A NEW HOMOGRAFT IMPLANT TECHNIC FOR ABLATION OF THE CHRONICALLY INFECTED FRONT ETHMOID SINAL COMPLEX

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INTRODUCTION

Rational medical or surgical treatment of an affection should be based on embryologic, anatomic and physiologic knowledge of the organ system involved. This requirement, we believe, is fulfilled in the improved treatment of chronic frontal sinusitis. For this reason we will briefly review some points in the embryology, anatomy and physiology of the frontal sinus.

Embryology:

There are disagreements among embryologists, anatomists, anthropographists, and even radiologists, as to the age at which the frontal sinus develops. Though this cavity can be demonstrated anatomically at an early age, it is only after several years of development that it becomes radiologically demonstrable.

However, all agree that the frontal sinus originates from the anterior ethmoidal complex. Alejo Belou, in a study on this subject came to the conclusion: that the development of the frontal sinus begins during the fourth month of intrauterine life.

Ermiro de Lima believes that the frontal sinus generally develops from the anterior extremity of the frontal recess; that is, from a prolongation of the cavity found anterior to the anterior end of the middle nasal concha, as if it were a diverticulum of the middle meatus proper.

The development of the fronto-nasal duct may make the frontal sinus appear to be an autonomous element independent of the group of anterior ethmoidal cells.

When the frontal sinus has its origin in the anterior extremity of the frontal recess, its development produces a short and narrow naso-frontal canal. When the naso-frontal duct originates in the uncobulbar area the frontal sinus drains laterally as though it were an infundibular cell. The fronto-nasal communication may also open through an anterior ethmoidal cell.

The age at which the development of the frontal sinus is complete and the time when it may become a clinical factor are both controversial. Both Buniolini and Tonti consider that one should not speak of a real frontal sinus before the age of two years. Tonti also maintains that until the seventh year of age the frontal sinus evolves slowly, but from then until the twelfth year of age it develops rapidly. According to Terracol, the frontal sinus develops between the sixth and eighth years of age. Elzer-Tillaux believes that development begins at twelve years of age. Steiner-Lazer and Teld consider that

the frontal sinus appears at one year of age, and Poirier believes that it appears at the age of two. In our own experience, as a rule, the frontal sinus is still ethmoidal at the end of the first year. During the second year it may reach the frontal bone at the nasion, and at the third it has already extended beyond this point. The definitive development, we have found, takes place between the fourteenth and twentieth year. The differences of opinion of the authors we have mentioned appears to us to be largely semantic.

Some insist that for normal development of a frontal sinus the lining mucosa of the sinus must also develop "normally". Tanturri considers injuries influencing mucosal development in early childhood are important influences on development of the frontal. Other authors, such as Ermiro de Lima, Carmody, Shea, Haar and Van Gilse suggest that it is infection which alters sinal development. They present a hypothesis similar to Wittmaack's schema for altered pneumatization of the temporal bone.

Van Gilse believed that atrophic degeneration of the nasal mucosa secondary to infection is a major influence on sinal pneumatization, emphasizing the fact that there is less disturbance of development of the maxillary sinus because being present at birth it is the first sinus to be completely pneumatized.

Anatomy:

French anatomists, among them. Testut, call the area of the forehead the "frontal sinus region". It is often simply called the "frontal region". The anterior wall of the frontal permits the most direct approach to the sinal lumen and is therefore called its surgical face. The prominence of the frontal region varies according to the degree of development of the sinus. The frontal region reaches from skin to the contents of the cranial cavity and is usually divided into layers or strata, which, from surface to depth are:

1. The superficial layer including the skin. This is thick and adherent, and is provided with hairs which form the eyebrow;
2. Subcutaneous cellular layer;
3. Muscular layer;
4. Submuscular connective tissue; this is formed of loose conjunctive tissue, without fat. This permits easy sliding movements of the eyebrow. This is of surgical value as it permits displacement of the other superfical layers and their separation from the periosteum, giving good operational exposure;
5. Periosteum;
6. Skeletal layer which is formed by the ciliary arches or upper edges of the orbital arches (with the supra-orbital notches) and one central or glabellar eminence.

