LOCAL ANESTHESIA: ITS TECHNIC IN SURGICAL INTERVENTIONS ON THE FRONTAL AND MAXILLARY SINUSES.*

BY GEORGES CANUYT, BORDEAUX, AND J. ROZIER, PAU.

General anesthesia always presents dangers, both immediate and consequent to the intervention or to the patient, whatever anesthetic may be used.

Whenever there is narcosis, there is danger. The immediate dangers are asphyxia, syncope and, above all, death. The mortality due to general anesthesia is slight, but it exists beyond question much more frequently than is reported.

The secondary results are manifested in the liver, the kidneys, the lungs and the general condition, and may go as far as death. The surgeon then brings in the diagnosis of shock under operation, but rarely assigns the real cause: the general anesthetic.

Regional and local anesthesia are the two kinds used constantly in otorhinolaryngology.

The purpose of regional anesthesia is to reach the nerve trunks whose branches give the sensation to the site of operation. It is applied at some distance from the field of operation. In bringing the anesthetic agent into contact with these nerve trunks, their connection is suspended and there is temporarily a real disconnection, from a physiologic point of view, which renders the field of intervention insensible.¹

Local anesthesia is too well known for us to insist upon a description. The name of Reclus² will continue to be connected with it permanently, for he was truly its father. Local

*Translation made in the office of the Surgeon-General of the Army from the original which was published in *La Restauration Maxillo-faciale*.

1. Pauchet & Sourdat.

2. See Piquand, *L'anesthésie locale par infiltration (méthode de Reclus)*.

anesthesia by infiltration, the method of Reclus, has rendered a tremendous service not only in our special field but also to general surgery.

In this article we set forth in detail the technic of anesthesia for operations upon the frontal and maxillary sinuses. It will be evident that we consider regional and local anesthesia together, for if regional appears sufficient theoretically it is still practically preferable to use local anesthesia in addition for constancy of result.

We take the liberty of making two suggestions:

1. There is a need of practice; successful anesthetics can be obtained only after many of them have been performed. It is a curious thing to find that many surgeons who understand very well that a long apprenticeship is necessary in order to administer chloroform properly are anxious to see their first attempt with a local anesthetic successful.

2. There is a need of patience; in fact, when the local anesthetic has been administered it is always necessary to wait at least a quarter of an hour before operating.

In order to manage to reach with precision the nerve filaments which it is desired to anesthetize, it is necessary to have a thorough knowledge of the anatomy of the region. So before beginning the technical study of local anesthesia for the frontal or maxillary sinuses we have thought it useful to run over summarily the tract and the point of emergence of the nerves which control the sensations of the face.

These nerves all belong to the trigeminus, or the fifth pair of cranial nerves.¹

ANATOMY.

Trigeminal Nerve.—The three large terminal branches of the trigeminus leave the ganglion of Gasser (Figure 2), lying over the inner part of the anterior surface of the petrous. They are, from within outward:

- I. The ophthalmic nerve, which enters into the orbit through the sphenoid fissure;

- II. The superior maxillary nerve, which leaves the cranium through the large foramen rotundum;

1. Testut, *Traite d'anatomie humaine (système nerveux)*.

III. The inferior maxillary, which goes through the foramen ovale.

The first two nerves are the only ones which we are studying, for they are the ones to be anesthetized for operations upon the frontal or maxillary sinuses.

I. Ophthalmic Nerve (Figure 2).—At the point where it enters the orbit the ophthalmic nerve is divided into three terminal branches: the nasal, frontal and lacrimal.

A. The Nasal Nerve.—The nasal nerve follows the inner wall of the orbit, proceeding towards the inner anterior orbital foramen, at the level of which it is divided into two branches, the external nasal and the internal nasal or anterior ethmoidal.

1. The external nasal nerve extends along the inferior border of the superior oblique muscle, and five or six millimeters posterior to the border of the orbit it divides into three branches:

(a) Superior branch running towards the inner part of the upper eyelid and the space between the eyebrows;

(b) Inferior branch, which supplies the lacrimal sac, lacrimal ducts and inner part of the lower eyelid;

(c) Median branch which, proceeding horizontally forward, leaves the orbit and branches out in the skin of the upper part of the dorsum of the nose, then its root extends to the lower border of the nasal bones proper.

