be so slight as to even fail entirely, the patient being unconscious
of any sinus trouble until accidently discovered. This fortunately
is the exception rather than the rule, as careful examination
in these cases will usually elicit some symptoms which will ultim-
ately lead to the correct diagnosis. On the other hand the transi-
tion from the acute to the chronic stage may take place without per-
ceptible abatement in the subjective sensations, the course of the
disease being so far as the symptoms are concerned to all intents
and purposes acute.

Actual pain in the sinus is usually absent, neither
do we find the sensation of fulness nor sensitiveness to pressure as
in the acute form. When the sinus is filled with dilated cysts or
mucous polyps the sensation of distention is sometimes present.
Headache in some form is a common symptom, the most frequent
being supra orbital neuralgia, although in severe cases, particularly
when partial stagnation occurs, the pain is apt to embrace the cor-
responding half of the head.

In mild cases the pain is absent or at most takes
on the character of full tense feeling in the superior maxillary
region of the affected side. Often enough there are absolutely no
subjective symptoms from which one could draw an inference that
the maxillary sinus was affected; no tenderness, no swelling, teeth on
both sides apparently sound, and it is not until exploratory needle
puncture has been made that the diagnosis is established.

In moderate cases the pain is similar to attacks
of neuralgia, occurring at intervals and is characterized by its
indefinite localization being but rarely confined to the superior
maxillary region. In conjunction with the full tense feeling, sharp
shooting pains occur in the infra-orbital nerve and frequently in the supra orbital region, and indeed may be entirely localized to the latter. The patient usually complains of a dull, indefinite feeling of tension in the diseased side of the face and forehead. This pain is usually worse late in the morning and towards evening gradually relents. This is due to the fact that partial drainage of the cavity takes place as in the other sinuses. The patient usually admits of a dull, indefinite feeling of tension in the diseased side of the face and forehead. This pain is usually worse late in the morning and towards evening gradually relents. This is due to the fact that partial drainage of the cavity takes place as in the other sinuses. The pain and discomfort of the patient is markedly increased by indulgence in alcohol or tobacco. Occlusion of the nares on the affected side is intermittently present, being especially marked when the sinus is full of pus, just before the emptying process occurs.

The explanation of this lies in the fact that the pressure of the contained secretion causes a hyperemia on the lateral nasal wall, thus causing the mucosa to swell and at the same time stimulating the nerve bodies in the inferior and middle turbinates. As soon as the sinus empties itself these structures shrink and the nose again becomes free.

In severe cases one would suppose that when the mucous membrane of the sinus had undergone great degeneration with perhaps underlying caries of the bone, the acute local pain would be well marked. The indefinite character of the pain is still marked, but the feeling often lessens with sudden, lightning like paroxysms of neuralgia, is so intensified as to become almost unbearable. These neuralgia attacks are not confined to the diseased side, but are often combined on the opposite side, particularly over the course of the infra-orbital nerve and in the parietal region. Occlusion of the nares is marked and more or less constant and around the vestibule, particularly on the affected side.
exzematous eruptions are to be observed. The tense feeling is continually present, the patient seldom being entirely free from some discomfort, as in the preceding conditions. Even after a through lavage the pain is not relieved. Alcohol and tobacco are absolutely untolerated. Any sudden jarring, stooping over, straining at stool, in fact any conditions which cause congestion of the head, will cause congestion of the head, will cause unbearable anguish. The feeling of anguish so completely covers the affected side that one is often at a loss to definitely state whether several and not one particular sinus is affected, this tension in other words, is so wide in its scope as to be not at all pathomonic of maxillary sinuses, (14)

The pain from maxillary sinus infection is often described as pain over the frontal region, as a referred pain from infra- to supra-orbital pain. It is not as high or wide spread as in true frontal infection and with a feeling of distention over antrum (15).

In chronic inflammation of the frontal sinus usually results as a sequela of an acute inflammation. The one great causative factor of chronicity of it is disturbance of the normal mechanism of drainage.

The symptoms of chronic inflammation of this sinus, may vary from their total absence to those quite as marked as in the acute stadium. In contradistinction to the acute process, all phases of pain may be absent. Cases have been reported in which great inflammatory changes have taken place in the sinus mucosa without the patient having ever complained of the slightest symptom of headache.
The character of the headache may assume any of the innumerable phases characteristic of pain, ranging from slight sense of numbness on the affected side to a sickening splitting cephalalgia, the greatest paroxysms being synchronous with the heart beat such as are observed in cerebrospinal meningitis. The latter phase is only met with in acute exacerbations during periods of congestion from over indulgence of food and drink, especially alcohol, and after unwonted mental exertion or during the prodrome of a pending complication.

The headache seldom assumes any definite form, but is subject to the greatest vagaries, depending upon even the most trivial occurrences, therefore, the sufferer must exercise certain prudences which are unknown to the healthy individual. Constipation indigestible foods, alcohol in every form, tobacco, mental and physical exertion, stooping, jarring, in fact any condition which tends toward circulatory congestion of the head, are prone to give rise to distressing symptoms and must be therefore, strictly tabooed.

Neuralgic pain in the chronic form is rarely observed except in acute exacerbations of the inflammation from taking cold.

The pain is above the orbit in the general region of the frontal sinus. The precise locality often changes with the character, thus during the relative quiescence the cephalalgia is apt to be indefinitely distributed over a larger region than when severe exacerbations occur. In the latter event the pain frequently concentrates in a definite area, manifesting dissimilar characteristics.

Typical pain located in the frontal sinus may finally be elicited during some stage of the affection. While this may not
always be confined to the limits of the affected cavity nevertheless, the approximation is sufficient to warrant the appellation of frontal sinus infection. The prominence of this symptom is in direct ratio to the pressure within the cavity, both positive and negative. Occasionally the pain is greater in the healthy sinus. No other explanation than that of reflex phenomena can be given to this curious phase.

