

CELLULAR CHANGES DURING AND AFTER
ACUTE MASTOIDITIS WITH A CONSIDER-
ATION OF THE INADVISABILITY OF
CERTAIN OPERATIVE PROCEDURES
AT PRESENT LARGELY IN
VOGUE

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I was prompted to present this paper by an informal discussion of the subject with a fellow member of this Section, during which discussion it developed that there existed between us a wide difference of opinion in regard to certain surgical fundamentals involved. My own observations have convinced me that the number of operators who do not hold views similar to mine is not small, and this opportunity is sought for a comprehensive discussion of the subject. It is to be hoped that none of the Section's time will be taken up with discussions of unimportant differences in technic or of procedures applicable to unusual departures from type, which in no way form any part of the subject. I appreciate that certain individual cases are laws unto themselves and present conditions which cannot be foreseen; exceptional virulence of infection, unusual lack of resistance on the part of the patient, in short, anything which has a "*sui generis* all its own," as a western writer once expressed it, may be adduced in valid argument against some portion of the contents of this paper, which deals only with general principles underlying the surgery of acute purulent mastoiditis.

It was my intention originally to make the pathologic findings during and after acute inflammation the basis of a study of the questions involved, but physical incapacitation at the time projected for this part of the work, and discovery of some authoritative statements regarding these pathologic findings determined the presentation of the subject without pathologic material.

My propositions are briefly the following: In operative treatment of an acute purulent inflammation of the tympanomastoid structures, any procedure having for its object aught than relief of pressure and establishing drainage is a surgical error. The antrum should not be opened in the absence of special indications for so doing, and should never be curetted under any circumstances.

The mucoperiosteum of the tympanic cavities, unlike its continuation in the eustachian tube, contains almost no glands, only a few scattered ones being found on the floor, the inferior portion of the outer wall, and the outer part of the superior wall of the cavum (von Tröltzsch and Bulle). The epithelium is ciliated cylindrical in type only over small areas. That covering the membrana tympani, the ossicles, promontorium, attic and pneumatic spaces of the mastoid is pavement epithelium (Jacobson and Blau, and Külliker). Transitional cell zones delimit the latter areas. Kessel describes minutely stomata in the pavement epithelium of tympanum and antrum communicating directly with underlying lymph-channels, and calls attention to the enormous absorptive powers of this structure, as does Bezold, who adds a comment relative to the equally great power of recuperation after violent inflammation and enormous swelling incidental thereto, thickening of 10 to 12 mm. having been observed in membrane normally 0.02 mm. thick, with subsequent absorption of all inflammatory exudate and complete subsidence of swelling.

Mucous secretion has its origin in two sources, the glands and the epithelium. Siebenmann failed to find

the glands reported by certain authors and takes issue with them as to the existence of any glands at all. Schwalbe, Blau and others remark the possibility of the existence of moderate accumulations of secretion on the floor before eustachian tubal drainage can begin. It seems certain that to cause the outflow via the eustachian tube of accumulated secretion is not the sole function of the cilia.

The pneumatic spaces of the mastoid process and the aditus are dependent almost entirely on the pavement epithelium to remove secretion. In the tympanum a considerable part of the secretion is removed through absorption by the lymph-streams via stomata in the pavement epithelium, ciliary action being concerned in urging onward the masses of secretion toward the tube and toward the pavement-epithelialized absorption areas. The mucoperiosteum of the aditus, antrum and pneumatic cells of the mastoid bears non-ciliated pavement epithelium, and its blood-supply is concerned in nourishing the mucosa on the one hand, and the underlying bone on the other. Where it covers non-diploetic bone it constitutes the sole source of nourishment to the bone; diploetic bone receives additional nourishment from the circulation of the diploetic vascular system. Diploe is found in the temporal bone in widely varying distribution; Zuckerkandl, Zoja, Schwartze and others have examined many hundreds of temporal bones with a view to ascertaining facts relative to the presence of diploe; the consensus of these findings indicates that in about 40 per cent. the pars mastoidea contains no diploe; in about 22 per cent. it is entirely diploetic, and in about 38 per cent. it is mixed, pneumatic-diploetic. Diploe is normally absent from three sites in the temporal bone, the promontorium, the prominence of the horizontal semicircular canal, and the internal auditory meatus (Neumann).

