

FUNCTIONAL APPROACH TO SURGERY OF THE MAXILLARY AND ETHMOIDAL SINUSES

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This new technique for treatment of chronic infections of the maxillary and ethmoidal sinuses is based on embryological, anatomical, physiological and pathological facts.

Embryology

The ethmoidal and maxillary sinuses start to develop approximately at the third month of the intra-uterine life. While the maxillary sinus occasionally shows deviations from the normal, the ethmoidal cells on the other hand have a tendency to variations in number, size and shape. The ethmoidal cells in their development have the power to spread in different directions, posteriorly towards the sphenoidal sinus, anteriorly to the frontal sinus, and even send out a few cells in front of the frontal sinus. Below, the ethmoidal cells may be in contact or in continuity with the antrum. The embryological evolution of the sinuses should always be considered in their surgery. The antrum which exists only as a single cavity on each side and which has a certain number of functions to fulfill to which we shall return at a later stage, should be interfered with as little as possible. On the other hand, the ethmoidal sinuses which are formed of a great number of cells, the size of which we ignore completely, are the result of a capricious embryological development. This capricious development may be result of disorder in the formation of a standard pattern, due to pre- or post-natal infection. From what we have just mentioned, we can conclude that interference with the ethmoidal cells may be permitted as it would be only to a limited degree. Complete interference with the ethmoidal sinuses should only be considered in the presence of a chronic infection involving the whole ethmoidal mass.

Anatomy

As mentioned above, there is very little variation in the anatomy of the maxillary sinuses. They are all of pyramidal shape, formed by five surfaces. The only variations in the maxillary sinuses, apart from size, are as follows:

1. The ostium situated in the medial wall may be found at a different level and of different size.
2. The relations between the ethmoid and the antrum vary insofar as the former may be in contact or in continuity with the latter.
3. The depth of the maxillary sinus in relation to the base of the nasal fossa varies considerably.

All these three points will be mentioned again when we consider the post-operative drainage of the antrum. As the maxillary sinus is the only constant sinus in respect of anatomical structure, I do refrain as far as possible from interfering with its anatomical integrity. The ethmoidal cells have a two-fold relation to the maxillary sinus; that is, as mentioned above, they may be merely in contact or in actual continuity. Their anatomical structure is most inconsistent, in respect of embryological and post-natal development. This condition may permit one to be less conservative when dealing with the ethmoidal cells.

Physiology

The purpose of this new operation is to interfere as little as possible with the function of the antrum. This means that one should be as conservative as possible in order not to alter the anatomical condition of the nasal cavity as there is no possibility of a normal function without normal anatomy. Our purpose then will be to establish a normal function of the sinus by interfering as little as possible with the anatomical structures, but, at the same time, we will have after removal of the diseased tissue to keep in mind drainage and aeration of the antrum. In attending to a diseased antrum due to hypo-ventilation we must be careful not to produce a hyper-ventilation. To obtain a normal ventilation of the antrum, we have to respect as much as possible:

- a. the mucus membrane of the sinus;
 - b. the integrity of the ostium;
 - c. establish a good air current into the middle meatus and the antrum. This can be done by fracturing the attachment of the middle turbinate and to displace it slightly towards the septum;
 - d. to use an efficient drainage from the sinus into the nasal cavity.
- There may exist a stenosis of the ostium, then a larger catheter is introduced even if some force in its introduction is necessary. This catheter should be kept a few days longer in the antrum and slightly mobilised each day.

Pathology

Before proceeding with the surgical technique of this operation, I would like to discuss the etiology of chronic infections of maxillary and ethmoidal sinuses, which are the only ones which should be dealt with by the new technique. The cause may be:

- a. Anatomical: due to anatomical irregularities of the ostium, of the ethmoidal and maxillary sinuses, of a deflected septum, of large turbinates, etc.
- b. Infectious: clinical evolution of acute rhinitis due to absence of aeration and drainage of the sinuses, resulting in oedema and, finally, formation of polypi with complete obstruction of the ostium.