As mentioned before, the pain shows a decided tendency toward instability. In a long and chronic case there is a well defined tendency toward periodical exacerbation at certain hours of the day, followed by an equal regularity of remission. This exacerbation usually occurs during one of the morning hours, lasting a variable length of time and remitting as quickly as it appeared. The regularity with which this occurs day after day and week after week is quite inexplicable.

Oedema of the upper eyelid frequently occurs in, especially soon after arising in the morning and disappears during the day. It is caused by pressure within the sinus, on the veins of the mucosa which freely anastomose with those of the eye and eyelid.

In the earlier stages of hyperplastic ethmoiditis a condition resembling chronic coryza predominates. Every exposure to cold, draughts, damp feet etc. brings on attacks of sneezing, increased watery secretion from the nose, ocular manifestations etc.,. When the disease has become out spoken one of the principal symptoms is head ache which is marked in the regions of the nasal base above and below the eyes and often radiating toward the temples. It is not constant
but seems to depend largely upon the state of congestion of the head.
Occasionally the pain is so intense as to simulate an idiopathic neuralgia and lead to resection of a nerve. Unlike pain from the other sinuses, it is not so markedly affected by indulgence in tobacco or alcohol or by stooping or sudden jarring. A marked feeling of fulness is present in the upper portion of the nose, and not infrequently the patient complains of intraocular pressure.

The secretion on account of its abundance, may be one of the most prominent and annoying symptoms. It is of the thin watery type, straw colored, leaving no perceptible stain upon the handkerchief. During attacks of acute coryza it often assumes a purulent consistency, but after the disappearance of the cold, resumes its former appearance.

Disturbances in the sense of smell are common on account of the occlusion of the olfactory space by the encroachment of polypoid tissue. Anosmia is naturally most frequently met with, although occasionally a subjective unpleasant musty odor is now and then perceived by the patient. This is undoubtedly due to stagnation of the secretion in some of the interstices behind the polypoid swellings with invasion of saprophytic microorganisms. An unpleasant taste in the mouth is often present in the morning due to stagnation and fermentation of the secretion which has collected in the choanae during the night. Pharyngeal bronchial symptoms and orbital symptoms are also frequently met with.

Perhaps no other sinus presents such a wide deviation in the subjective and objective symptoms as the chronically diseased sphenoid. A chronic empyema of this cavity frequently exists without
special manifestations which would direct the attention of the patient or the examining physician to this portion of the cranium. On the other hand, sufferers from this disease have been so seriously affected as to seek relief from their misery with such extremes as suicide. The subjective symptoms, therefore would depend upon certain conditions, and these conditions are at once referable to and largely dependent upon the drainage of the sinus.

In cases with free drainage the condition present is actually a low grade form of inflammation in the mucosa of the sphenoid sinus, discharging a thin, mucopurulent secretion which, by reason of sufficient drainage, is never confined under pressure with in the sinus.

The most prominent symptoms in these cases are referred to the naso pharynx. The patients often complain of an almost constant postnasal discharge, which has a tendency to dry in the pharynx and is so difficult to dislodge that they are often required to use the finger for this purpose. The secretion has the consistency of pasty glue, and during the night forms into crusts. Discharge through the anterior nasal passages is scanty and often entirely absent, but occasionally, on violent blowing some particles may be observed in the handkerchief. Headache in the common meaning of the term is absent, only occasionally is there a vague fulness behind the eyes, which tends to dull the faculty and create a condition of apathy.

In cases with intermittent or deficient drainage headache is the most prominent and at the same time one of the most unreliable symptoms connected with the disease. Its presence depends upon the pressure of the secretion or of swollen mucosa within the cavity,
in contradistinction to the sense of fulness behind the eye which is due to mechanical pressure from the actual oedema of the parts from venous stasis. As the internal sinus pressure, except in extreme instances, is not constant, it naturally follows that the headache must occur in periodical attacks, the severity of which is dependent upon the degree and prolongation of the pressure of the contained secretion. These attacks occur as a rule daily and last a varying length of time, from one to several hours, the patient being usually prostrated for the time being. When remission occurs it is seldom complete, as a dull, indefinable ache continues until the next paroxysm, in the severe cases it is this ache that reacts so upon the patient's nerves, as to make every succeeding paroxysm of pain anticipated.

The exact location of the head pains is impossible to determine, as it varies with different degrees of inflammation as with different individuals and even in similar cases is not localized in any definite spot.

Generally speaking it begins on the vertex and radiates downward to the temples and sometimes into the mastoid region. Again it may centre in the occipital region, extending into the muscles at the nape of the neck. The deep seated pain is located behind the eye balls and when severe even embraces these structures. During the paroxysms of stage of retention the cephalalgia changes, its character of a heavy pressure upon the top of the head. Indulgence in alcohol or tobacco, constipation or any slight irregularity which would tend to cerebral congestion exercises a marked influence on the severity of the pain. Dizziness and vertigo are often prominent and manifest themselves on any sudden change of the position of the head.
Diagnosis.

A thorough history is as essential in making a diagnosis of sinus inflammation as in any other disease, if not more so. Often times the history will reveal cause of the patients discomfort, when physical examination reveals very little, if any thing, in the way of pathological changes. The history usually obtained has been discussed under symptomotology.

In uncomplicated sinusitis patients usually complain of nasal, discharge, either from the front on stooping or on blowing the nose or else post nasally, when the chief question for diagnosis is to determine the precise focus involved. But patients who suffer from septic toxaemia or sub-infections on the contrary very often fail to notice or to any great extent, the nasal discharge, and it is only by careful inspection that the discharge can be discovered. In these patients it is their symptoms rather than the amount of discharge that count. Any infected nasal sinus that does discharge into the nasal passage may yeild such scanty secretion that although the discharge may be plainly seen by inspection at one moment, it may drain away or be blown or washed away, so that when it is sought again there may be nothing to see. Hence with a negative result as far as seeing streams or streaks of discharge in a patient whom one has reason to suspect of nasal sinus infection, one should examine more than once and also carefully note whether there is any abnormal turgence of the turbinals or a localized inflammation of the nasal mucous membrane.