2. The internal nasal nerve passes through the inner anterior orbital foramen, over the cribriform plate of the ethmoid, through the ethmoid foramen and enters the nasal fossa, dividing into two branches:

(a) The internal supplies the mucous membrane of the septum (anterior half);

(b) The external, which is to supply the anterior portion of the mucous membrane of the turbinates and the meatus, passes to the outer wall of the nasal fossæ and then under the skin of the alæ of the nose.

B. Frontal Nerve.—The frontal nerve enters into the orbit through the external portion of the sphenoid fissure and runs along the superior wall. Behind the posterior border of the orbit it separates into the external and internal frontal nerves (Figure 1).

1. The external frontal nerve leaves the orbit through the supraorbital foramen or groove and divides into:

(a) Frontal (Figure 3) or ascending branches distributed to the skin of the frontal region ;

Fig. 1. Schematic.

Emergence of the terminal branches of the Arigeminus.

1. Supraorbital or external frontal nerve. 2. Internal frontal nerve. 3. Infraorbital nerve. 4. Mental nerve.

(b) Palpebral (Figure 3) or descending branches to the skin and mucous membrane of the upper eyelid ;

(c) An osseous branch which leads directly into the thickness of the frontal bone and is distributed in part to the diploe

and the pericranium and in part to the mucous membrane of the frontal sinuses.

2. The internal frontal nerve (Figure 1) leaves the orbit between the external border of the frontal and the superior oblique. At the level of the orbital border it gives off frontal filaments (Figure 3) (periosteum and skin of the forehead), palpebral filaments (Figure 3) (skin and mucous membrane of the inner part of the upper eyelid), and nasal filaments (Figure 3) (skin of the region between the eyebrow).

C. Lacrimal Nerve.—This nerve follows the external wall of the orbit and supplies sensation to the skin and the mucosa of the outer part of the upper eyelid.

Summary.—The ophthalmic nerve supplies sensation to the anterior two-thirds of the occipitofrontal region, the superciliary region, the internal two-thirds of the upper eyelid, the inner part of the lower eyelid, and finally the inner part of the ala of the nose.

II. Superior Maxillary Nerve (Figure 2).—This nerve leaves the cranium through the large foramen rotundum, penetrates the posterior portion of the pterygomaxillary fossa, which it crosses obliquely, and then enters into the infraorbital canal. It passes through the infraorbital foramen and spreads out into numerous terminal branches, the infraorbital nerves (Figures 1 and 3), which are distributed to the skin, and the mucous membrane of the cheek, nose and upper lip.

In the pterygomaxillary fossa (Figure 2) the nerve occupies the most elevated part of the region.

In the infraorbital groove the superior maxillary is separated from the soft parts of the orbit by a simple fibrous layer.

In the infraorbital canal (Figure 2) it follows the bony wall of this channel over its whole course.

From its entrance into the infraorbital groove to the infraorbital foramen the superior maxillary nerve follows the roof of the maxillary sinus (Figure 2), from which it is separated by only a thin bony plate. This last even may be lacking in places, in which case the nerve is separated from the sinus by only the mucous membrane.

From the ganglion of Gasser, where it starts, to the infraorbital foramen the superior maxillary nerve gives off five branches (Figure 2):

Fig. 2. Semischematic.

Superior maxillary nerve and inferior maxillary nerve; their distribution and branches.

- 1. Gasserian ganglion. 2. Ophthalmic nerve. 3. Superior maxillary nerve. 4. Inferior maxillary nerve. 5. Sphenopalatine ganglion and anterior middle and posterior palatine nerve. 6. Posterior dental nerves. 7. Anterior dental nerves. 8. Dental plexus. 9. Orbital branches. 10. Mental nerve. 11. Internal maxillary artery. 12. Maxillary sinus.

A. The middle meningeal branch which, having its origin in the cranium, is distributed to the dura mater.

B. The orbital branch (Figures 1 and 10), which penetrates into the orbit through the sphenomaxillary fissure, runs along its external wall and there divides into two branches: a superior or lacrimopalpebral branch (lacrimal gland and upper eyelid) and an inferior or temporomalar branch (skin of the temple).