The glabella or nasal eminence is proportional to the development of the frontal sinus and is, therefore, larger in man than in the woman or child. separated from one another to form its cavity; (the frontal sinus itself). The two frontal sinuses are separated from one another medially by the inter-frontal septum; the smaller the cavities, the thicker the septum. Sometimes the inter-frontal septum is perforated and the two frontal cavities are directly connected. The base of the inter-frontal septum is usually midline; superiorly, however, it may be deflected laterally; sometimes it even lies transversally. It may cross the midline and cause a sinus to invade the area

of the contralateral sinus. According to Sieur and Jacob, this occurs in fifteen percent of heads. One must keep this in mind in doing surgery on these sinuses so as to avoid opening the wrong sinus.

Size and capacity of the frontal sinus:

The frontal sinuses are variable in size and often one side may differ from the other in the same person. The average capacity of a single frontal sinus varies between 4 and 5 cc. Variations in the size of the frontal sinus may be almost infinite. A sinus may vary from complete agenesis to sinuses which reach laterally to the external angle. They may also reach backwards to invade the anterior two thirds of the orbital roof.

Clinical-surgical classification of the frontal sinus:

From both the clinical and from surgical point of view, it is useful to classify the frontal sinuses as small, medium and large. Van der Hoeven-Leonard considered that a large sinus favors stagnation of secretions inside. Another factor favoring retention of pathogenic secretion in the sinus cavities is extensive leucocytic infiltration of the sinal mucosa.
According to size the frontal sinus is classified as follows:

a. Small sinus: This has a transverse diameter less than 18 mm. Its lateral extremity corresponds to the junction of the inner and median third of the orbit. Generally, there will be no stagnation of secretions in such a sinus;
b. Medium sinus: This sinus has a transverse measurement between 18 and 30 mm. It occupies most of the median third of the orbital wall. There is stagnation in 23% if sinusitis occurs.
c. Large sinus: A large sinus has a transverse extent of more than 30 mm. It may spread far beyond the medial third of the orbit and sometimes reach its lateral edge. There is stagnation in 86% of such sinuses when chronic infection is present.

Walls and relationships of the frontal sinus:

1. Anterior, subcutaneous or surgical wall. The anterior wall is covered by the superficial layers of the ciliary region. Its thickness (average 4 mm) is in proportion to the development of the frontal sinus. The thickness may vary between 8 mm (small sinus) and 1 or 2 mm (large sinus), and for this reason the anterior walls of some sinuses are more fragile than those of others;
2. Posterior or cranial wall. This wall covers the anterior cranial fossa. This relationship explains the frequency of intracranial complications in frontal sinusitis. The posterior wall is always present and has a constant thickness of, approximately, 1 mm;
3. Sinal cavity. The cavity of the frontal sinus is irregular. Diverticuli often form on its edges, especially the superior one, which favors retention of exudates;
4. Fronto-nasal opening (frontal duct): This duct connects the frontal sinus with the middle meatus and its size is variable. If the ethmoidal cells are well developed it is long and narrow. If the ethmoidal cells are not well developed the sinus may connect directly with the middle meatus, through a duct 2 of 3 mm wide and about 15 mm long. The sinal orifice of this duct is next to the intrasinus septum or near the inner edge of the orbital

section of the sinus floor; the nasal orifice opens into the middle meatus, sometimes into the unciform canal, the ampoul fornix, or through an ethmoidal cell.

Physiology of the frontal sinus:

We agree completely with Sir Victor Negus' conclusion that the paranasal cavities must be considered undesirable air spaces, without useful function.

Clinical-surgical considerations:

Accepting the conclusion of Negus as that of an authority, and because of the experiences of ourselves and others in surgery of the frontal sinus, we have developed a technique which eliminates a sinal cavity by filling it with osseous tissue and isolating it from the cavity of the nose.

In regard to the influence of the size of the frontal sinus on the evolution of disease Professor Bergara concluded that when the transverse diameter is less than 18 mm, disease usually may be eliminated by such measures as decompression of the middle nasal concha; surgical correction of deviations of the nasal septum; widening the fronto-nasal duct, extirpation of nasal polyps, and procedures of endonasal treatment. Even if the diameter is more than 18 mm, if it is less than 30 mm, he thought that one must attempt cure by endonasal treatment, but he has reservations as to prognosis in such an instance. If the transverse diameter of the sinus is over 30 mm wide, he believes that chronic sinusitis may be cured only with surgery. Endonasal treatment may be started, but is less effective the greater the transverse extent of the sinus.

