

have been made, as already quoted, by Bing and others that dulness at the right apex can be caused by the swelling of bronchial glands.

In 100 cases of this investigation of questionable tuberculosis, it was shown that in fifteen there was no tuberculosis and of twenty-four diagnosed as tuberculosis, seventeen proved negative. In these thirty-two negative patients the glands were shown to be enlarged. In eighty patients of 100 diagnosed as questionable and in twenty-four diagnosed as positive cases the apices were the parts under consideration. Of the eighty, the right apex was questioned in thirty-two, the left in eight and both in forty cases. In five cases of enlarged questionable aneurysm of the aorta, there proved to be enlarged glands present and no aneurysm. Therefore, we have apparently found dulness in a number of cases at the apices and especially at the right apex where no congestion or infiltration was found, but where enlarged thoracic or bronchial glands were evident. Considering that of 147 patients with questionable or positive cases of tuberculosis or other diseases, there were glands on the right side in fifty, on the left in seventeen, on both sides in forty-four and in the mediastinum—that is glands above the roots of the lungs—in thirty-six cases, we can state that glands do occur more often on the right side than on the left and in conjunction with the right apex dulness. In the examination of these cases it was difficult to determine the presence of glands or their number when there was either tuberculosis, congestion or some such disease extending over a great part of the chest and consequently overshadowing the glands. It does not, therefore, follow that when glands have been seen on the left side, and not on the right, that they may not, however, be present there also. It is a question also whether the statement which Bing makes that bronchial glands occur mostly in young children is absolutely correct. In this series of cases, 118 patients were adults, that is, above 20 years of age. It is a more difficult matter to percuss an adult chest for bronchial glands than a child's. In the adult chest we must take into account development due to occupation, habits, etc. On the other hand, children show a so-called physiologic dulness at the right apex which may prejudice one in favor of bronchial glands. In fluoroscopic examinations a child's chest gives a greater opportunity to discover bronchial glands than an adult's. Still, of 145 patients, only twenty-seven with thoracic glands were below 20 years of age. Another group of cases, which is not included in this present paper, but which may have bearing on the consideration of bronchial or mediastinal glands, is that in which there is obscurity of the space behind the heart and aortic vessels. On account of the more questionable nature of this obscurity, these cases were not investigated.

Sukiennikow states that the prevailing position of the lymph glands is anterolateral, especially the tracheo-bronchial group, and gives this as a reason for the difficulty that is encountered in diagnosing them, when enlarged, by percussion. Osler's statement is broader still. He says that unless the glands are large enough to cause compression of lung tissue, he doubts whether the ordinary bronchial adenopathy ever can be determined by percussion in the upper interscapular region.

One other difficulty was the inability to tell in certain obscure cases whether a gland was single or whether two or three were adherent. From our anatomic knowledge, it is very likely that in the case of bronchial glands there were several instead of one.

Usually, where the glands appeared on both sides the apices were also affected, and in a large number of questionable cases of tuberculosis the glands were either single or on one side.

The conclusion is that in a number of cases the glands were enlarged where tuberculosis was either not present or suspected, and were of sufficient importance to either produce certain physical signs confused with tuberculosis or were the probable cause of a tuberculin reaction.

#### CONCLUSIONS

1. Enlarged glands occur more frequently on the right side than on the left.
2. Enlarged glands may cause the signs which are often considered as those of early apical tuberculosis. This has been explained in anatomic and physiologic terms.
3. Enlarged glands occur in both tuberculous and non-tuberculous patients and probably occur as frequently in adults as in children.
4. Positive tuberculin reactions may, therefore, in negative tuberculous cases, be due to enlarged glands in the mediastinum, etc., when apical signs are not present.
5. The results of this investigation demonstrate the common failure to diagnose the presence of mediastinal or bronchial glands, and show the importance of emphasizing the more careful examination of so-called early tuberculosis cases.

In addition to the articles previously cited the following references will be found of interest:

Bosman: *Nederl. Tijdschr. v. Geneesk.*, No. 15, 1910.  
Walsh: *Tr. Nat. Assn. Study and Prev. of Tuberc.*, Sixth Ann. Meet., pp. 166, 324.