C. The sphenopalatine nerves, two or three in number, are sent off within the pterygomaxillary fossa, and after a short course join the sphenopalatine ganglion.

D. The posterior and superior dental nerves, two or three in number, branch off from the superior maxillary just as it enters the infraorbital groove. They descend to the tuberosity of the maxilla, give off several twigs to the buccal mucous membrane and to the gums, and enter the bony canal in proximity to the molar teeth. There they form plexuses from which are distributed:

1. Dental filaments (roots of the large and small molars);
2. Alveolar filaments (periosteum of the sockets of the teeth);
- (3) Mucous filaments (mucous membrane of the maxillary sinus);
4. Osseous filaments, which are lost in the maxilla itself.

E. Anterior dental nerve (Figures 2 and 8) starts eight or ten millimeters posterior to the infraorbital foramen, and proceeds towards the incisors. It sends out recurrent filaments which anastomose with the dental plexus noted above and is finally lost in the following:

1. Nasal filaments (mucous membrane of the nasal canal);
2. Dental filaments (roots of the two incisors and the corresponding canine);
3. Alveolar filaments (alveolar periosteum and mucous membrane of the gums);
4. Osseous filaments (superior maxillary).

F. Infraorbital Branches (Figures 1 and 3).—The terminal branches of the superior maxillary nerve are divided into three groups:

1. Ascending or palpebral filaments (skin and mucous membrane of the lower eyelid);

Fig. 3. Schematic.

Terminal and superficial branches of the ophthalmic superior maxillary and inferior maxillary nerves.

1. External frontal or supraorbital nerve, with its filaments spread out to the skin of the cranium and upper eyelid. 2. Internal frontal nerve with frontal palpebral and nasal branches. 3. External nasal nerve. 4. Infraorbital nerve. 5. Mental nerve.

2. Descending or labial filaments (upper lip, skin and hair bulbs and the underlying mucous membrane and glandular bed);

3. Internal or nasal filaments (skin of the ala of the nose and of the vestibule of the nasal fossæ).

G. Sphenopalatine ganglion (Figures 2 and 5, Figures 5 and 1), or ganglion of Meckel.—This ganglion is located in the pterygomaxillary fossa and joined to the superior maxillary nerve.

It sends out nerve fibers which carry sensation to the nasal fossæ, the palate and the upper part of the pharynx. These are:

1. The pharyngeal or pterygopalatine nerve, which gives sensation to the upper part of the pharynx and the eustachian tube;

2. The superior nasal nerves descend into the nasal fossæ through the sphenopalatine foramen and are divided into:

a. External branches to the superior meatus and the superior and middle turbinate, the roof and lateral wall of the pharynx;

b. Internal branches (mucous membrane of the septum);

c. Orbital branches (external wall of the orbit, posterior ethmoid cells and the sphenoid sinus).

3. The palatine nerves (Figures 5 and 6) are three in number and descend into the posterior palatine canal:

(a) The anterior palatine nerve (Figure 5) supplies the mucous membrane of the roof of the mouth, the soft palate, the middle and inferior meatuses, the inferior turbinate and the maxillary sinus;

(b) The middle palatine nerve (Figure 5) (mucous membrane of the tonsils and the pillars of the palate);

(c) The posterior palatine nerve (Figure 5) (the two surfaces of the soft palate).

TECHNIC OF LOCAL ANESTHESIA FOR THE FRONTAL SINUS.

General Remarks.—Local anesthesia is preferable to general anesthesia in the radical cure of frontal sinusitis. In fact, if the technic to be described is followed with precision, the anesthesia is perfect, and to us it seems quite useless to submit a patient to operation under chloroform with the incon-

Fig. 4. Schematic.

Trigeminus nerve. Sensative zones dependent upon this nerve.

A. Sensative territory of the ophthalmic nerve. B. of the superior maxillary nerve. C. Of the inferior maxillary nerve.

1. Supraorbital or external frontal nerve. 3. External nasal nerve. 4. Infraorbital nerve. 5. Mental nerve.

veniences which accompany this method of anesthesia during and after operation.

However, it should be added that while we prefer local anesthesia for the radical cure of frontal sinusitis, we do not absolutely condemn general anesthesia, as we do in the radical

Fig. 5. Schematic.