Therefore, when the diseased sinus is very large, or when in a small cavity the disease has failed to respond to endonasal treatment, one must operate, and the decision should be made before appearance of complications.

The first treatment of chronic suppurative frontal sinusitis, whether the sinuses are large or small, with septi or without, is usually done by the endonasal route, for the following reasons:

1. Many patients will be cured.
2. Though suppuration may not be eliminated, it may be lessened to the extent that it will no longer endanger the patient.
3. Widening the naso-frontal communication doing a trephine-puncture may not only relieve the patient's symptoms, but will make sure that disease is not problematical when more adequate surgical treatment is begun.
4. Patients will not resist the suggestion of an external operation if endonasal medical and surgical procedures have failed to produce symptomatic relief. The terms "radical" and "conservative" should refer to the complete surgery of the sinus by the external route (radical) and to the endonasal procedures (conservative).

Development of our technique

Since 1952, when we began using Bergara's technique for external surgery of the frontal sinus, we have used several different substances to fill the sinal lumen, such as cancellous bone autografts; fat homografts; fibrin sponge; blood clots; and fresh and preserved bone homografts without complete satisfaction. As a result of studies done both in Argentina and abroad, we

7. There must be complete immobilization. (In operations on the frontal sinus this is easy to secure).
8. Survival of the graft should be protected by the use of antibiotics since the sinus is already infected.

The mechanism of acceptance

The mechanism by which the osseous graft takes root is similar to that found in the healing of a fracture. A hematoma forms in the bed prepared by the surgeon to receive the graft; the fibrin becomes organized; embryonal tissue and vessels appear, osteoid tissue is formed and finally bone originates. A graft which has lost its vascularization dies, but leaves its calcium salts to the host for future bone formation. Fibrin holds a graft weakly to its receiving bed, but in such a way that vessels of the host may enter into the haversian canals of the graft. Osteoid tissue also forms around the graft. Therefore, there is growth by both an external and an internal endohaversian apposition which forms a reticulated osteoid tissue and slowly becomes lamellar, arranging itself along force lines. Dead osteocytes are replaced by live ones. In two or three months recalcification takes place and sometimes one may observe that the transplanted bone has begun to take part in the humoral changes of the host. It takes two or three years, however, for the graft to acquire all the morphological characteristics of the tissue onto which it was implanted.

According to Pais, study of biological evolution permits one to affirm that endosteal cells survive in osseous autografts, although most of the graft dies early. Acceptance of a graft is conditioned on revascularization, reabsorption, and on osteogenic activity of the host, induced and directed by the graft. This reaction appears quickly in a fresh autograft; to a moderate but still useful degree in fresh or frozen homografts; but to a very slight degree in a fresh heterograft. In the latter reabsorption is the most notable reaction. The evolution of reactions in frozen heterografts is still being investigated. Dead grafts are never incorporated by the host. According to Pais, they are usually encapsulated as foreign matter, and very rarely, they may be reabsorbed slowly. Incorporation of a graft is also impossible if the ground substance of the host has no osteogenic power, and particularly if the implantation is not functionally necessary.

Generally grafts must be shaped with care. With our technique, however, we need only to triturate or pulverize painstakingly the chosen material, except where bone sheets to close an opening or repair a loss of material are needed. In such a case we carefully cut out sheets of cortical bone with gouge, forceps and scissors to the correct size and shape.

The bed prepared for the graft must usually be aseptic. In our patients this is impossible (infected frontal sinus) for the reasons which oblige us to operate. One must therefore be painstakingly careful with the sinus cavity. Due to aseptic suppuration from osseous splinters in patients who were otherwise recovering favorably from operation, but who healed completely only when all pieces of incompletely triturated bone were eliminated, we now insist that the preserved bone to be grafted must not only be completely triturated, but also comply with the second and third conditions mentioned above.

decided on the trial of homografts of preserved isogenous bone which Professor Hernan Anguilar kindly supplies us with from the "Bone Bank" in the Tornú Hospital of Buenos Aires.