After acute destructive processes involving the periosteum alone, or the periosteum and underlying cortex, diploetic bone undergoes rapid repair, granulations nourished by new-formed vessels from the diploetic circulation springing up and covering the site of the destructive process very rapidly; non-diploetic bone, on the contrary, undergoes repair very slowly, for the reason that it is entirely dependent on one vascular supply, that of the periosteum, which has been involved in the disease process and hence is not so well able to respond to the call for new vessels and nourishment.

Now consider briefly the steps in common to all acute purulent inflammations in the pars mastoidea, the avenue of infection of which is the tube and tympanum. Acute purulent infection of the cavum tympanicum, epitympanum and aditus causes acute inflammation of the mucoperiosteum, which swells enormously; the eustachian tube is closed and there is purulent matter under pressure in tympanum, attic and antrum. In writing of pus enclosed in the cavities of the middle ear under pressure, Körner says:

• The earlier this pressure is relieved and the freer the drainage, the better the prognosis for cure without bone-destruction. The later pressure is relieved and the less adequate the drainage, the oftener the bone and mucoperiosteum will partake in the destructive process. In case of inadequate drainage, the thin bony walls will suffer synchronous attack of the destructive process from both sides. By swelling of the mucoperiosteum the small mouths of the tubes are easily closed off from the antrum, thus setting up a purulent process apart in such cells, while antrum and cavum tympani may undergo complete healing.

The previously existent cavities of the tympanum and mastoid are completely filled by swollen mucoperiosteum, the circulation of which is so interfered with by counter-pressure of the non-yielding bony walls, within which is found insufficient space for swelling, as to result in back-pressure and consequent epimembranous and subperiosteal serum extravasation. The infecting organisms multiply rapidly under such circumstances and under the influence of their life-products on the tissues decalcification and peptonization begin in the bone.

Up to this point the pathologic changes described are common to non-diploetic, diploetic and mixed pneumatic and diploetic types of mastoid process. In the non-diploetic mastoid process the first bony tissues to suffer are the thin walls of pneumatic cells, which are solely dependent on the periosteal circulation for nourishment and protection. Deprived of this, they undergo rapid destruction, and abscess formation occurs. The abscess enlarges in all directions until some portion of bone is encountered possessed of sufficient resistance to withstand the action of the infectious products. Such resistance can lie only in bone whose circulation is unimpaired—or, in other words, bone not solely dependent for its vascular supply on the infected mucoperiosteum. In such bone, response to the call on the resources of the body for serum and phagocytic protection is prompt; serum protectives in excess flush the part, cohorts of phagocytes assemble, Nature's ramparts in the shape of delimiting organized exudates are thrown up and the progress of the destructive process in this direction is arrested. Then attempts at repair become evident almost at once in the form of granulation tissue, new-formed vessels extending into the exudate, organization and cell replacement, having their source of nourishment in the unimpaired vascular supply of the bone where the destructive process has been arrested. To repeat, an arrest in the progress of a destructive suppurative process in the mastoid may occur when it reaches bone possessed of an unimpaired vascular supply independent of the mucoperiosteal lining of the pars mastoidea. In the type of mastoid process now under discussion (the non-diploetic) the cortex would be the first bone encountered capable of such resistance. In a mastoid process of this type, abscess formation may proceed from one, or more than one nidus, separate abscesses forming at first, breaking into one another as their centrifugal enlargement goes on. Thus the whole processus mastoideus from zygomatic cells to tip cells may be converted into one or more cavities filled with pus and products of bone destruction. The mucoperiosteum by reason of its vascular content is able to withstand the acute inflammatory attack better than the bone, and it is unusual to find mucoperiosteal sloughing even in the presence of wide-spread destruction of bone. In non-diploetic mastoid processes with very thin or deliquescent cortical areas, it not infrequently occurs that the bone destruction proceeds to the external periosteum before the arresting of the purulent process takes place. In such cases pus under pressure finds its way through the bony cortex and intra- or extracranial subperiosteal abscess results (Bezold's perforating abscess, epimastoid abscess, epidural abscess, perisinus abscess, etc.).