Innervation of the external wall of the nasal fossae.

A. Territory of the ophthalmic nerve. B. Territory of the superior maxillary nerve.

1. Sphenopalatine ganglion. 2. External sphenopalatine nerve. 3. Posterior nasal nerve. 4. Anterior palatine nerve. 5. Anastomosis of the anterior palatine nerve with the external sphenopalatine. 6. Terminal branch of the middle palatine nerve. 7. External branch of the internal nasal. 8. Nasolobar nerve.

cure of maxillary sinusitis. This is an important point which we think should be noted.

On the other hand, the technic which we are about to describe is only applicable, of course, if the Ogston-Luc method

as modified by Moure is employed, namely, free opening of the frontal sinus near the root of the eyebrow (cutaneous incision along the eyebrow), careful and complete curettage of the sinus cavity, including all diverticula, if any exist, enlargement with the curette and clearing out of the infundibu-

Fig. 6. Schematic.

Innervation of the internal wall of the nasal fossæ.

A¹. Territory of the ophthalmic nerve. B¹. Territory of the superior maxillary nerve.

1. Branches of the internal nasal. 2. Internal sphenopalatine nerve. 3. Anastomosis of the internal sphenopalatine with the anterior palatine nerve.

lum in the anterior ethmoid region, with free communication of the sinus and the corresponding nasal fossa, and immediate complete suture of the skin.

This operation, in Professor Moure's service, has always given good results.

As for the various mutilating and useless external methods, they have been replaced, and we will not speak of them again.

Instrumentation: A syringe (model left to choice of operator); a fine strong needle.

Anesthesia of one frontal sinus: Twenty cubic centimeters of novocain, solution 1/200, to which is added six drops of adrenalin solution, 1/1,000. A solution of cocain hydrochlorate 1/10, for anesthesia of the nasal fossa and ethmoid.

Anesthesia of both frontal sinuses: Forty cubic centimeters of novocain solution 1/200, cocain solution 1/10, for anesthesia of the nasal fossæ and ethmoids.

Technic.—The ophthalmic nerve cannot be reached by local anesthesia. It is necessary to direct the needle as far as the sphenoidal fissure, which is a dangerous proceeding, because of the proximity of the motor nerves of the eye. We must be content therefore to irrigate its terminal branches.

The most important nerve to attack is the supraorbital or external frontal, which emerges from the orbit at the supra-orbital notch of the orbital arch at the junction of its inner and middle thirds.

To get perfect anesthesia the nerve should be attacked in the orbit, in contact even with the roof, before the branches emerge, and where it approaches the internal frontal nerve which supplies the internal portion of the upper lid.

The soft parts are first infiltrated, then the periosteum, and where the external frontal nerve emerges.

For this purpose, as indicated in the accompanying figures, it suffices to circumscribe the operative field with a series of punctures (Figures 7 and 8); it will be noted that not only is the region of the frontal sinus to be operated on anesthetized, but also at least the inner half of the opposite frontal sinus. In fact, it is frequently found that the sinus and nasal septum, instead of being in the median line, are situated two, three or four centimeters away from it, at the expense sometimes of the right and sometimes of the left sinus. Moreover, the two sinuses may communicate with each other, and in the course of operation it may be necessary to go beyond the strict theoretical limits of the operated sinus. For these reasons then the anesthesia must always be extensive, comprising much territory on the opposed side. We have often found this foresight valuable.

The nasal fossa and ethmoid are anesthetized by tampons.

Fig. 7. Anesthesia of the frontal sinus.

The figures 1 to 8 indicate the exact points where the needle should be introduced in order to effect anesthesia of the frontal sinus.

The zone of anesthesia is shown in the figure; however, it should be understood that the anesthesia passes by the diffusion of the liquid beyond the zone indicated.

It is quite effective, especially if one leaves in place a wad of cotton saturated with cocain during the entire operation, thus maintaining the anesthesia up to the moment of establishing nasosinus communication.

Advantages.—These are all the known and classic advantages of local anesthesia, namely, hemostasis, considerable lessening of the gravity of operation, harmless postoperative results, etc.

Inconveniences.—These are negligible. The principal one is that the anesthesia must be successful and that it can only be attained after a long apprenticeship.