At first we used only pulped cancellous bone to fill the sinal cavity. But later we found it expedient in some patients in whom the sinal walls had been destroyed to a greater or lesser degree to use sections of rib cortex:

for 1. esthetic reasons, to prevent or repair the sinking of the anterior wall; and 2. to rebuild damaged walls of a sinus so as to keep the filler material in place. The results that we have attained with this material have been much better than those obtained with any of the other materials. The two failures with this technique were due to lapses in technique. In one patient, as there had not been enough osseous "pulp" prepared, filling was completed with blood clot. The operation was quickly followed by reactivation of the infection. After reoperation on the sinus using the correct technique, the patient has had an excellent clinical and esthetic result. The second failure occurred in an eighty-two year old patient. We consider this failure the effect of deficient osteogenic power (inadequate circulation).

Types of disorder for which our technique has been used

We have used our operative technique in patients with the following defects of the frontal sinus walls:

a. fistulization of the frontal sinus owing to infection (osteomyelitis);
b. tumors; such as wearing away of contiguous bone from osteoma;
c. necrosis of an osteoperiosteal flap;
d. fractures involving the anterior wall of the sinus due to blows on the forehead.

Formerly, cavities in bone resulting from the loss of substance by trauma, or, (more frequently) surgical exenteration, according to Delitalia, were either left to nature or filled with a mass based on zinc oxide, iodoform or bismuth. Now, pieces or splinters of cortical, or preferably, cancellous bone are used to repair these defects.

Autografts, although sometimes irreplaceable, have a limited application due to the fact that to obtain them, an additional operative procedure is required which may be poorly tolerated because they can supply only limited shapes and dimensions. Homografts can be ready in preformed shapes and dimensions and what one needs can be obtained when needed. It is unfortunate that bone must be secured from extremities amputated because of trauma or vascular disturbances. To avoid danger of obtaining infected material bone should not be obtained from fresh corpses.

General surgical conditions for incorporation of osseous grafts

1. Perfect hemostasis.
2. Good contact of the osseous surfaces.
3. Avoidance of dead space to avoid sinal repneumatization or cystical formations.
4. Avoidance of interference by soft tissues because it prevents the formation of the osseous callus.
5. The suture lines of soft parts must not overlie defects to avoid adhesive scars.
6. Old cicatricial tissue must be eliminated from the soft parts for esthetic reasons.

Access routes to the frontal sinus

The routes of access to the frontal sinus are: a. endonasal; b. orbital; and c. anterior or frontal. The technique we advocate uses the anterior or frontal route of access.

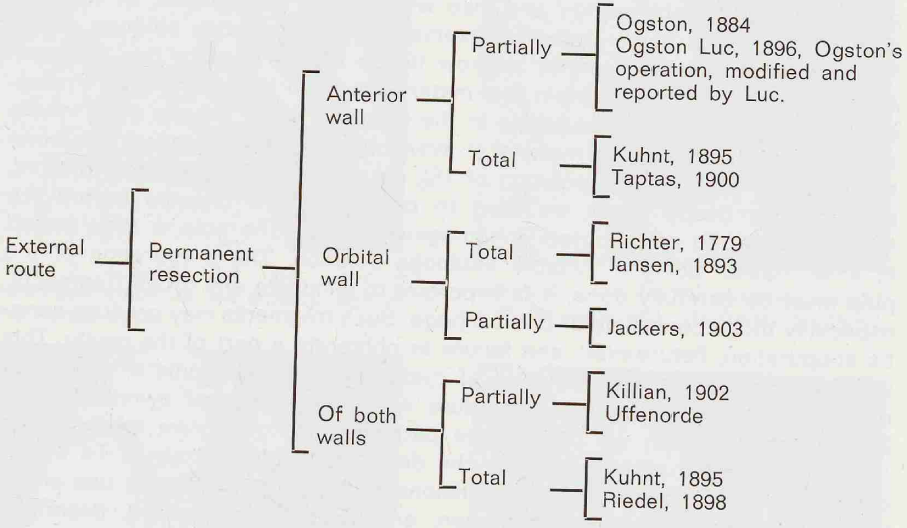
Difficulties in the long term cure of chronic frontal sinusitis have been the origin of the many surgical techniques advised. By the process of elimination we have finally arrived at a satisfactory technic of ablation and permanent elimination of the sinal cavity.