In diploetic mastoid processes containing only one or perhaps two pneumatic spaces, genuine abscess formation does not take place. This type of mastoid process is only very rarely the seat of inflammatory disease of any kind. Acute purulent invasion of such a mastoid results in either one of two radically different pathologic con-

ditions. Ordinarily the bone itself escapes infection, true empyema antri being the condition. When the diploetic bone surrounding the antrum does become affected by the purulent inflammation, acute osteomyelitis of the mastoid process occurs. Acute osteomyelitis is extremely rare in the mastoid process and occurs only in young subjects of low vitality, in whom it is very apt to prove fatal. In spite of radical pathologic differences, differential diagnosis between acute osteomyelitis and abscess is not easily made.

There remains the mixed type of processus mastoideus, partly pneumatic, partly diploetic, constituting about 38 per cent. of all. Of these about three-fourths are pneumatic except for 3 or 4 mm. of diploe at the tip, and about one-fourth are half pneumatic and half diploetic, according to Zuckerkandl, Schwartze, Zoja, Politzer and others.

In the mixed type of mastoid process, purulent inflammation effects the formation of small abscess cavities which may remain discrete or become confluent, at whose margins are found organized exudate and granulation tissue. This is almost the only condition in which granulation tissue is found at operation within the pars mastoidea during the course of acute mastoiditis. Most so-called "granulation tissue" found at operation is not true granulation tissue at all, but intensely inflamed and swollen mucoperiosteum.

Analysis of the sequence of changes during the ordinary course of acute purulent infection of the mastoid process fixes the ultimate responsibility for tissue destruction on structural peculiarities of the affected part: unyielding walls completely enclosing mucoperiosteum which undergoes enormous swelling within inadequate spaces, resulting in almost complete retention of inflammatory products because of occlusion of natural ways by the swollen mucosa—almost complete stagnation of circulation because of increased intramastoid pressure—serum-exudation—infiltration of tissues—decalcification of bone—peptonization of pulp—pus under pressure—absorption of toxic products into general circulation—systemic effects of absorbed toxins.

Unlike the mastoid spaces, the tympanic cavity is equipped with a safety appliance, the membrana tympani. This bulges or ruptures in the presence of increased intratympanic pressure, which obviously can never rise beyond the breaking-point of the membrana tympani. Relief of pressure by sufficiently wide opening of the membrana tympani affects the mucosa of the cavum tympani, aditus and antrum, resulting in rapid subsidence of swelling and increasingly better drainage of these cavities. The Germans say: Every acute middle-ear inflammation manifests a tendency to heal spontaneously in spite of all treatment.¹ It has been remarked by many observers, among whom Jacobson and Blau, Politzer and Neumann may be mentioned, that in many cases of acute abscess of the pars mastoidea no communication exists between the abscess cavity and the antrum; and further, that healing takes place in these cases much more rapidly when the antrum is not opened. Many writers have corroborated the observation of Körner that during the course of acute mastoid abscess formation the antrum and cavum tympani may undergo complete healing as the result of adequate drainage through the membrana tympani.

What general surgical principles apply to the operative treatment of these various conditions? Free drain-

1. Jede akute Mittelohrentzündung zeigt die Tendenz sich spontan aufzuheilen, trotz aller Behandlung.

age of the tympanum, aditus and antrum by means of a large incision in the membrana tympani, kept freely open by re-incision as often as necessary, should be regarded as the first and most urgent indication. This cannot be emphasized more strongly than it already has been by those who have spoken with an authority I do not possess, yet again and again in my practice I have encountered cases of acute tympanomastoiditis in which actual "puncture" of the membrana has been made. A "puncture" is practically no better than no opening, as it is sure to be closed up almost immediately by the edematous mucosa of the tympanum.