Indications.—Local anesthesia of the frontal sinus and corresponding nasal fossa is indicated for:

1. The radical cure of unilateral and bilateral frontal sinuitis. This is the most frequent condition and should be absolutely well in hand.

2. Radical cure of traumatic frontal sinuitis, particularly that seen in war.

We must say, however, that in traumatic sinuitis the anesthesia is not as good as in ordinary sinuitis; in fact, the contused, damaged and scarred tissues are less responsive to anesthesia. One should carefully increase the dose a little and use 25 or 30 cubic centimeters of novocain solution for each sinus to be operated upon.

3. Foreign bodies and war projectiles in the sinuses. This is the least important indication, but gives excellent results on condition that the projectile has been carefully localized before operation. We urge that operating for projectile be done under intermittent fluoroscopy, if an unsuccessful operation is to be avoided.

TECHNIC OF LOCAL ANESTHESIA OF THE MAXILLARY SINUS.

General Remarks.—For the radical cure of maxillary sinuitis local anesthesia is the method which should be employed.

The technic about to be described is applicable to the radical cure of maxillary sinuitis according to the Caldwell-Luc operation:

1. Free opening of the canine fossa.
2. Complete curettage of the antrum.
3. Free communication between the sinus and nasal fossa.

It is the only method employed at Bordeaux by Professor Moure and has always given perfect satisfaction.

We absolutely condemn general anesthesia (Moure), be-

Fig. 8. Local anesthesia of both frontal sinuses.

The figures 1 to 10 show the exact points where the injections should be made to obtain anesthesia of both frontal sinuses.

The anesthesia obtained passes beyond the zone indicated.

cause, beside the dangers inherent to all narcosis, it is still more dangerous in operations on the maxillary sinus, and more particularly if the operation is bilateral.

The blood from hemorrhage which is abundant may go into the air passages and may necessitate tracheotomy. Moreover, it obscures the prognosis by reason of subsequent bronchopulmonary complications.

Instrumentation: A syringe (model according to the choice of operator) and a fine strong needle.

Anesthesia of one maxillary sinus: Twenty cubic centimeters of novocain, solution 1/200, to which is added six drops of adrenalin, solution 1/1,000. A 10 per cent solution of cocain hydrochlorate for anesthesia of the nasal fossa.

Anesthesia of both maxillary sinuses: Forty cubic centimeters of novocain solution.

ANESTHESIA OF ONE MAXILLARY SINUS.

Technic. 1. Anesthesia of the Canine Fossa.—Inject two cubic centimeters along the line of mucous incision, from the canine to the first molar, inclusive. Inject four cubic centimeters subperiosteally in the canine fossa and throughout its extent.

2. Anesthesia of the infraorbital nerve (Figures 12 and 2). The surgeon should look for the infraorbital nerve externally. To do this he inserts the needle through the skin of the cheek at a point which corresponds to a perpendicular passing through the middle of the inferior border of the orbit and at least two centimeters below it. The needle is pushed to the bone, then, tattoo fashion, directing it toward the internal border and two centimeters below it. This causes the patient to have slight sharp pains, which indicate to the operator that he is on the right path. Finally, the needle suddenly penetrates the infraorbital foramen, touches the nerve and produces an exquisite flash of pain referred to the teeth. This is absolute proof that the object has been attained.

With the needle it is necessary to penetrate well into the foramen if one desires to obtund all the terminal branches spreading out from this region, and especially the last collateral branch, the anterior dental, which comes off a little behind the terminal thickening in the osseous canal. Four cubic centimeters are injected in the locality of this nerve, by which it will be completely obtunded. The infraorbital nerve can also be reached by inserting the needle under the mucosa

of the canine fossa and pushing it up toward the emergence of the nerve. It will not be best to use this method until the operator has become accustomed to looking for the nerve and is familiar with his task.

Fig. 9. Anesthesia of the superior maxillary nerve by the orbital and by the zygomatic routes.

This figure shows the position of the needles when they are in contact with the trunk of the superior maxillary nerve.

Needle 1 is passed by the orbital route.

Needle 2 is passed by the zygomatic route.