The first procedure should be anterior and posterior rhinoscopy. The usual inspection by anterior rhinoscopy, only requiring a speculum, forehead mirror, and a good light, is naturally a matter of routine in every case and never remitted, for it brings to view
from in front so much which cannot be seen by any other method.

Discharge from a frontal sinus, anterior ethmoidal cells or from the maxillary antrum appears beneath the anterior end of the middle turbinal body, thus from any of these sources the discharge enters the nasal passage below the attachments of the middle turbinal. While it usually comes to the front and escapes anteriorly on stooping or blowing the nose, it naturally runs back when the head is thrown back, as in bed or on sniffing. Of course, if discharge is copious, it may be necessary to wipe out or wash out the passages first and then wait for a fresh stream to appear.

Discharge from a sphenoidal sinus or posterior ethmoidal cells run into the sphenethmoidal recess, above the posterior end of the middle turbinal body, and so occupies the olfactory fissure until it drips downwards. When fairly copious such purulent discharge from the sphenoidal sinus or posterior ethmoidal cells may be seen at times far back in the olfactory fissure.

Posterior rhinoscopy is mainly useful for the inspection of adenoids or of discharge coming from the sphenoidal sinus or posterior ethmoidal cells, when a definite streak of pus is often seen coming backwards from above the posterior end of the corresponding middle turbinal body, more over it reveals any polypus growth in the choane.

Probably more information than by the above methods can be obtained by the use of the endo-rhinoscope. The instrument is in principle a short and small calibre cystoscope, with a periscopic lens and electric lamp at the distal extremity. The nasal passages or at least the floor and the lower part of the septum
and outer walls should first be made insensitive by a suitable local anaesthetic.

The instrument is then introduced, lens uppermost, under inspection with the help of a nasal speculum to guide its entrance, and as soon as it has been slipped well into the choana, the nasal speculum is removed and the observer's eye applied to the proximal end. On slightly rotating the instrument, first inwards, the back of the vomer is clearly indentified unless the lens and the lamp have not reached the nasopharynx and are still in front of the choana, in which case the instrument is pushed back until the posterior border of the vomer comes into view.

First it is essential to familiarize oneself with the appearances of healthy structures, the outlines of the normal vomer, its border, and of the turbinals, the eustachian tubes, normal remains of the nasopharyngeal tonsil and the normal appearance of the vessels running upwards and inwards and the inferior turbinal to the outer nasal wall.

When purulent discharge is seen by the endoscope it is often so plentiful and diffuse that the difficulty is to locate its source which is the important matter to determine. It may be so copious and diffused that apart from the knowledge that in the absence of intranasal ulceration, growths or foreign body, it is almost certainly coming from one or more infected sinuses, nothing can be determined until the excess discharge is blown or mopped out. Unless the passages have just been washed out there is usually sufficient left for fresh discharge to ooze out on the involved sinuses. In other cases it may be there is but a single streak of discharge
and then the value of the observation depends on its position.

For locating the source of the observed discharge one has often to neglect diffuse strings and carefully note whether a string or stream of discharge is coming from, the middle meatus, the superior meatus or posterior end of the middle turbinal.

The value of endo rhinoscopy lies in its assistance in detecting discharge in the posterior part of the nasal passages, sometimes not seen by any other means, secondly in enabling the observer to locate the source of the discharge in a large proportion of cases. But if a diagnosis of nasal sinus infection can be arrived at, the actual location of the source or sources of discharge should be determined by diagnostic exploration. If other methods have excluded frontal or sphenoidal sinus or posterior ethmoid cell involvement, it is usually sufficient to investigate the maxillary antra otherwise it is safer to explore all by the syringe, and set at rest any doubt as to which sinuses are healthy and which infected.

Transillumination is one of the common practices in vogue and considerable reliance is placed on the findings by most users. Transillumination of the maxillary sinus may prove helpful if only in provisional diagnosis, yet although it will often afford positive evidence of sinusitis it is only in cases where other more reliable signs and symptoms render transillumination unnecessary. But frequently antral trans-illumination is positively misleading, and hence worse than useless and much the same may be said of transillumination of the frontal sinuses. Though one may sometimes confirm a diagnosis which on other ground can be made with greater certainty it cannot be compared with the reliability of skiagraphy of
of the frontal sinuses. In disease of the ethmoidal cells and sphenoidal sinuses it is useless.

With a view to testing the unreliability of transillumination in 259 cases of antral sinusitis occurring in P. Watson-Williams clinic at the Bristol Royal infirmary in which the transillumination test had been checked by suction syringe samples. It was found unequal illumination of the two antra proved that the one showing the shadow was nevertheless definitely infected in five out of six cases. Twenty percent error was found when transillumination was checked by macroscopic findings.

Skagrams are usually one of our most valuable diagnostic aids of many nasal sinus infection, but too much reliance is sometimes placed on them more particularly in the diagnosis of ethmoidal and sphenoidal sinusitis.

The maxillary antra are fairly close to the plate and in the large majority of patients the presence or absence of maxillary sinusitis is reliably indicated in the skiagram. The wide variation in the thickness of the bone on the two sides due to varying development of the two sinus in the same case however sometimes proves misleading, as the thick bone causes a resemblance to the shadow of an infected sinus.

The frontal sinuses being close to the plate, a good antero posterior skiagram will often afford the clearest evidence of their being normal or infected. The clearly defined outline of a healthy sinus contrast with the wooly outline and shadow almost invariably distinctive of chronic sinusitis. If the whole skiagram is blurred from the patients moving or from technical faults it is generally useless for diagnosis. Lateral skiagrams for th-
Frontal sinuses are mainly of value in revealing the depth of the sinus cavity, for a deep sinus from before backwards is easier to enter pernasally and to drain freely than the shallow sinus, while on the other hand the shallow sinus if opened externally is less prone to leave a disfigurement than the deep sinus.