The local depletion of the tympanic mucosa incidental to free incision is a desideratum hardly second to giving exit to retained purulent matter. True empyema antri will need no further surgical procedure in order to secure complete healing as a rule.

Acute mastoid abscess should be opened freely and drained thoroughly as early as possible. Acute osteomyelitis of the processus mastoideus should be laid wide open and treated as an open wound until completely closed from the depths by healthy granulation tissue.

Diagnosis between abscess and acute osteomyelitis may not be made in many cases; it is possible to overlook a cell containing infectious material unless the operator makes a complete exenteration of the processus mastoideus from tip to zygoma via the antrum. Nevertheless I believe that complete exenteration as very widely practiced and advocated to-day, whether by chisel and gouge, burr, rongeur or curet, for any form of acute purulent mastoiditis, is inconsistent with sound surgical principles. I have witnessed many operations for the relief of acute inflammation of the mastoid process at the hands of technically skilled operators who did not cease their operative ministrations until they had encompassed a thorough removal of every visible vestige of intracortical tissue, leaving the exenterated inner cortex from tip to antrum and upward to zygoma as smooth as a billiard-ball, when as a matter of fact their services to the patient for the last thirty to forty-five minutes of the operation were of a nature to increase liability to serious internal ear and intracranial complications, as well as to render healing as difficult as possible rather than to promote it.

In the course of healing after such operative treatment, the cavity must first fill up by granulation. The granulations must have their origin in vascular supply not incapacitated by disease or operation. The inner cortex, denuded of every vessel-bearing tissue, has only a very minute haversian system by which to transmit nourishment from the circulation of its remaining periosteum for the growth of new tissue; the inner antral wall, non-diploetic and bare of mucoperiosteum, is incapable of granulation. These surfaces remain almost as smooth as the operator left them until overspread by extensions of granulation tissue originating at the wound margins, which carry down with them their own source of nourishment and tissue-repair in the form of new-grown vessels, ultimately reaching and covering the antral wall. Then, and not until then, can epithelial extensions from the mucosa of the aditus find foothold in the antrum. During all this process, which consumes weeks, the wound remains open practically to the aditus, while at the wound margins the granulations will have become so exuberant as to necessitate repeated destructions. Not until the antral walls are epithelialized is the wound converted from an antral fistula to a granulating wound filling up from the bottom. From

four to eight weeks elapse between operation and final cicatrization. This is not the end, however. Contraction goes on apace in the new-formed cicatricial tissues and ultimately there exists, at the end of the aditus, a "step-off" cavity much larger than the original antrum, not lined with mucoperiosteum, but with an epithelialized cicatricial basement-layer poor in blood- and lymph-vessels, lacking entirely the absorption mechanism peculiar to the endantral periosteomucosa, a cavity poorly drained as compared with its predecessor and, by reason of poorer drainage and lack of high absorptive efficiency and rich vascular supply, peculiarly defenseless in the presence of a reinfection.

Too much stress has been laid on the danger of failing to clean out thoroughly every pocket of pus when operating for relief of acute purulent mastoiditis. In empyema antri this danger practically does not exist at all. In acute osteomyelitis the conservative surgery of open-wound treatment involves allowing the separation of viable from non-viable diseased tissues by necrobiosis or necrosis and the removal of the latter in the form of pus, slough or sequestrum in the natural course of dressing the wound. It is not regarded as possible or desirable, in dealing with acute osteomyelitis, to effect removal of all infected bone at operation, nor is it considered a menace to possible recovery to overlook pockets of pus or areas of infection. Furthermore, no surgical procedure whatsoever can prevent the reinfection of the whole surface of the wound within the twenty-four hours following operation.