To reach the nerve it is necessary to thrust the needle under the zygomatic arch perpendicular to the external surface of the superior maxillary. Then by directing it upward and backward, it penetrates into the pterygomaxillary fossa where the nerve is found.

Needle 2 shows the last step.

3. Anesthesia of the Superior Maxillary Trunk.—This is the most important injection—in fact, theoretically anesthesia of the trunk of the superior maxillary nerve should be sufficient.

Practically this injection alone does not cause absolute anesthesia, but if it is well and successfully done, combined with anesthesia of the canine fossa and infraorbital, the anesthesia is excellent. We constantly obtain perfect anesthesia, in every patient, in the radical cure of maxillary sinusitis.

Two ways are at the choice of the surgeon in reaching the superior maxillary nerve at the large foramen rotundum: the zygomatic and the orbital route.

1. Zygomatic Route (Figures 9, 11 and 12).—Taking the zygomatic arch as a landmark, the needle is inserted through the skin under the lower border of the arch a finger's breadth in front of the ascending ramus of the lower jaw, and is pushed to the bone which is the external surface of the superior maxilla. The needle should be glided deeply the entire length of the latter, directing it upward and backward; thus the pterygomaxillary fossa is penetrated at the superior maxillary nerve. As soon as the nerve is reached by the needle point the patient feels a violent flash of pain comparable to a discharge of electricity, referred to the teeth. The maneuver is then successful, and four or five cubic centimeters of the solution are injected.

In this way the nerve is reached in the posterior wall of the pterygomaxillary fossa, near the foramen rotundum, and the sphenopalatine ganglion at the same time. Wounding of the internal maxillary artery is possible, theoretically; practically, it is very rare, and even if it happens there is no danger.

The above is an easy, certain method, free from danger, and has given us such good results that we now employ it almost to the exclusion of every other.

II. The Orbital Route (Figures 9, 10, 11, 12).—By this route (Chevrier) the superior maxillary nerve is reached at the sphenomaxillary opening. This opening, situated at the upper limit of the posterior wall of the pterygomaxillary fossa, has the large foramen rotundum at its posteroinferior extremity. Under the fibrous membrane which covers the opening in the living, completely separating the orbit from the

posterior wall of the pterygomaxillary fossa, the superior maxillary nerve gives off the most of its collateral branches—the palatine nerve, the posterior dental branches and the orbito-lacrimonal—before entering the inferior orbital groove.

Having taken as a landmark the inferior border of the

Fig. 10. Anesthesia of the trunk of the superior maxillary nerve by the orbital route.

We have thought it useful for the purpose of clearness to photograph this plan with the skull.

1st Step. The needle (1) is thrust perpendicular to the floor of the orbit.

2nd Step. The needle is glided along the floor of the orbit and lowered slowly until it becomes oblique (needle 2).

When the needle leaves the bony floor, it will enter the orbital fissure, if it is thrust deeply backward.

The maneuver is complete when the patient complains of lightening pains in the teeth.

orbit, at a finger's breadth from the external border, the needle is entered perpendicularly to the floor of the orbit (Figure 10). This done, it is necessary to glide it along the floor, lowering the needle progressively until the bony resistance ceases. Then the orbital fissure is penetrated. It remains only to force the needle, which was at first perpendicular to the orbital floor but is now oblique, into the vicinity of the superior maxillary nerve. The maneuver has succeeded when the patient feels a sharp flash of pain radiating to the teeth. Five cubic centimeters of solution are injected while progressively withdrawing the syringe.

The orbital route is more difficult than the other; it demands large experience and considerably impresses the patient, who fears for his eye. We have employed it for several years without trouble or accident (Canuyt).

Theoretically grave accidents are to be feared—false paths causing a lesion of the eyeball, phlegmon of the orbit, paralysis of the oculomotor nerves, etc. Practically there are none; the sole complication noted were the hematoma, the cause and mildness of which are easy to understand. Either the zygomatic route or the orbital route gives complete anesthesia of the jaw, upper lip, all the teeth, nasal fossa, lower eyelid and the sinus cavity of the side injected.