It is always helpful to have an anteroposterior skiagram of the frontal sinuses, if only to make certain that they even exist, as sometimes they so ill developed that they do not extend above the orbital margin. The pain may be referred to the frontal sinus region from a sphenoidal sinusitis or some other conditions causing neuralgia and leading to an erroneous suspicion of frontal sinusitis when a skiagram may show the absence of these sinuses.

Sphenoidal sinusitis can rarely be definitely recognized by either the usual anteroposterior or lateral skiagrams. If however, the sphenoidal sinuses are radiographed anteroposteriorly in the oblique direction as described below the skiagrams usually afford valuable diagnostic evidence.

Ethmoidal sinusitis in anterioposterior skiagrams shows a definite blurring on one side as compared with the other, is strongly suggestive of ethmoidal sinusitis, and an absolutely clear skiagram likewise strongly suggests that these sinuses are not implicated. But there are so many different cell walls that must be penetrated by the rays, and the plate must always be so far removed from the posterior cells, that no absolute reliance can be placed on the skiagram alone. Again even when a skiagram correctly indicates the existence of ethmoidal sinusitis, it still remains to differentiate which cells are diseased and which are healthy, for the infection may
involve the anterior or posterior group or both.

Speaking generally, skiagrams of the sinuses appear most useful for the diagnosis of frontal and maxillary antral sinusitis and some times of ethmoidal and sphenoidal sinusitis, but for positive diagnosis other confirmatory methods are usually required. It is for cases in which clinical symptoms and signs leave the diagnosis of sinusitis doubtful that the skiagram becomes most useful. Much depends on the quality of the skiagrams, and where there is room for doubt the expert radiologist is often more cautious in making a positive diagnosis, and then there are those whose sinus skiagrams are lacking the technical excellence.

Many authorities will disagree with many of the above statements in regard to the use of the roentgenogram in the diagnosis of sinusitis. Many different positions are used by different men in the making of their plates, and many positive remarks can be found regarding positive diagnosis if the pictures are taken with different landmarks in mind. All will probably agree there are very few men who are sufficiently skilled in the interpretation of an xray of the sinuses, to accept their reading without question.

The diagnostic suction syringe method of separately extracting the discharge contained in the nasal sinuses and submitting the specimen to bacteriological examination has proved very reliable as diagnostic measure. Briefly stated, one first notes whether any discharge sucked into the syringe is clear or purulent, normal sinuses usually contain nothing but air. The contents of the syringe are then squirted into a sterile bottle for bacteriological examination, by stained films and by cultures, the films to show
cytology, and phagocytosis of organisms, the cultures to reveal the organisms present.

Absolute accuracy of result cannot be claimed, of course any more than for invariable accuracy of the histological examination of neoplasms, but it affords the nearest approach to diagnostic accuracy possible. Whether the discharge is copious or but scanty, the value of the method lies in the means afforded for rapidly determining which sinuses are healthy and which infected. (16)

The use of opaque or iodized oils within the sinuses before roentgenograms are taken is an important step toward accurate diagnoses, over the simple roentgenogram. Iodized oil can be used as routine in the antrums, and may be used elsewhere if surgery is contemplated. Iodized poppy seed oil, forty percent-diluted with heavy petrolatum or iodized rape seed oil diluted fifty percent and brominiz ed sesame oil full strength constitute the opaque oil of choice. The oil should be used immediately after irrigation or not at all for from seven to ten days as swelling may follow. The frontal sinus should be filled in the knee chest position, sphenoids should be injected on one side at a time to prevent overlapping, antrums one at a time. The use of the oil brings out clearer and with greater detail pathologic changes in the sinuses. (17)

The sinuses may be filled by the displacement method also, and is now employed by some men. The simplest method of introducing liquids into a cavity is to pour it in. Gravity carries the liquid to the remotest cavities and as it fills them displaces the contained air.

The method of instilling the fluid by the displacement
method requires that the head is inverted so that the chin and external auditory meatuses are in same vertical plane, fluid is instilled into the nose, negative pressure (180) mm is applied intermittently to one nostril, while a finger closes the other and the patient closes pharynx by saying the letter k. The patient is then returned to the erect position. About eight mm is installed into the nose. If the ostia are closed no filling results. In this way the ethmoids are filled and this alone is the only way in which they can be filled completely. (18)

The methods most commonly employed in diagnosis consists of:

1. Thorough history.
3. Transillumination.
4. Endo-rhinoscopy.
5. Simple Reontgenogram
6. Roentgenogram plus iodized oil.
7. Diagnostic exploral suction.
Complications.

A large number of diseases have their origin in affections of accessory nasal sinuses. These complications have until rather recently received but scant attention from medical investigators and medical writers. Even at present surgical authors including to a notable extent those who specialize in surgery of the head either have made no mention of this subject or have dismissed it with far too little consideration. Internists have been foremost in their investigation of focal infection, and to them credit is due for many recent advances in etiology and treatment. The subject still deserves wider recognition for it is true beyond question, that serious and even fatal disease not infrequently originates solely in the labyrinth of the paranasal sinuses. It is equally true that many ailments originate in these foci while not immediately serious or fatal, finally become so and are meanwhile, a menace to the comfort and well being of those so afflicted.

All complications of sinus disease are due primarily to previous bacterial invasion of one or more sinuses. Every case operating to produce the primary sinus affection is therefore, a cause of the complication. Since but a comparatively small percentage of cases of sinus infection are followed by complication it becomes necessary to seek reason for its occurrence in some and not in all. Such reasons are based either on the character of the anatomy of the given sinus or upon the virulence of the invading organism. The main reasons are therefore either anatomical or pathological.