In acute abscess of the mastoid process, the prime indications are free drainage and relief of pressure, just as in the case of abscess in any other locality. Failure to clean out pockets of pus during the course of the operation which meets these two indications constitutes no potential danger to the patient, whereas overzealous removal of tissue wide of the abscess cavity limits does constitute very grave potential danger, in that it involves destruction of a safeguard the importance of which to the patient cannot be overestimated, namely, the bulwarks of organized inflammatory exudate which Nature throws up, completely surrounding any such circumscribed purulent infection, obstructing far more effectively than any device of man egress from the septic focus of toxins into the general circulation, and of micro-organisms into the neighboring tissues and vessels. The vascular anastomoses between the circulation of the pars mastoidea and that of the meninges and internal ear render extension of infection from an acute mastoid abscess into these danger zones more likely after operation involving the destruction of Nature's barriers than after operation leaving these inviolate.

The second indication, therefore, in the surgical treatment of acute purulent mastoiditis is to make sufficiently wide removal of the outer cortex and intercellular lamellæ to make certain of free drainage and relief of pressure. In a non-diploetic mastoid process, this removal should extend from the uppermost cells downward to the tip and backward to the rearmost cells; in semidiploetic, from the uppermost cells to the inferior and posterior limits of pneumatic cells.

Opening of the antrum should be dependent entirely on the existence of specific indication for such procedure. General indications for opening the antrum are the following:

"1. When bone intervening between abscess cavity and antrum is found by the probe to be softened and mushy.

"2. When the swollen lining of the abscess cavity protrudes directly into the antrum.

"3. When direct communication exists between abscess cavity and antrum.

"4. When, in addition to symptoms of mastoid abscess, symptoms of meningeal irritation are present.

"5. When, after simple opening of abscess cavity, no amelioration of pain in the ear follows, or when symptoms of cerebral nature present suggesting extradural abscess or meningitis.

"6. When in the presence of normal healing after simple opening profuse discharge from the ear persists for several weeks."

Should it be decided to open the antrum, either at first operation or later, the operator should never do more than make free opening into this cavity. The use of the gouge or curet in the antrum is never indicated and should never be made for at least two main reasons, viz:

No matter how badly swollen and inflamed the endocranial mucoperiosteum may have been, with the subsidence of the acute inflammation consequent on free drainage, it will return to its former condition with practically no impairment of structure or function, a postoperative result not possible after the curet has been used in the antrum. More important even is the second reason, that the curet traumatizes the bony wall of the vestibule and tegmen, and increases the possibility of the extension of infection to the internal ear and meninges.

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ABSTRACT OF DISCUSSION

DR. NORVAL H. PIERCE, Chicago: The idea of the feasibility of opening the antrum instead of entirely cleaning out the mastoid bone to the inner surface is not new. In 1882, Hessler wrote an article in the *Archiv für Ohrenheilkunde*, in which he supported the theory that it is unnecessary to open the antrum or clean out entirely the mastoid cells in the majority of acute cases. As to opening the antrum I agree with Dr. Lewis that it is much better if possible to avoid opening the mastoid antrum and for the reason that he has given. If we take away the outer and posterior walls of the antrum we leave only the inner wall clothed with its mucoperiosteum. The surrounding defenseless bone is very poor in blood-supply and granulation tissue develops relatively slowly from this portion, and a large cavity is left, much larger than the original antrum, that is clothed or nourished by a low grade of mucoperiosteum, which is very liable to repeated inflammations, and the recurring mastoiditis that we so often see, especially in children, is due to this enormous cavity buried in the depths of the wound and the additional invasions following influenza and colds. We cannot gain access to the antrum and drain it and wash out the middle ear without running the risk of the formation of this large poorly nourished cess-pool that occurs from taking away the outer and posterior wall. In a certain number of cases recently I have been able to enter the antrum from below, leaving the outer posterior walls of the antrum, making an opening the size of a pea into the antrum, through which it may be washed out and with it the cavum tympanum. In that way we retain the natural shape of the antrum and do not have that large cavity which occurs from the other way of operating. Regarding the taking away of the osseous structures down to the inner cavity of the skull, we are between the devil and the deep sea.