Great importance should be given to the study of function of the nasal cavities before deciding upon surgery of the sinuses. One cannot help feeling concerned about the great number of surgical techniques in surgery of the sinuses, and the less standardisation in any operation, the more inefficient appears to be the great number of different techniques. Whenever one decides to interfere with an antrum by radical operation, one should always keep in mind

the end result from the functional point of view. There is no purpose in performing a radical operation by replacing one defect by another. There is rarely an urgent indication for operation of chronic sinus infection, which may lead to complications, but the slightest disorder in function in the sinus area may lead to permanent discomfort and distress to the patient.

Indications for Functional Surgery

The operation we are going to describe should be used in cases which have not responded to conservative treatment, and where the radiological investigations with an opaque medium show important alterations in the mucosa or presence of polypi. I would not advise this operation in cases where intranasal antrostomy has been performed previously, as there is already interference with the anatomical structure as a result of the previous operation.

X-rays of Sinuses

No operation of this kind should be performed without previous radiological investigation. First, X-rays should be taken before injection of an opaque medium in the sinus, in three positions — lateral, naso-frontal and naso-mental. Should the X-rays show an opaque antrum, then the antrum should be washed out and only then an opaque medium should be introduced. Otherwise, there may be formation of a level between the watery solution of the pus and the oily solution of the medium, which may lead to diagnostic errors. X-rays of the ethmoidal sinuses should be in Hirtz's position. When the X-rays in lateral position are taken, (the injection is made through the inferior meatus), the patient will be lying on the side which is going to be examined first. The opaque medium is injected very slowly until the patient feels some drops coming down into his throat, indicating that the antrum is full and the ostium patent. At this moment, the injection should be stopped and the X-rays taken.

Surgery of the Maxillary and Ethmoidal Sinuses

The main criticism of maxillary and ethmoidal sinus operations lies in the small amount of consideration which has been given to embryological, anatomical and physiological principles. The symptomatic surgery of the sinuses which is based on pathology, should be condemned if the etiological and functional factors are not considered. In operating on sinuses one should keep in mind their functions and to achieve this purpose, the anatomical integrity has to be preserved. To achieve a functional rehabilitation in sinus surgery, one has:

1. to approach the area of chronic infection by means causing the least injury to anatomical structures;
2. to remove the cause of the chronic infection;
3. to establish drainage of the sinus cavity.

Radical operation of maxillary and ethmoidal sinuses should be advised only in cases which do not respond to conservative treatment (antibiotics, vasoconstrictors, washing-out of antrum). The sinuses ought to be carefully investigated radiologically. This new technique which we are going to describe

will satisfy all the points mentioned above. This operation, which can be performed under local anaesthetic, is usually performed by me under general anaesthesia with intra-tracheal intubation. One may use a vaso-constrictor for local injection into the canine fossa to reduce bleeding, but again I am using lowblood pressure instead. Should one use local anaesthetic, one should be careful to inject the solution superficial to the periosteum. Under no circumstances should there be penetration of local anaesthetic between periosteum and bone.

Technique of Operation

The lip is elevated to expose the gingivo-labial region. The incision of the soft tissue in the canine fossa should be superficial to the periosteum and starting at the level of the canine ridge, 1 cm. above the gingival border (below the gingivo-labial fold) and being directed laterally and slightly upwards towards the zygomatic process. Great care must be taken not to injure the periosteum, while dissecting the soft tissue. Once the soft tissue is separated from the periosteum, it is lifted up towards the orbit. Haemostasis ought to be complete. For anatomical and technical reasons, one draws an imaginary line from the infero-lateral border of the orbit to the nasal pyriformis (Horowitz's Line), a line which separates the infra-orbital foramen from the canine fossa. Once the periosteum is exposed and haemostasis secured, two parallel incisions are made in the periosteum, vertical to the author's line, and separated one from the other by a distance of about 14 mm. The mid-line which passes between the two vertical incisions has also get to pass through the infra-orbital foramen. The upper ends of the vertical incisions ought to start approximately 6 mm. below the foramen. A third incision is now made in the periosteum so as to unite the lower ends of the two parallel incisions. So far we have outlined the size of the bony window which we are going to cut in the canine fossa. The borders of the rectangular window periosteum are now liften up to a distance of 1—2 mm. towards the centre of the window so as to permit suture of the window to its frame after the diseased sinus has been attended to. Next, the bony wall of the canine fossa is opened. The opening is done with the help of a special osteotome.