The situation of the sinuses at the top of the respiratory tract, wholly above the digestive apparatus favors the entrance by gravity of septic material from the sinus into the pharynx, larynx and bronchial tree, or into the stomach and intestinal tract.
This disposal of pus and muco pus is not only true of children who swallow everything, but also of adults, who try as they may to clear and expectorate the products from the infected cells will not be able wholly to do so, a certain portion always finds its way into the digestive tract. Gravity, therefore, partly responsible for certain respiratory and gastro intestinal complications.

The anatomical relationship of the sinuses is so intimate to many important structures that disease of a serious nature could long exist in the cell without rupture and invasion of adjacent sterile tissues. In many skulls the roofs of the ethmoidal cells and frontal sinuses form the greater portion of the floor of the anterior cranial fossa. The lamella of bone which forms this roof and floor, and which separates the septic contents of the sinuses from the sterile intracranial tissues of this fossa is exceedingly thin, often paper thin. When the contents of one of the sinuses is under pressure, such as must occur when its normal drainage is blocked, this shell of bone gives way and provides, leakage from sinus to dura. The osseous walls of the sphenoidal sinuses are likewise thin and an out break of these infected contents may occur as just described, the septic fluid escapes in this instance into the middle cranial fossa, where meningitis or brain abscess would of course at once be set up.

Venous blood from these portions of the frontal, ethmoidal and sphenoidal sinuses which lie immediately adjacent to the dura mater finally empties in most part into the cavernous sinuses. Numerous small venous radicals form communication between the veins of the mucous membrane of the sinuses and the venules of the dura mater. The possibility is therefore always present of any suppurative pro-
cess within these sinuses extending to the dura or cavernous sinuses
through intercommunicating lymph and venous channels, in which case
serious intracranial disease may be transferred without visible
rupture of the sinus wall. The anterior ethmoidal veins empty into
the ophthalmic veins and may carry septic products thence to the
cavernous sinuses. The ethmoidal veins also anastomose with the
numerous orbital veins which may account for orbital complications
from the ethmoidal disease without actual destruction of any part of
the intervening osseous wall.

Chief among the diseases listed by Evans, complications
which may arise from focal infection are myocarditis, endocarditis,
pericarditis, pyelitis, acute rheumatic fever, affections of the skel-
atal muscles, bursitis and arthritis. Several diseases not enumerated
should be added among them asthma, bronchitis and infective disorders
involving the digestive tract. Attention should however be called to
the fact that the several foci of infection in the head other than the
nasal sinuses may be involved either separately or together in the pro-
duction of any general complication. For example an arthritis may be
the sole and direct result of suppurating antrum or it may be due partly
to a coexistent tonsil infection. (19)

Secondary infection in the respiratory tract first
among these should be mentioned the pharynx and larynx, due to the
constant contact of infective discharge is one of the most frequent
causes of the small lymphoid hypertrophies of granular pharyngitis.

The infection also tends to spread to the larynx and trachea
causing a husky voice and hawking of tracheal mucus. In professional
voice users and more particularly singers the only symptoms may be a
weakness in impurity of tone or inability to take any heavy part. Even in the absence of nasal discharge, the nasal passages should be scrutinized, and inquiry made for indications of slight toxemia or signs of latent sinusitis.

Nasopharyngeal sepsis, in the form of septic tonsils and adenoids, is widely recognized as one of the prolific sources of catarrhal otitis media, that this needs no discussion, but in the absence of tonsillar infection, the nasal sinuses should be suspected, as the successful treatment of aural sepsis, either catarrhal or purulent, often depends very largely on the determination of its parent source of infection. Mastoiditis will frequently be found to be associated with chronic sinusitis, which in many cases must be considered the determining cause of the mastoid suppuration.

Acute and chronic bronchitis often result from the common cold, it would seem that the nasal sinuses could have the same effect. It is not certain whether the bronchial infection is blood borne or due to aspiration, or travels by either route. Experimental work has been performed in which iodized oil has been introduced into the nasal passages during sleep, radiograms subsequently revealed its presence in the lungs of five out of eleven persons, thus apparently showing how readily pus or infected discharge from the nasal fossae may be aspirated into the bronchi. Many authorities believe in every case of bronchiectasis the existence of nasal sinusitis should be investigated, as the diagnosis of such an often unsuspected factor not only closely concerns the successful treatment of the bronchiectasis, but should also diminish the risk of further serious complication such as brain abscess.
In regard to pulmonary tuberculosis of oral/nasal origin, its course and prognosis is now established. But it is not so generally recognized that nasal sinusitis may cause a clinical picture which is hardly distinguishable from early apical pulmonary tuberculosis, in the loss of weight and appetite, night sweats, irregular fever, malaise, cough and purulent sputum, sometimes bloodstreaked, and pulmonary sub infections with definite signs of moist rales particularly at the apices or at one or both bases. The resemblance to phthisis is further enhanced in those cases subject to septic catarrhal laryngitis. Cases diagnosed as tuberculosis without any tubercle bacilli being detected in the sputum should be carefully examined for evidence of naso-oral sepsis, for in many such non tuberculous patients the focal sepsis has been effectively seated. It is curious that sputum even when teeming with virulent pyogenic organisms, is usually reported as being negative when no tubercle bacillus is found as though the only matter for concern was tubercle and sepsis of no moment whatever.

Nasal sinusitis as a causal factor in spasmodic asthma is most frequently shown in cases of asthma developing in adult life and it may be that septic infections spreading to the lower air tract has some influence. There is reason to believe however that the asthmatic paroxysm is often a reflex neurosis depending on the afferent irritation influence of the fifth nerve in the nose on the efferent vagus through the association of the bulbar nuclei of these nerves. Consequently in such cases spraying the nose with weak cocaine causes a cessation of the asthma for the time being, a useful diagnostic point that would of course be disastrous as a means of treatment. Many cases of asthma are arrested by eliminating focal sepsis in the nasal sinuses and
in those cases associated with nasal polypus, it is as essential
to treat the sinus infection causing the polypus formation as to re-
move the actual polypi.