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### IMPROVED TECHNIC OF THE THIERSCH GRAFT FOLLOWING THE RADICAL EAR OPERATION \*

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In the preliminary report of the improved technic of the Thiersch graft following the radical mastoid operation,<sup>1</sup> I reported a series of eighteen cases, in which graft was applied four days following operation, and said that never before had such a series of cases been brought to healing in such a short time and that never before had the hearing been so uniformly good (Table 1).

I shall here report a series of twelve cases in which I operated. Graft was applied at the time of operation. This report will be even better than the former, besides eliminating a second operation that consumes almost as much time as the original mastoid operation, while the original operation is only lengthened about fifteen minutes. This of itself, I consider a great boon for the procedure; in fact, it makes the radical ear operation a simple, concise and precise operative procedure, attended with no risk to life whatsoever, providing the cochlea and canals are intact (Table 2).

The further improvement of the technic will consist in a more thorough removal of the mucous membrane of the tube, the mucous membrane of the inferior part of

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1. *Ann. Otol., Rhinol. and Laryngol.*, March, 1911.

the tympanic cavity, and the cutting away of the inferior bony meatus, so that it is absolutely on a plane with the floor of the tympanic cavity. I shall repeat the detailed technic of this operative procedure.

Every individual cell is destroyed until hard bone is encountered, or the dura, sinus or nerve uncovered. This final destruction of cancellous bone is best accomplished by me with a hand burr; it can be done with a burr driven by electricity, however, I prefer such burr for the bone of greater density. It is very essential that all the uneven surfaces be made perfectly smooth.

The outer part of the bony meatus must be removed sufficiently to be on a horizontal plane with the floor of the tympanic cavity. The posterior bony wall must be cut down to the floor of the newly-made bony meatus. By this procedure more room is gained and the pocket which was formed by the tympanic cavity has been eliminated. In the removal of the posterior bony meatus

Everything said so far, while absolutely important in every radical operation, is much more important when Thiersch grafts are to be applied, as any infection that may remain in the bone will ultimately destroy the graft and one will fail to accomplish what he set out to do.

The Neumann plastic should be made in preference to all others for this particular procedure, the upper and lower flap, sutured in place and the point of the V sutured to the auricle. The sutures to be used in holding the V part of the plastic should be catgut. The sutures for the upper and lower flap had better be catgut, as the use of other sutures, if allowed to remain, may or may not cause trouble in the after treatment of the case.

At this time I use hot saline solution as a hemostatic agent inspecting the cavity from time to time; finally, to reassure myself, I use peroxid of hydrogen several times. When I am satisfied beyond a question of doubt that everything is away, I put in gauze saturated with

TABLE 1.—EIGHTEEN CASES OF RADICAL EAR OPERATION BY IMPROVED THIERSCH GRAFT

Case No.	Age	Sex	Discharge	Operative Findings	Hearing Before and After Operation	Duration of After-Treatment (weeks)*	
104	26	F.	Childhood.	Cholesteatoma.	Whisper, 6 ins.	Whisper, 6 ft.	Six.
105	14	M.	Two yrs.	Cholesteatoma.	Speech, water, 6 ft.	Speech, water, 15 ft.	Four.
107	28	M.	Childhood.	Cholesteatoma.	Whisper, 3 ft.	Whisper, 3 ft.	Six.
108	10	F.	Childhood.	Cholesteatoma.	Whis'r, water, 12 ft.	Whis'r, water, 26 ft.	Four.
109	10	M.	Childhood.	Cholesteatoma.	Whisper, 1 ft.	Whisper, 26 ft.	Four.
110	14	M.	Childhood.	Cholesteatoma.	Whisper, 1 ft.	Whisper, 25 ft.	Four.
111	25	M.	Two yrs.	Cholesteatoma.	Whis'r, paper, 3 ins.	Whisper, 6 ft.	Six.
113	33	F.	Childhood.	Cholesteatoma.	Whis'r, paper, 3 ft.	Whis'r, paper, 20 ft.	Three.
115	26	M.	One yr.	Cholesteatoma.	Whis'r, paper, 15 ft.	Whis'r, paper, 26 ft.	Four.
117	16	M.	Childhood.	Caries.	Whis'r, paper, 1 ft.	Whis'r, paper, 6 ft.	Four.
118	12	M.	Five yrs.	Caries.	Speech, 3 ft.	Whis'r, chair, 25 ft.	Three.
119	16	M.	Two yrs.	Caries.	Whisper, 25 ft.	Whisper, 3 ft.	Four.
120	9	M.	Seven yrs.	Cholesteatoma.	Whisper, 1 ft.	Whisper, 6 ft.	Three.
121	29	F.	Childhood.	Caries.	Whisper, 6 ins.	Speech, 1 ft.	Three.
122	29	F.	Childhood.	Caries.	Whisper, 3 ft.	Speech, 3 ft.	Four.
123	4	F.	Three and one-half yrs.	Cholesteatoma.		Good.	Four.
124	30	M.	Childhood.	Cholesteatoma.	Whis'r, chair, 2 ft.	Whis'r, chair, 15 ft.	Five.
125	18	F.	Ten yrs.	Cholesteatoma.	Speech, 2 ft.	Whisper, 25 ft.	Four.