In the following table are listed the various techniques we have used previously and which have culminated in the one we now employ.

Techniques of frontal sinus surgery

Endonasal route.
This was dropped a long time ago as it is an uncertain, dangerous, difficult and incomplete operation.

Those based on the studies of: Good, Vacher and Denis, Luc, Watson-Williams, Harris, Mosher, Halle and Lafite-Dupont.



Temporary opening into sinus externally with preservation of the permeability of the naso-frontal duct.

Brieger, 1894
Schoenborn, 1894
Czerny, 1895
Kocher, 1897
Winkler, 1897
Hajek, 1897
Colovine, 1897
Hoffman, 1904
Abalos, 1917 (Argentine)
Bergara, 1926

Forerunner of our present technique which includes a temporary opening into sinus externally with occlusion and filling of the sinus cavity.

Runge, 1750. Cauterizes the operational cavity with styptic pencil to produce fibrosis.
Kuhn and Riedel. Extirpate anterior and inferior walls and join the soft parts to the posterior wall.
König and Koch. Extirpate anterior wall.
Hajek. Stimulate the granulation, plugging the cavity with carbasus idoformata.

Our surgical technique

We observed many recurrences of sinal disease and reinfections following operations on the frontal sinus when using Abaloss' technic as modified by Bergara. Bergara advocated maintaining permeability of the naso-frontal duct and used a homologous graft of preserved fat. He showed, by experiment on dogs, that such fat grafts tend to be replaced by bone formation.
Bergaglio also used an autogenous fat graft to "ablate the sinus cavity permanently", but he occluded the sinal ostium to prevent communication with the nasal cavity.
We believe that many of the failures we observed when using the fat graft technique were the result of its non-retention in the sinal cavity.
Tieffenberg described the use of autogenous bone to fill out both the post-operative mastoidectomy cavity and to ablate the cavity of the frontal sinus. From the results we obtained when using the substances advocated by these authors for use in obliteration of the frontal sinus cavity, and from our experiences without obliteration and also when using Spongostan, in 1952 we decided to try the homo-graft of preserved bone for routine ablation of the frontal sinus cavity. We prefer marrow tissue of the ribs for this purpose. As stated previously, we obtain this material through the courtesy of Professor Hernán Aquilar, who maintains in the Hospital Tornú a bone bank where an abundant supply of this material is available to us when needed. The bone pieces are preserved in a solution of 1% paraphenol. We use finely trituted, porous bone tissue which we start to prepare a few minutes before the initial incision, so as to obtain a homogenous pulp. The pulp is then stored in small flasks, using a suitable antibiotic solution. The preparation of the pulp must be carefully done. It is important to eliminate any gross fragments, especially those consisting of cortical bone. Such fragments may produce aseptic suppuration, fistulization, and failure to obliterate a part of the cavity. This will produce subsequent formation of cysts which may become infected and cause failure of the surgical procedure with continuance of symptoms.
During the operation we display the patient's roentgenogram taken in the lateral position so as to determine the depth of the frontal sinus. To obtain exact areal and circumferential dimensions of the frontal sinus we use either teleradiography or the metallic screen, graduated in centimeters, described by Zamboni, Tato and Bergaglio. The screen has the advantage of sterility and can be used during surgery for better orientation of the surgeon. With our technic only routine sinus x-rays are required for our orientation.
The technical details: The operation is done under local anesthesia using novocaine 2%, supplemented with twenty drops of 1% adrenaline solution to each 100 cc of anesthetic. With xylocame (0.50%) a solution of epinephrine hydrochloride 1 : 100.000 is used. Demerol and atropine is given prior to anesthesia in milligrams per kilogram of body weight. General anesthesia may also be used.
In general we follow Bergara's osteoplastic flap technic, which establishes an osteoperiosteal opening in the anterior wall of the frontal sinus continuous with the inferior periosteal flap.
First step: The primary incision is made bisecting the eyebrow. The incision is then continued through the subcutaneous tissue and muscular layers until the periosteum is exposed. (1) The incision is begun 1 mm below the

Figure 1. Incision in the eyebrow. Do not deviate the incision outside of the brow.