We are only concerned here with the nasalfactor when
that becomes the determining cause of the attacks of paroxysmal dysp-
noea, the general pathology of asthma and underlying dyscrasia, the in-
fluence of diet, animal, or plant emanations, and of atmospheric pres-
sure being outside our sphere. But the not infrequent interdepend-
ence of asthmatic attacks on abnormal nasal condition, and particularly
on chronic sinusitis, is abundantly evident from the excellent results
following nasal treatment in suitable cases. Probably attacks of as-
thma determined by nasal sepsis are sometimes in part due either to
cytolysis and protein sensitization or to allergic effects of pre-
vious bacterial infection.

The gastro-intestinal tract may be subinfected from
the nose and mouth, directly by organisms swallowed, or indirectly
by organisms carried by the blood or lymph vessels.

The patients may swallow immense numbers of septic
organisms with impunity is certain, for the normal acid gastric secre-
tion is a potent antiseptic barrier, but if the infection is continued,
it fairly frequently results in gastric catarrh, or gastritis, with
hypochlorhydria, constipation, diarrhea or recurring colitis. It would
seem likely that nasal or oral infection may originate local gastric
or duodenal ulcers, or by spreading through a relaxed sphincter of Oddi,
cholecystitis, and gall stones or as more commonly appears to happen,
appendicitis. Again such gastro-intestinal infections may be indirectly
determined by toxemia with resulting endocrine exhaustion or by mal-
nutrition, vitamin deficiency, increasing susceptibility to micro-
organisms invasion of intestinal tract. Incidentally we may
recall that it has been shown how phagocytes containing organisms
still living, may be transported to the liver and spleen where the
tissues react, causing there lysis, which suggests that infection of the
gall bladder may arise in some such manner other than by blood vascular
convetstion.

Organisms conveyed by the blood stream may infect the
gastric mucosa for it has been demonstrated that organisms apparent-
ly indentical with those from the sphenoidal sinus are within the
gastric mucosa. But it may be, the toxins alone display elective affini-
ity for certain tissues and regions and thus it is likely that by sensi-
tization of gastric mucosa infected by organisms swallowed the patho-
logical effects of the blood borne infection may be enhanced. Hence
the attempts to overcome the infective lesions of the gastro-intestinal
tract by direct disinfection are more likely to succeed when a
primary infective focus has first been eradicated.

It has been thought for some time that sinus infection
and appendicitis were somewhat related, and many investigators have
proved the frequency of the two existing together and have decided
they have more then a causal relationship.

Focal infection may exert an influence on the heart
thru reflex effects of nasal affection on the heart. Toxaemia effects
the pathological process involved in the production of fibrous tissue.

The really close physiological relationship between
the nose and the heart is common knowledge which is applied when smell-
ing salts are used to stimulate the fifth nerve and so resuscitate the
lagging heart in faintness. On the other hand the inhibition of the heart action through the olfactory nerve is exemplified by faintness induced by strongly smelling flowers. The heart's action is therefore stimulated or inhibited from the nasal passages by reflex impulses through the bulbar centres. It has been shown by Cajal that afferent fibres of the fifth nerves, through their receptive nucleus, form communications with the nucleus ambiguus, the motor nucleus of the vagus in the medulla. Hence we have direct anatomical evidence which explains the influence of the nasal innervation on the heart's action in health, and which also accounts in some measure for the depressed cardiac action that is quite commonly a notable feature in patients with no cardiac disease, but with nasal obstruction, with or without infective rhinitis. The restoration of the nasal functions in these cases is usually followed by corresponding benefit to the functional activity of the heart.

The functional activity of the heart particularly in the elderly is often depressed by the chronic toxaemia of focal sepsis from whatever source and with the elimination of the infective focus the heart action becomes more normal. Focal sepsis especially from the teeth, tonsils, nasal sinus, stomach, colon and genital orinary tract are among the causes of functional heart disorder, and should always be remembered.

Fibrous tissue due to organisms is brought about by an invasion of the bacteria. The bacteria carried in do not multiply, they are destroyed, but with their destruction the liberation of their toxins causes a poisoning of the cells immediately around them, and the accumulative action of these toxins, whether locally or at a distance, brings about the death of these cells and replacement by fibrous tissues.
It appears probable that in chronic infective arthritis a similar process of death of the pyogenic organisms and tissue cells occurs with replacement by fibrous tissue. It does not mean that all cases of so-called chronic rheumatoid arthritis are due to fecal infection, and and then those in which fecal sepsis is rightly regarded as the determining factor it seems possible the the organisms may in some cases exert their influence indirectly on the joints, by exciting endocrine imbalance and inducing disturbances in basal metabolism or some toxic-eutrophon eurasis due to gastro intestinal sepsis, may implicate tissues in and around the joints. But it is a well known fact a considerable percentage of cases which are cured or strikingly relieved by eradicating definite focal sepsis.

In a series of twelve cases of chronic arthritis in young children recorded by Dean and Armstrong (20), as the ages excluded dental sources of infection, if not also gallstones and other sources except nose and throat, the arthritis had failed to clear up after tonsil and adenoid operations, but sinus exploral suction with cultures revealed antral pus or mucopus in all but one, who had purulent ethmoidal infection. Improvement in the arthritis followed operations on the infected sinuses. Many authorities doubt the role of chronic sinusitis as a factor in arthritis, saying focal infection elsewhere is causing the trouble. (16)
Treatment.

In discussing the treatment of Chronic Nasal sinusitis we are concerned only with local treatment of the nasal conditions. The systemic complications are the responsibility of the general physician, or surgeon.

The subject of chronic nasal sinus infections more or less fall into three groups.

1. Those who like the majority of cases of acute sinusitis, if given time, recover spontaneously with the added resistance induced by simple remedies, rest, and hygiene.