Duration of after-treatment:

In 4 cases 3 weeks.  
In 10 cases 4 weeks.

In 1 case 5 weeks.  
In 3 cases 6 weeks.

\* The duration of the after-treatment dates from the day of the radical mastoid operation and not from the day of the graft, which was four days later.

Hearing, following operation, for whisper:

In 6 cases 25 feet or more.  
In 3 cases 15 feet or more.  
In 3 cases 6 feet.

In 2 remained the same.  
In 1 case could not be measured, but good.

TABLE 2.—TWELVE CASES OF RADICAL EAR OPERATION

Case No.	Age	Sex	Duration	Operative Findings.	Hearing Before	After	Duration of After-Treatment (weeks)
127	21	M.	Childhood.	Caries.	Whisper.	Improved.	Three.
128	21	M.	Childhood.	Caries.	Whisper, 3 ft.	Improved.	Two.
129	31	M.	Childhood.	Caries.	Whisper, 6 ins.	Whisper, 25 ft.	Ten.
130	38	M.	Five yrs.	Caries.	Whisper, 6 ins.	Whisper, 18 ft.	Six.
131	20	F.	Childhood.	Caries.	Whisper, 3 ins.	Remnants.	Four.
132	46	M.	Childhood.	Caries.	Whisper, 2 ins.	Whisper, 15 ft.	Four.
133	34	F.	Fourteen yrs.	Negative.	Whisper, 3 ft.	Whisper, 26 ft.	Three and one-half.
134	17	M.	Eight yrs.	Caries.	Whisper, 6 ins.	Whisper, 6 ft.	Three and one-quarter.
135	9	M.	Three yrs.	Caries.	Whisper, 1 in.	Whisper, 4 ft.	Three and one-half.
136	7	F.	Infancy.	Caries.	Whisper, 3 ft.	Whisper, 25 ft.	Four.
137	17	M.	One yr.	Caries.	Whisper, 6 ft.	Whisper, 26 ft.	Three.
138	9	M.	Childhood.	Caries.	Whisper, 3 ft.	Not made.	Three.

and facial spur, great care must be exercised in not injuring the facial nerve. This is best avoided by chiseling the wall away with large chisels and working parallel to the nerve, so that in the event that the nerve is uncovered, it would not be cut. This particular point will enable the operator to remove more bone than any other with more safety to the facial; in fact, the facial will not be cut by an experienced operator.

The mucous membrane of the tympanic cavity must be entirely removed. I literally mean that after a very thorough inspection, none can be detected, at this place it will be necessary in most cases to use a hemostatic agent of some kind, as hot saline solution, hydrogen peroxid or epinephrin. Most careful attention must be directed to the tube in order to remove the mucous membrane thoroughly.

The tympanic wall should be so thoroughly removed by chisel and made smooth by burrs, so that the small searchers of Jansen's will not be arrested.

epinephrin (P. D. & Co.), this gauze is held in the cavity under pressure by an assistant, while the grafts are being prepared. At the time I begin my preparation of the ear plastic, the nurses are preparing the leg or part from which the grafts are to be taken. In this preparation, mercury bichlorid has never been used. Sterile salt solution used in excess, following all the other aseptic procedures.

I try to get about three or four grafts  $\frac{1}{2}$  inch wide by  $1\frac{1}{2}$  inches long, and some smaller ones,  $\frac{1}{4}$  inch by  $\frac{1}{2}$  inch. Some of the grafts may be lost in preparation or in applying them.