There is not the slightest doubt but that the vast majority of the patients would do better if we simply took away the outer wall of the mastoid as far as the cells reach, back to the occipital bone, upward to the zygoma, scraping away the softened tissue that probably never would regenerate; but, if we invariably follow this

course we are bound to leave certain dangerous foci about the sigmoid sinus; there is no way of avoiding it. To examine the mastoid thoroughly and find out if there are any of these dangerous foci, it is necessary to exenterate the mastoid process; if we want to run the risk of some of these concealed foci remaining, I suppose that 90 per cent. will heal quickly by the simpler method.

DR. CALVIN R. ELWOOD, Menominee, Mich.: It is not a pleasant task, especially for one who does not open the mastoid as often as he should, to keep in best practice to work with chisel and gouge in such close proximity to the cranial cavity, and, if in favorable cases, the desired result can be as safely and surely attained by simply removing the cortex and exposing the superficial cells, without the anxiety which attends the opening of the antrum, it would be fine.

It may be assumed that all are agreed concerning the source of infection—an extension of an infectious process from the middle ear through the aditus to the antrum, and thence to the ramifications of the mastoid cells. The walls of these cells—especially the non-diploetic type—are poorly nourished, being dependent on the mucoperiosteum along which the infectious process may spread by pin-head prolongations to remote cells. This mucoperiosteum becomes greatly swollen and easily falls prey to bacterial action, in which condition it would be logical to suppose it would sufficiently deteriorate to leave the underlying bone without protection or nourishment. Such fragile bony partitions would naturally become necrotic and necessarily be thrown off as sequestra before repair can take place. We cannot tell definitely the condition of the mastoid from observations previous to surgery. We cannot tell at the time of operation the viability of the osseous structure, while experience has taught that dead bone left behind means delayed repair, if not more serious trouble. Therefore, when surgery is necessary why not do it thoroughly? I do not leave the surface as smooth as a "billiard ball" believing as Beck has pointed out, that the burr, probably through heat generated, delays repair. I do, however, endeavor by use of the curet to leave a perfectly clean cavity without a cell unopened, believing that thereby I hasten the healing process both by granulation from the bottom and sides and the periosteum above.

DR. C. F. WELTY, San Francisco: So long as we have a method in which we can eliminate all the possible source of infection it seems to me there is absolutely no question left as to the course we should pursue. We may be a little longer in bringing our cases to complete healing, there may be a little more depression, but no such deformity as Dr. Lewis speaks of in his paper have I seen. In about a hundred acute cases, only one patient did not recover and required a radical mastoid afterward. The others recovered without secondary operations. That is a sufficient number to show that there is something worth while in the procedure of going down to hard bone. It is not possible to have such results by being less thorough. Dr. Lewis himself says that, if you have profuse discharge at the end of two weeks, it is better to open the antrum; there you are subjecting the patient to a second operation which should not have been necessary at all. I recall a patient seen in consultation who had been operated on and continued to have a small amount of fever and deep-seated pain. I insisted that there must be some cells that had not been uncovered and when these were eliminated the patient recovered speedily. On three or four occasions I have found cells almost on the inner end of the petrous portion of the temporal bone.

DR. G. F. COTT, Buffalo: When we have a virulent infection due to streptococci or colon bacilli, then I think we must open up freely in every case. When the infection is a mild one and the ear is dry before or at the time of operation, then it is not necessary in any case to open the antrum. When you are sure that you have the cells cleaned out and that no more pus is present, then, instead of packing, close up the wound and heal by blood-clot and the patient can go home in three or four days. If a focus is left it is no trouble to take out the stitches and clean it out. I have had one

patient go home in three days perfectly healed. The result remained good for I observed him for several weeks.