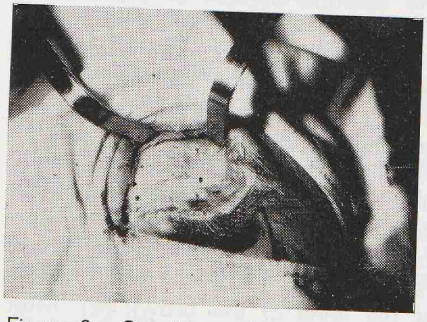


Figure 2. Creation of the opening osteo-periosteum in the anterior wall of the frontal sinus.

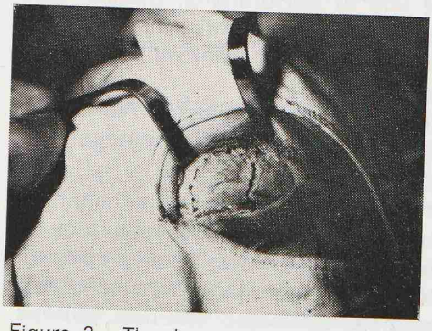


Figure 3. The bone is sectioned with a narrow chisel.

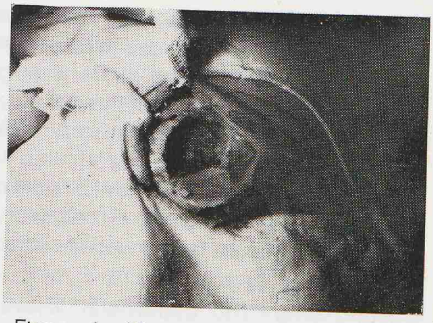


Figure 4. The osteo-periosteal flap is movable, with the periosteum preserved in its base.

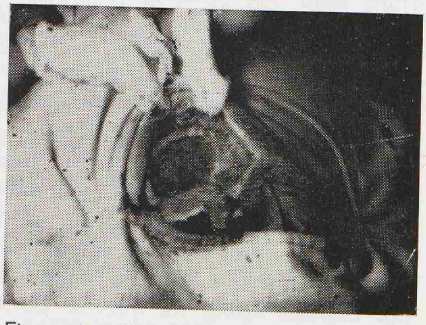


Figure 5. The frontal sinus is repleted with the bone pap, previously prepared.

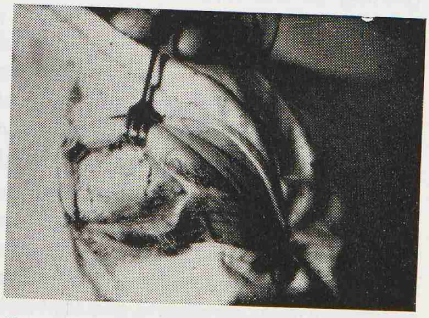


Figure 6. Reapplication of the bone flap to the opening.

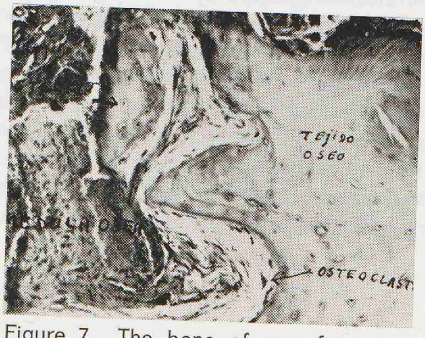


Figure 7. The bone of new formation.

superior margin of the eyebrow, topographically over the frontal process of the maxilla and continues laterally in the axis of the eyebrow for about its medial two thirds. If the sinus is large the incision may be extended laterally to the most lateral extension of its cavity. Preservation of the vessels and nerve exiting from the supraorbital foramen is advisable to maintain nutrition for healing of the wound and also to prevent the possibility of the mythical "postoperative neuritis" by a neuroma caused by the transection. Preservation of the periosteal attachment of the flap is important to maintain its nutrition of the osteotomy flap and failure to preserve it may cause loss of this long operculum.