2. Those in whom the localized infection persists with varying activity according to the patients varying resistance and who through requiring special treatment may recover without operation.

3. Those in whom the infective sinus disease is so definitely established that operative eradication of the nasal infective process becomes essential.

The first group, namely patients with chronic nasal catarrh spreading to the sinus, for whom general medical rather than local treatment is called for, comprises many weakly and ill fed children, reared in badly ventilated houses under unwholesome conditions, overfed with starchy food and with but little fresh milk, meat, and vegetables.

It should not be too readily assumed that the catarrhal child is a result of septic tonsils and adenoids, often enough, the nasal catarrh and other symptoms are largely the outcome of the malnutrition, resistance to catarrhal and pyogenic infections being thereby lowered, while the hypertrophic lymphoid aggregations in the naso pharynx and fauces may represent defensive reaction against the swarming oro-nasal organisms.
In many older patients too the value of general hygiene, sunshine and actinotherapy, fresh air and suitable diet, as well as many simple remedies, such as saline aperients in gastro intestinal stasis etc., 

The practical value of general hygiene with particular attention to the correction of hypo-vitaminosis in young children has been amply proved by the researches of Dean and Armstrong and Daniels. (20)

The importance of hypo-vitaminosis as a determining factor in the development of pyogenic lesions has been also demonstrated by the researches of Mellanby and Green. (21)

It has been mentioned the frequent tendency to spontaneous recovery from sinus infections and their secondary infections, although this applies much more to the acute than to the chronic infections.

And the problem that must be solved is when to rely on this tendency to recovery, and when to operate, for while unnecessary interference is to be discouraged, ill judged expectancy may be fraught with very grave consequences.

Conservative and radical are the two procedures employed in treatment, with the balance of opinion on the conservative side.

Which method to apply in each particular case is sometimes questionable but as has been stated the man who does not know which to use certainly does not know enough to use the radical. (16)

E.R. Lewis plan for conservative treatment if followed as indicated has given very good results.

1. Suitable regular exercise.
   a. Elimination of foods not agreeing with the patient.
   b. Foods with a good balance of vitamins.

2. Dietary regimen.
   b. Fluids eight ounces per hour per ten pounds of body weight.
3. Periods of alkalinization, as evidenced by neutrality or slight alkalinity of the urine.

4. Periods of oxidization controlled short of focal reactions.

5. Salicylates to control pain.

6. Use of physical therapy, hot fomentations, radiotherapy or diathermy.

7. Local therapy, by tamponade, (organic silver salts) negative pressure alone or in conjunction with tampons.

8. Mechanotherapy, inderiction of hard blowing of the nose, habituation to cleaning nose by suction down nasopharynx, negative pressure.

9. Avoidance of all washes of nasal and submerging head while swimming etc.

10. Continuance of regimen for months regardless of prompt subsidence of symptoms, resuming at intervals even in absence of symptoms, resuming at intervals even in absence of symptoms.

The chief aim in the treatment is to restore nasal tissue to normal physiological condition as soon as possible. (22)

The suggestions of E R Bray should also be considered in conservative treatment in which he stresses exercise, proper diet, proper clothing, vitamins, and calcium. Also before surgery be sure of the possibility of allergy as the etiological factor. Remove all obstructions such as deviated septums, hypertrophied turbinates. (23)

A few of the conservative methods will be discussed which include certain drugs, vaccines and simple lavage of the involved sinuses.

Manganese is one of the drugs which has proved successful even without operation but it is much more likely to be helpful after drainage has been established. The intramuscular infections of colloidal manganese are recorded by E Watson Williams (24), the dose
ranges from 5cc to .5 cc. Four to seven injections usually give the required result.

Sulphur again is helpful in chronic satarrhal affections, especially a course at various sulphured springs.

Vaccine therapy has not proven itself of considerable value. Autogenous and stock vaccines are of no value unless the infected sinuses have been previously opened and drained and then the patient usually recovers completely without them. Nevertheless vaccines appear helpful in certain cases in overcoming any remaining secondary infection, and in rendering the patient less susceptible to subsequent reinfection. An established and persistent infection in a nasal sinus is seldom more than temporarily inhibited by vaccine therapy, infections within the tissues may be more definitely influenced. But so long as a primary focus persists in the sinuses or tonsillar crypts, the organisms usually soon regain ascendancy and the toxemia recurs. Hence we see why vaccines are so disappointing compared with eradication of the infected focus. Non specific protein therapy has also been tried. T A B injections have proved helpful in some widespread pyogenic complications and ionization beneficial particularly in mild infections.

Douches, sprays and local disinfectants

Accumulations of sticky mucopus may be removed with advantage by occasional usage of an alkaline salt solution, such as nasal plasma salt or equal parts of powdered chloride, bicarbonate and borate of sodium, but the mucous and cellular constituents of the secretion are defensive and therefore frequent douching and spraying tends to liberate the organisms, defeat the local defensive processes, and may even keep up a copious discharge. Hence for continual daily usage more benefit is often
derived from oily solutions of bland disinfectants, colloidal iodine, silver or eucalyptol, etc.

Eradication of the sources of focal sepsis in most cases of sinusitis is undoubtedly the soundest therapeutic measure to aim at, for all the nasal sinuses are accessible and the patients are very exceptional for whom this line of treatment is unsuitable or the results are unsuccessful if taken in time.

The persistence of a sinusitis as a chronic infection is usually due to some anatomical defect and then the first essential for success is to establish free drainage of the diseased area, which is more important than the removal of every scrap of infected mucous membrane. Often quite small operations will suffice, more particularly in such cases as a chronic catarrhal ethmoiditis which has not resulted in bone disease and polypus. The first essential is to determine which of the many sinuses are definitely infected and here again one has to differentiate between the large majority of cases that require only some slight operative measure and the relatively small minority in which a radical operation alone can suffice, the latter measures are considered as conservative treatment.