Dr. SEYMOUR OPPENHEIMER, New York: What proportion of cases in which the antrum is left intact require reoperation and in what proportion of cases in which closure has been successful has there been a continuation of discharge from the ear? I think the proposition a very retrograde one. Dr. Lewis says that to open the antrum is not surgical; I think just the opposite. I am quite satisfied that a great many cases that require reoperation are cases in which the mastoid antrum has not been opened sufficiently. The mastoid antrum bears the brunt of the burden and if the proposition were placed before me to open the antrum and not do anything else or to leave the antrum unopened and clean out the rest, I should accept the former proposition.

Dr. T. R. CHAMBERS, Jersey City: I second what Dr. Oppenheimer has said and enter a protest against the position taken by Dr. Lewis. I am amazed at Dr. Pierce. He knows that in every mastoid operation you should open the antrum. Many times we find a dry antrum and we do not curet, of course, or do a radical operation.

Dr. B. A. RANDALL, Philadelphia: The question must depend, I think, a little on the definition of osteomyelitis. Those of us who have seen cases of genuine temporal-bone osteomyelitis, such as reported in this Section by Dr. C. W. Richardson, will never be in doubt about it. It is not true in a clinical sense that because a little of the contents of the diploetic bone is involved, there must be osteomyelitis. The middle ear involves all the pneumatic cavities. The antrum, which so many speak of as mastoid, is the posterior portion of the tympanum and as such is as well able to take care of itself as the tympanum proper or the eustachian tube. As well say you must curet the eustachian tube as to say that you must always curet the antrum and open all the cells. The pneumatic cells may extend clear to the sella turcica in some instances. We must realize that these operative cases offer an infinite variety and we can lay down for the beginner no rule that will make the matter an easy one, so that he can do it as well as the expert who has had a thousand cases or more. If we are to do good surgery we must first decide whether we are dealing with empyema or caries. I hold that empyema of the mastoid can resolve successfully and safely with no bad results, but I do not advise the younger man to trust that. If you are not sure it is better to operate thoroughly; it is safer, but there are many cases that can clear up just as does many an empyema of the antrum of Highmore. When you have caries to deal with, it is a totally different proposition. Tissue which is no longer viable must be taken away. The expert recognizes this by sense of touch with his curet; the beginner who has this yet to learn must risk overdoing a little rather than slight his work.

Dr. E. R. LEWIS, Dubuque: I am afraid I have been misunderstood by some; these men will get my ideas more clearly by reading the paper. One speaker alluded to my not opening the antrum, but I say that the man who opens the antrum without specific reason makes a surgical error; and he who, with or without specific reason for opening the antrum, curets its mucoperiosteum, has, without any justification, destroyed what is of enormous importance to the patient, a lymphatic organ which cannot regenerate. I wanted to bring out particularly that the mucoperiosteum is an important organ, possessing functions of great value to the individual, and that unnecessary surgical destruction of any part of it is an unjustifiable procedure. Dr. Oppenheimer asks for something with which I cannot furnish him. I have not a large clinical practice and corps of clinical assistants to tabulate the results of my work. I have been practicing otology for eleven years in a town of 40,000 and have had my share of mastoid work; all the surgery has been based on the principles here set forth. I have not had one patient with an acute case who has been under my care from the outset develop intracranial complication, chronic suppuration, or internal ear disease; and not one of my cases has terminated fatally.

TONSIL DISSECTOR, TONSIL-GRASPING FORCEPS, TONSIL HEMORRHAGE CLAMP

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One end of the dissector (Fig. 1) is a retractor for the anterior pillar while applying forceps, and while inspecting the cavity from which the tonsil was removed. The other end is for dissecting out the tonsil. The edge is neither dull nor sharp, but rather an edge that is produced by the use of a fairly rough oilstone, and will cut when given a quick stroke with some pressure and will act as a dull dissector when used without much force.

The forceps (Fig. 2), from the nature of its action, buries itself deeply in the tonsillar tissue under all rea-

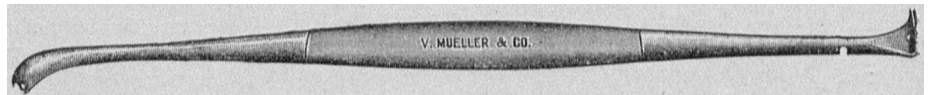


Fig. 1.—Dissector.