Second step: The superficial layers are undermined over the frontal sinus, preserving the submuscular fascial layer by using a spatula or periosteotome or protecting the tissue with gauze.

Third step: An opening is created in the osteoperiosteum of the anterior wall of the frontal sinus. Trepanation of the frontal sinus is begun by making an orifice with a surgical drill at a point two millimeters above the articulation of the frontal bone with the frontal process of the superior maxilla. The osseous layer is exposed by making a small crucial incision in the periosteum. The drill is advanced until resistance is no longer encountered, being careful, however, to avoid injury to the posterior wall of the sinus. A curbed dental probe is introduced into the opening (Silva's modification) so as to palpate the superior limit of the lumen of the sinus. Equally spaced consecutive perforations of the anterior sinal wall are made obliquely from the outside toward the center of the sinal cavity along the superior border of the frontal sinus, but omitted along its inferior border (at the level of the brow). (2) After the periosteum is divided along the line of perforation, the bone is divided, using a narrow 5 mm chisel with a large bevel, the perforation always beginning at the inferior medial end of the line of perforations. Special care should be taken that the division of the bone is done with a pronounced bevel at the expense of the posterior face of the anterior sinal wall to prevent the falling in of the osteo periosteal flap into the cavity.

Tato uses a triangular drill instead of a chisel to section the bone. We believe this produces a loss of substance which is disadvantageous for postoperative consolidation of the osteoperiosteal flap.

Fourth step: Elevation and mobilization of the osteoplastic flap, hinging it along the brow by using two spatulas to elevate at the two extremities of the osteotomy. The force is applied slowly and constantly with lever motion.

Fifth step: With an elevator and gauze the pathologic mucosa is completely removed. Any dividing walls that are present are eliminated with drill, forceps, gouge and curette. We insist on complete removal of all mucous membrane because any not eliminated will cause cyst formation. Most care is necessary at the external angle of the sinus, because there are partitions that have escaped x-ray diagnosis and can be frequently found. Finally, with the use of a polishing drill, all irregularities of the bone are eliminated, leaving a smooth sinus cavity. Continuous irrigation and aspiration during drilling prevents injury to the bone from the heat developed by the drill and assists in the removal of the tissues and secretions.

Sixt step: The mucous membrane is freed and eliminated from the peri-infundibular ethmoid cells. Then the fronto-nasal communication is blocked

to prevent infection ascending from the naso-pharynx, the maneuver also assisting in obliteration of the sinus. A piece of rib cortex is fashioned to fit the naso-frontal duct and applied from above with as snug a fit as possible. This assures us that the obliterating bone will not be displaced into the nose. We presented this technic to the VI° Pan American Congress of O.R.L. at Rio de Janeiro in 1953.

Seventh step: The cavity is carefully filled with the bone pulp previously prepared. The material is compressed firmly enough to secure its perfect conformation to the sinal walls, eliminating all dead spaces, continuing until the sinus is completely filled. The osteoperiosteal flap is then replaced in its normal position and the borders of section are approximated with wires. Completely filling the sinus in this manner, induces new formation of bone, and secondarily contributes to the support of the flap. (5)

Eighth step: The periosteum is closed, using interrupted triple zero plain catgut sutures to obtain good approximation of its edges. The muscle and fibrous tissues are managed in the same manner the skin is closed with silk or cotton sutures using Donatti's method. A small Penrose drain is inserted. Vaseline gauze is placed over the line of incision as a pressure dressing and an eye dressing is applied. (6)

Immediate postoperative care: Vitamins C and K, calcium gluconate and antibiotics are given and an ice bag is applied over the surgical area. The dressings are changed in 48 hours and the eye is left covered. The pressure dressing is reapplied. The drain is removed in two to four days. A collyrium may be used if indicated. The skin sutures are removed on the seventh or eighth day.

During the postoperative period there is edema of the area of operation that includes the eyelids. This disappears in a week to ten days. Pain is seldom marked and a simple analgetic is usually sufficient to secure rest for the patient.

The antibiotics are continued for fifteen days.