The osteotome is semi-circular in shape and has been specially made with two sharp points at its distal end. One of the points is introduced into the canine fossa and the osteotome is then directed in such a way that the mucus membrane is lifted up together with the anterior wall of the antrum.

While cutting the anterior wall, pressure is exercised from inside towards the outside of the antrum so as to avoid damage to the window and to the underlying mucus membrane. Once the three incisions (two vertical and one horizontal) are made on the bony wall, the window is moved towards the infra-orbital foramen and it will have a hinge-like movement. The bony rectangular window will remain attached to the rest of the anterior wall by means of periosteum anteriorly, and mucus membrane posteriorly. Now a wide opening has been created in the anterior wall of the antrum and one can start dealing with the diseased sinus. Should there be granulations or polypi on the mucus membrane of the window, then they should be removed until the end of the operation, as they may have a protective influence on the rectangular window.

Now the bony window remains attached to the rest of the anterior wall of the antrum by means of periosteum anteriorly and mucus membrane posteriorly.

Inspection and Attendance to Sinus Cavity

1. The mucus membrane should be inspected and, if there are polypi, they should be removed. Mucus membrane which appears slightly thickened should be cauterised with 10% solution silver nitrate.
2. The floor of the antrum should be curetted if there is evidence of osteitis.
3. The ostium is inspected and polypi removed from the antral and nasal side if they are present. Catheterisation of ostium is carried out with great care.
4. The medial postero-superior angle should be carefully examined in view of its continuity with the ethmoidal cells. In this case, operation should be completed by the De Lima Petriantoni ethmoidal operation.

Drainage

Drainage should be secured by the introduction of a self-retaining catheter through the ostium, in cases where there has been infection of the antrum only, and through the posterior ethmoidal cells where there has been infection of the ethmoidal cells and where the operation has been completed by the De Lima Petriantoni technique. We would like to point out here that the drainage of the medial wall of the sinus in the Caldwell Luc operation is not sufficient, as the floor of the antrum lies about 8—12 mm. below the nasal floor.

5. After drainage has been secured, one replaces the rectangular window in position and the periosteal edges of the window are sutured to the periosteal frame of the canine fossa. Very fine needles and catgut are used. The proximal end of the catheter passes through the nose, laterally, and finally fixed with elastoplast to the patient's forehead. This catheter will serve a triple purpose:

- a. aeration of the sinus;
- b. drainage of the sinus, and
- c. syringing of the sinus.

The first syringing is done twenty four hours after operation, with a warm solution of saline and it is repeated twice daily for two to three days. I would like to insist on cutting the window as laterally as possible so as to get a thorough view of the ostium. This also avoids interfering with vessels and nerves situated medially.

The Advantages of this New Approach are:

1. By the incision and lifting up of soft tissue no injury will be sustained by the infra-orbital nerve.
2. Little interference with vessels and nerves (anterior and middle superior dental nerves).
3. No penetration of fibrous tissue into the sinus cavity from the osteo-genetic periosteum.

4. No disorder of the air currents in the nasal cavity.
5. No interference with natural drainage of sinus cavity through the ostium and no interference with the movements of the cilia which may still exist.
6. As no contra-opening has been performed in the medial wall of the sinus (inferior meatus or middle meatus) there is likely to be very little functional disorders in this cavity.
7. The very lateral position of the window permits an easy introduction of the instruments into the sinus and directing them towards the medial supero-posterior angle.
8. As the ethmoidal cells and polypi have been removed through the antrum, there is no interference with the middle turbinate and olfaction.
9. This technique reduces the post-operative treatment.
10. It reduces the hospitalisation of the patient.

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