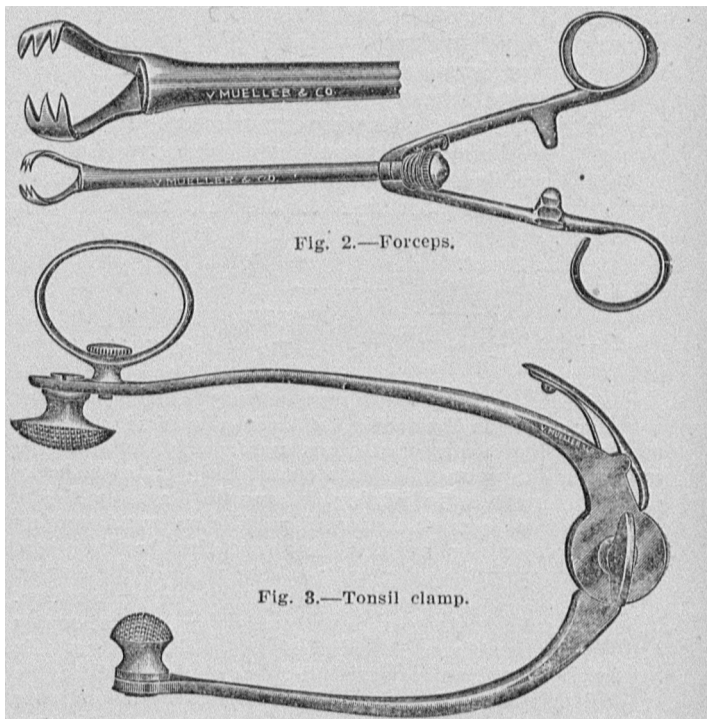


Fig. 2.—Forceps.

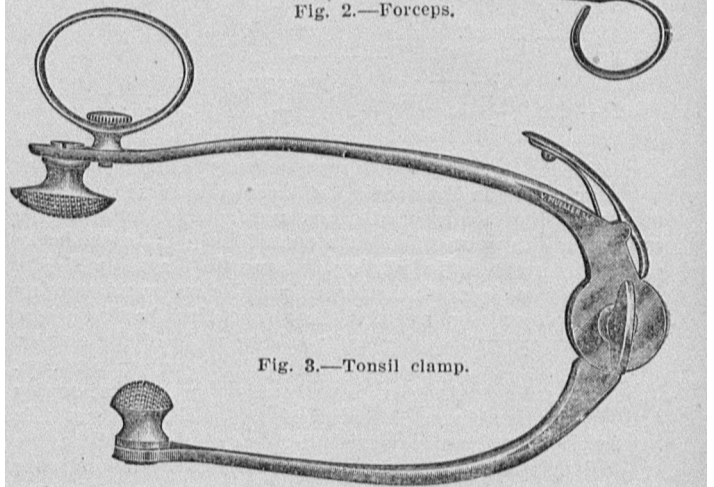


Fig. 3.—Tonsil clamp.

sonable conditions. The forceps is laid against the tonsil with the jaws open, one jaw at the inferior end of the tonsil, the other jaw crowded up into the supratonsillar fossa, and then the jaws are pushed into the tonsil as the handle is locked.

I have used these two instruments for five years. They have never been recorded; but now that the dealers are importing the dissector by the gross (most of which are incorrect models) I feel compelled to offer the instruments.

The tonsil clamp (Fig. 3) is intended for a double purpose; first, as a method to control hemorrhage while removing the second tonsil if the blood from the first one interferes; for this purpose there is a ring fitted to the outside arm through which the assistant can slip his finger and by having the clamp half open exert pressure in the fossa and still be out of the way; second, as a tonsil hemostat clamp to be placed in position and remain for a reasonable time to check prolonged hemorrhage.

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