Advantages of the method

This operative technique does not need another operation to obtain the graft material. The "pulp" used is easy to obtain, with no limitation as to quantity. For the rest, loss of material is of little consequence and the cost is low. It is not necessary to have special equipment to care for the bone: preserving solution (paraphenol 1%) in a sterilized bottle is enough.

In cases in which there is partial destruction of the osseous walls by osteitis or other causes, they must be reformed with pieces of compact cortical bone placed in such a way as to close the defect and provide maintenance of the filling material without danger of its slipping out.

We operated on one patient with an osteoma of the frontal bone which destroyed partially the intersinus septum and the orbital roof in this manner. Postoperative radiograms showed the graft in place with gradual disappearance of the graft and its progressive replacement by new bone. (7)

With other methods of ablation partial repneumatization of the operated sinus is described, exposing it to reinfection.

Repneumatization takes place via the naso-frontal duct. We have not observed this in our patients and we attribute this to the obliteration of the infundibulum

by the little plate of cortical bone which seems to prevent invasion by the epithelium and permit the reorganization of the graft by reabsorption and new formation of bone.

This technique is applicable in the following cases:

1. "Pure" frontal sinusitis.
2. Mucocele of the frontal sinus.
3. Osteoma of the frontal sinus. We believe that opening the frontal sinus to eliminate a bone tumor disposes the sinus to future infection. This is prevented by abolishing the sinus.
4. Pansinusitis:
   a. When treating patients with an anterior ethmoiditis which does not permit trans-antral ethmoidectomy because the channel is very narrow and does not permit the free passage of Ermiro de Lima's curette.
   b. If there are abnormalities of the frontal sinus, such as multiple frontal sinuses, or partitions in the sinus, we cannot hope to cure the sinus by the transmaxilla-ethmoidal approach. If such variations are present in only one sinus we treat the other sinus by the transmaxillary approach, and in the same operative session we do the osteoplastic technique on the unusual side.

Contra-indications:

Except for those which would prevent any surgical intervention, contra-indications do not exist. In our experience, extending over fourteen years. The only difficulties encountered were the following: in one case a fragments of cortical bone was present in the osseous pulp and caused aseptic suppuration with elimination of the fragments. Two years later the episode was repeated. When finally healed, a navel-shaped cicatrix remained, with a poor aesthetic result.

CONCLUSIONS

1. The technic is simple.
2. The filling material is easy to obtain, does not require another operation on the same patient or on a donor and is cheap.
3. The postoperative course is satisfactory.
4. From the aesthetic point of view, to the best of our knowledge and belief, this technic is superior to any other procedures.
5. We have operated on over sixty-two cases with this technique and have had only two failures — one for technically incorrect surgery, and the other because the patient was so old (82 years) that the osteogenic function seemed to be notably reduced.

SUMARIO

Los autores enfatizan que para hacer un tratamiento quirúrgico racional de las afecciones del seno frontal, es necesario basarse en un amplio conocimiento de la embriología, anatomía y fisiología del mismo.

Hacen por consiguiente una breve sintesis de los conocimientos embriológicos, anatómicos y fisiológicos del seno frontal, insistiendo muy especialmente sobre la anatomía, ya que su conocimiento es indispensable para la perfecta realización de la operación sin peligro para los pacientes y también para la obtención de los mejores resultados.

A continuación hacen una reseña histórica de las distintas técnicas empleadas, hasta llegar a la técnica osteoplástica a la que consideran eminentemente argentina.

Describen los distintos tiempos quirúrgicos y sostienen que para lograr resultados satisfactorios, es necesario ocluir el conducto nasofrontal y obturar el seno en forma total, previa eliminación de toda la mucosa sinusal.

Usan como material de relleno y de oclusión homoinjerto de hueso conservado en solución de Parofenol al 1%, que obtienen del Banco de huesos.

Si bien el autoinjerto de hueso es bueno, afirman que con el empleo de hueso conservado, evitan una segunda operación al paciente, que en ocasiones et más dolorosa y con un postoperatio más prolongado que la operación principal.

Su experiencia se basa sobre 62 casos; los resultados fueron ampliamente satisfactorios en 60 casos y solamente 2 fracasos.

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