The Jansen spatula is used, grafts are taken from the razor directly to the spatula, all edges straightened and put aside for use. When grafts are in readiness the epinephrin tampon is removed from the ear. The cavity will be found to be absolutely dry and if not, more epinephrin must be used; the cavity must be free from oozing blood or the grafts will not adhere.

The first graft is fastened with a searcher into the tube, bringing it out over the floor of the tympanic cavity posteriorly; second superior to the first, brought back over facial into mastoid cavity. The third usually covers the remaining wall of the attic and antrum. The three which have been used are the larger ones. The uncovered areas that are left are covered by the remaining grafts, the one being selected that will cover the denuded area best. Small pledgets of cotton are now used to fix the grafts; they must be so small that they do not touch either surface while being put in place. The first one is put over and into the tube, the second firmly applied to the posterior inferior quadrant, the next over the stapes and so on until all the grafts are held well in place, so they will not be materially disturbed when a dry tampon is introduced. The size of this tampon will correspond to a piece of gauze 2 or 4 inches square. After the dry gauze, a similar piece of gauze is saturated with 0.5 per cent. solution of phenol (carbolic acid) in paraffin oil, U. S. P. (especially sterilized in 10 c.c. ampoules),<sup>1</sup> and packed within the mastoid cavity; after this a similar piece, larger or smaller as the occasion may demand, is used to fill the entire cavity made by the operation. The posterior wound is now closed in the usual manner. It will be found that an additional tampon by way of the meatus will assist materially in holding the plastic in the way intended, resulting in a very large meatus with cut surfaces all within the ear. This materially adds to the comfort of the patient, as well as preventing a contracted meatus. The usual outside dressing is used. The ear tampons are removed on the fourth day. If there is any difficulty or pain in the removal of the tampons, contrary to the ordinary teachings, hydrogen peroxid can be used in excess to soften and loosen them; this procedure will also aid in getting rid of the blood and stop bleeding, so that the small cotton fasteners that were put in to hold the grafts in place can be seen and taken away. I wish to add that it is quite important to know the number of small cotton balls that have been put in the ear to hold the grafts, otherwise one may be left which will cause trouble sooner or later.

In 50 per cent. of the cases one will look into a white cavity; in fact, all of them are white if one takes the time to stop the bleeding that comes from the inner surface of the soft parts which have been sutured and could not be covered with graft.

This is the improved technic of the Thiersch graft in the radical ear operation.

In fact, a graft never adheres to the tampons to be torn from its attachments. In some of the cases, the outer layer of epidermis will loosen in ten days or two weeks after they have been applied; they will always leave a delicate epidermis that will harden in a very short time. I hardly know how to account for the fact that, in some cases, the entire graft remains in place, while in others the outer layer comes away. The only explanation that I can offer is that, in some instances, the graft is too thick. This does not seem to be serious, however, as the cases heal in about the same time. Occasionally it will happen that granulation tissue makes its appearance when the edges of the graft are not in perfect apposition. They are very easily destroyed with the ring knife. At the following dressing, the denuded area will be completely dermatized.

Occasionally, excessive granulation tissue makes its appearance in the region of the plastic. This is removed with curet and packed tight with gauze saturated with

sterile liquid petrolatum. Contrary to the teachings of to-day, bichlorid of mercury is used to irrigate the cavity. This is necessary where there is an unusual amount of pus or odor from secretion. In other instances where there is more debris than should be, I always irrigate with the intratympanic cannula and under inspection, so that the force of the stream is directed to the particular spot that requires attention. I also irrigate with normal salt solution and boracic acid.

As has been said before, the oil dressing is removed in four days, or sooner if necessary. In two days a second dressing is made which includes an irrigation of bichlorid of mercury, 1-3000, and from this on, dressed daily until complete recovery. The particular reason for the bichlorid at the second dressing is to remove disagreeable odor, debris, or to see with more accuracy that all the cotton tampons have been removed.

The final procedure of every dressing is a thorough drying of the ear. After this, pulverized boracic acid is blown into the ear, single small pieces of gauze, 1/2 inch square, introduced into the ear, with a small roll of gauze fitting snugly into the outer meatus. As a rule, the bandage is left off in from ten to twelve days after the operation.