The general surgical principles employed in treatment of chronic sinusitis are all that will be discussed, the operative technique and the explanation of the different types of operations will not be considered.

The procuring of proper drainage is the paramount idea in all types of operation upon the sinuses. Draining in most fields of surgery implies incision into a cavity and subsequent collapse of soft parts leading to an obliteration of the infected space.
Early successful work on the accessory sinuses of the nose frequently employed this principle and freedom from disease was the result. Unsightliness of the depression where obliteration can be obtained and the difficulty of obliterating certain cavities were the supreme difficulty encountered.

From the above facts it became certain cures must be obtained with out collapse of the bony wall. Killian broke away from his contemporaries and success rewarded him. The upper cavity was obliterated and healed completely. The lower parts did not always heal for reluctance to remove the orbital ridge. Fear of deformity denies us this panacea except in exceptional cases. If free drainage is obtained a large proportion of diseased sinuses will return to normal.

Constructive surgery should always be first attempted before other measures, such as removal of tonsils, adenoids, straightening of the intra nasal septum etc, and then given sufficient time to prove itself as beneficiary.

Intra nasal surgery on the sinuses has a definite sphere of usefulness. The simple amputation of the anterior and of the middle turbinate may be beneficial but is apt to be disappointing in cases of sinus disease serious enough to warrant any operative measures. This is also true of partial ethmoidectomies. Intranasal surgery for relief of chronic frontal and maxillary gives good result in some cases. Very often it happens the benefits would be permanent if the opening from the sinuses could be kept permanently open.

Extra nasal surgery expresses the last word in nasal sinus surgery. It divides itself into two major operations one the radical modified Caldwell Luc operation on the antrum, and the other the fronto-ethmoidectomy. All sinuses in the head can be operated on by these
two methods. When there is frontal disease we usually find that the ethmoids are also diseased and sometimes the sphenoid. In such a case operation can handle all three groups at one time. If only frontal sinuses, enough of the ethmoid mass is removed to give direct drainage. If ethmoid cells alone diseased they are reached thru same incision, and only such cells as are diseased are removed.

If frontal sinuses are diseased, the lining is removed as completely as possible. Almost impossible to remove all of the lining if the sinus is large. Draining down into nose will usually cure it, but if not it is usually due to lack of proper drainage. This occurs even in the Killian type of operation which gives opportunity for eradication of all disease under direct vision. In the Lathrop principle the space gained is often narrow and complete healing does not occur. Attempts to overcome this is attempted by drainage tubes in place for weeks, sounds have been passed, mucous membrane emplaced, but still failures. In spheno-ethmoid surgery cure can be obtained by complete removal of the ethmoid cells. In sphenoid operation the two cavities are made into one and the floor simultaneously removed. (25)

Some of the radical operations of the antrum are the removal of a section of the anteroinferior portion of the naso antral wall, in order that permanent free drainage may thereby be secured. This operation is applicable to cases which have not progressed to the excessive formation of polypi in the antral mucosa or to necrosis of the bony walls.

In operation through the canine fossa, the facial or anterior wall allows a large opening and has therefore long been a favored location for entering the maxillary sinus, as it seems best adapted to the wide exposure of the antral cavity. Many operators favor the removal of diseased membrane only, others prefer the eradication of the lining mucosa in its
entirety and allow the cavity to granulate.

The Caldwell Luc operation consists in creating a counteropening into the antrum through the outer nasal wall.

Two general methods are employed for the treatment of chronic empyema of the frontal sinus, intra nasal and which is local and surgical and external (radical) operation. The purpose of the radical operation upon the frontal sinus is to eradicate the diseased mucosa which lines its walls, to excavate all necrosis of its bony walls and surrounding structures, to remove such portions of the anterior and inferior walls as may be necessary to carry out the operative technique and to insure drainage and finally to obliterate the entire cavity.

In the Luc operation the primary incision extends along the supraorbital ridge over its inner onethird. After retracting the peristomeum the anterior wall of the sinus is partially resected. Through this opening the cavity of the sinus is scraped and free communication established into the nasal cavity through the naso-frontal duct.

In Kuhnts operation the anterior wall of the sinus is entirely removed, a vertical incision being carried upward from the mesial end of the primary incision along the eyebrow. The entire membranous lining and all bony spic are then removed from the sinus.

The Killian operation consists in opening wide with a removal of a part of the frontal bone, all of the periosteal lining and the inferior wall of the sinus.

The radical procedure in connection with ethmoid disease consists in complete removal of one or both groups by the intra nasal route, and the complete removal by external operation.

The operative treatment of the sphenoidal sinuses consists in making an artificial enlargement of the sphenoidal ostium, the making
the making of a new orifice in the anterior wall of the sinus irrespective of the normal opening, and the radical procedure, whereby the entire anterior wall of the cavity is removed, together with thorough curetment of the lining mucosa and the diseased osseous walls. (26)

Proper conservative treatment consists of proper diet, rest, exercise, and proper climate, or at least a change in climate if possible. All of the above of course must follow any procedure to insure proper drainage.

The radical treatment depends considerably upon the man who is performing the operation.
Conclusion.

After reviewing the literature and textbooks on Chronic Nasal Sinusitis, it became evident it would be impossible to treat the subject as it should be. This paper contains the anatomy, pathology, diagnosis, symptomatology and the treatment, but only in a general way. Many conflicting opinions were encountered, and the author depended on his own judgement which of these should be recorded. Judgement was based somewhat on the prominence of the man, and to a certain extent that which sounded as common sense was accepted. The symptomatology in the main has been experienced. Treatment I believe should be conservative in all cases possible, and radical operation undertaken as the last resort. If drainage is obtained and the case treated in a somewhat similar fashion as tuberculosis, the results would probably be surprising. Certainly impression of once a sinus always a sinus should be eradicated from the layman's mind. This will probably never come about until the medical profession arrives at the conclusion, we are not all capable of making care of a case of chronic sinusitis.
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