4. Anesthesia of the Corresponding Nasal Fossa.—The nasal fossa is carefully tamponed with 10 per cent cocain solution, and especially the inferior turbinate. If a few cubic centimeters of novocain solution remain, we inject it over the nasosinus wall in the inferior meatus, in order to have a perfect anesthesia at the time of penetration. Finally, we put a gauze tampon impregnated with 10 per cent cocain solution in the nasal fossa to remain during the whole operation.

Thus performed, anesthesia of the maxillary sinus is

1. Logical. The superior maxillary nerve is obtunded at its trunk. The nerve branches are obtunded by infiltration;

2. Rapid. Three punctures are made, and an ordinary anesthesia of the nasal fossa;

3. Methodical. It comprises four steps: Anesthesia (1) of the canine fossa, (2) infraorbital nerve, (3) superior maxillary nerve, and (4) nasal fossa.

This technic gives constant results.

ANESTHESIA OF BOTH MAXILLARY SINUSES.

It is necessary, first, completely to anesthetize one sinus, then the other, but not overlap them. Twenty cubic centimeters are injected for each sinus, a total of forty cubic centimeters.

Fig. 11. Radiograph of a patient showing the method of anesthesia of the superior maxillary nerve.

Orbital route, needle 1. Zygomatic route, needle 2. This radiograph establishes that the two needles meet at the same point. We have thought it interesting to show in this way that the superior maxillary nerve can be reached in each of these methods: the orbital and zygomatic.

meters, Operation should be commenced on the sinus first anesthetized. It must be remembered that the radical cure of a double sinusitis is an extensive operation, rather long and

trying, and a hypodermic of morphin should be given when beginning the anesthesia.

ANESTHESIA FOR PARADENTAL CYSTS.

For paradental cysts the anesthesia should be made according to the following principles:

In the first place, it is very hard to know before operation whether the cyst is intra- or extrasinus. Errors on this point are frequent, and a cyst supposedly having no relation to the sinus cavity may be situated within it. Therefore we advise, save in exceptional circumstances, always to make a complete anesthesia of the maxillary sinus like that described for the radical cure of maxillary sinusitis.

Anesthesia of the canine fossa should be thorough, injecting about eight cubic centimeters, especially at the internal portion of the ala nasi and the ascending branch of the superior maxillary.

It is known that a paradental cyst, if it arises from an upper incisor or canine, pushes out of the upper lip and even into the nasal fossa. Therefore the anesthesia should be liberal in this region. Similarly, if the cyst arises from the first or second bicuspid or the first two molars, it will direct itself toward the sinus cavity. The tumor enlarges, pushing bone and periosteum before it, and goes toward the point of least resistance, which is the maxillary sinus; if the latter is intact, the cyst is extra-sinus; but if it is perforated we have an intra-sinus cyst, either membranous or bony, according to the case. Hence, from the viewpoint of local anesthesia, we must be ready for any eventuality and must have a complete anesthesia permitting completion of the operation, whatever surprises may occur.

To sum up, the technic of anesthesia is that for maxillary sinusitis with extensive infiltration of the canine fossa and internal aspect of the corresponding nasal fossa:

Advantages.—We shall repeat what we said of frontal sinus anesthesia—that they are those of local anesthesia in general, which need not be emphasized. With general anesthesia the radical cure of maxillary sinusitis is a grave, difficult and even dangerous operation.

Conclusion.—Never general anesthesia:

Indications.—(1) Radical cure of maxillary sinusitis, unilateral or bilateral.

(2) Radical cure of traumatic maxillary sinusitis, unilateral or bilateral.

(3) Paradental cysts, whether intrasinus or not.

Fig. 12. Anesthesia of the maxillary sinus.

This figure shows a patient on the operating table prepared for an operation on the left maxillary sinus. The anesthetized region has been circumscribed by a sterilized operative field after an application of tincture of iodine.

Needle 1 has been passed by the orbital route and is in contact with the superior maxillary nerve.

Needle 2 is in contact with the infraorbital nerve.

Needle 3 has been passed by the zygomatic route and is in contact with the superior maxillary nerve.

(4) Foreign bodies and projectiles in the sinus.

It is absolutely necessary that the projectile be perfectly localized by a radiologist before operation. Moreover, if the localization is uncertain it is indispensable to operate under the fluoroscopic screen, a sure method, which saves the surgeon from a fruitless operation.