The majority of this series of twelve cases have been more or less complicated because of prior operations or existing labyrinth complications that added somewhat to the risk of operation. Some of the cases are quite out of the ordinary. In many of the cases, healthy dura was uncovered by the chisel and grafts used as described. In two instances dura with a granulating surface presented, the grafts covered everything but the granulating surface of the dura.

In conclusion, I wish to state that all cases of chronic suppurative otitis media (chronic after one year duration, nose and throat in order) are dangerous to the individual; all patients should be operated on, and all will recover if properly operated.

Second, the hearing will be improved in all cases, providing that the internal ear is intact as shown by the tuning fork examination.

Third, there is no danger associated with the operation provided that the labyrinth is intact. This latter statement is based on approximately two hundred radical mastoid operations.

#### CASE REPORTS

**CASE 127.—Patient.**—A man, aged 21, a laborer, had had discharge from the right ear since childhood. At the age of 15 the ear was operated for the first time, and he had three different operations since. He came to me with an acute exacerbation of a chronic suppuration, pain over the whole side of the head, especially over tip of the mastoid. For three weeks previously he had had repeated attacks of vertigo.

**Examination.**—Head on diseased side was sensitive to touch and especially over the tip of the mastoid. Temperature 101 F., surface temperature of mastoid more than that of other side. The mastoid cavity was filled with connective tissue, foul smelling pus and debris; denuded bone detected by a probe. Patient could not hear whisper, except with the 7-foot hearing tube. Weber to the opposite side. C, C, c, all negative. Watch on bone, negative. Neumann's alarm apparatus, positive. Intense vertigo, tinnitus, spontaneous nystagmus to the opposite side. Caloric reaction, positive; the cold water was continued for quite a while before the nystagmus was increased. Fistula symptom, negative. From the findings it must be concluded that the cochlea and canals were intact.

**Operative Findings.**—Large mass of organized connective tissue filling the greater part of the cavity made by previous mastoid operations. The whole tip of the mastoid was carious, caries of the zygomatic cells, as well as the overhanging walls

of the attic and antrum. My findings offer evidence that the last radical mastoid operation was not sufficiently complete to hope for a cure. Neumann plastic, grafts applied in the usual way. Dressing removed in six days, every graft adherent. Eleven days after operation every graft came away, leaving a very delicate epidermis which became white in a very short time. Between the grafts were small granulating areas that were covered in a few days by epithelium from the graft.

This patient was practically well two weeks after operation; however, there was a serous discharge that continued for a few days longer. I think this discharge was due to the sensitiveness of the new epidermis.

Hearing improved, absolutely dry in three weeks.

**CASE 128.—Patient.**—A man, aged 21, laborer, had had a discharge from ear since childhood, and had three mastoid operations, the ear always having discharged. About one week before I saw him, he began to complain of pain over the whole side of the head, and had such intense vertigo that he had fallen in the street three times during the last week.

**Examination.**—The whole side of head painful to pressure, extremely painful over tip of mastoid. Temperature 100 F.; surface temperature of the mastoid increased over the other side. Scar of previous operation; foul, offensive discharge, large mass of organized connective tissue, uncovered bone discovered by a probe. Weber to diseased ear. Whisper (paper), 3 feet. Rinne, negative. Schwabach shortened. Negative for low forks, positive for high. Watch on bone, positive. Vertigo. No spontaneous nystagmus. Caloric reaction positive, very much exaggerated with only a small amount of water (hypersensitive). Fistula symptom, negative.

**Operative Findings.**—Overhanging attic and antrum walls carious. Polypi in antrum, horizontal canal stood out quite prominently; considerable of the bone about it had been destroyed by caries; large amount of connective tissue and additional caries of the tip of mastoid.

Neumann plastic, grafts; cavity dressed in five days, all grafts found adherent. Eight days after operation one graft came away, leaving a delicate pinkish-white epidermis. Case entirely dry fifteen days following operation. Hearing improved—as to how much I cannot say, because the patient left the city during the next few days without my permission.

I attribute the rapid healing in these two cases to the fact that the patients had been operated on before and were not cured; from this fact the bone was oversupplied with blood which in turn nourished the grafts very quickly.

**CASE 129.—Patient.**—A man aged 31, capitalist, whose ears had been discharging since childhood, during the year previous to operation had felt pain back of right ear, with increasing severity. For the last three years he had had headache on diseased side of the head; during the last three months, vertigo following headache had kept him in bed for twelve hours at a stretch. During this time he had been taken home in a conveyance repeatedly, because of intense vertigo. The patient said that the pictures on the wall would jump; when eyes were closed he would feel the eyes jumping.

**Examination.**—Sensitive over tip of mastoid; entire destruction of drum membrane; hypertrophied tissue covering promontory; no great amount of pus, not much odor. Whisper, 6 inches. Weber to this ear. Rinne, negative. Schwabach, short. C', positive. C, negative. C', positive. Watch on bone, positive. Vertigo and tinnitus, spontaneous nystagmus, negative. Caloric reaction, positive (hypersensitive). Fistula symptom, negative.

**Operative Findings.**—Former fracture across mastoid and into attic and antral wall, making same irregular. This does not appear in the history at all (confirmed later by question). Sclerosed mastoid, sinus well forward, dura size of quarter uncovered. Facial uncovered by caries, horizontal canal stood out quite prominently surrounded by spicules of carious bone, caries being very deep posteriorly. Neumann plastic and primary graft.

Following operation the patient had considerable vertigo, nystagmus and headache; in fact he was not quite free from it

until the primary dressings were removed which was on the sixth day. All grafts were intact. Fourteen days after operation graft over exposed dura came away leaving the characteristic pinkish-white appearance; no vertigo, nystagmus or headache at this time. About ten days following operation a granulation appeared posteriorly, just under the facial nerve, on more careful investigation a fistula was found that was quite deep, this was repeatedly curetted and touched with silver nitrate in substance until it finally healed in ten weeks.

The ear was entirely epidermized at the end of three weeks with the exception of the fistula; the hearing at that time had been increased from a whisper at 6 inches to a whisper at 25 feet. The hearing at the time he was declared well was 25 feet.

I mention this case more or less in detail to show why it required so long to heal. Had I been sufficiently careful to find this fistula, the patient would have been entirely well in three weeks. It accentuates the very points I wish to emphasize, namely, that complete search must be made, and so long as the Jansen sound is arrested the operation is not complete.

**CASE 130.—Patient.**—A man, aged 38, laborer, had had intermittent discharge from the ear for the last three years; three weeks before operation he began to have pain in the ear and had frequent dizzy spells, though he never fell. A swelling appeared below mastoid about one week before I saw patient.

**Examination.**—No pain on pressure or percussion. Swelling below tip of mastoid (Bezold's mastoiditis), large granulating mass was filling up meatus; offensive discharge. Whisper 6 inches. Weber to both ears. Rinne, negative. No spontaneous nystagmus. Caloric reaction, positive.

**Operative Findings.**—Sclerosed mastoid; small blackened areas throughout his sclerosed mass of bone; dura uncovered. From the abscess cavity the whole tip could be outlined. Neumann plastic, graft. Hearing before, whisper 6 inches; after, 18 feet.

I cannot say why healing was so slow in this case.

**CASE 131.—Patient.**—A woman, aged 20, stenographer, had had discharge from the ear since childhood, and repeated attacks of facial erysipelas; also repeated attacks of vertigo for several years past.

**Examination.**—No pain or sensitiveness on pressure or percussion; entire destruction of membrum tympani; small granulation protruding from attic. Whisper, 3 inches. Weber to opposite ear (marked adhesive process in the other ear). Rinne, negative. C', positive. C, negative. C' positive. Watch on bone, positive. Vertigo, positive. Tinnitus, positive. Spontaneous nystagmus, negative. Caloric reaction, positive. Hearing 7-foot tube, whisper positive.

**Operative Findings.**—Caries of attic and antrum; dura uncovered, the size of two thumb-nails. Fistula of the oval window with a blackened margin about it, which demonstrates that it has existed for some time; a good-sized probe was introduced into the fistula. Neumann plastic, grafts in usual manner and closed.

First day after operation, everything satisfactory; second day, some vertigo. Third day, vertigo, nystagmus to the opposite side, vomited five times. Fourth day, dressing removed, not so much nystagmus; patient vomited twice. Grafts all adherent.

During the four days, the patient had no fever, the vertigo and nystagmus disappeared gradually. The patient left the hospital in ten days, well in twenty-eight days.

**Observations.**—My only careful examination of this patient was made nine months prior to operation. From the examination as made at that time, the cochlea and canals were intact, so that a radical ear operation would not have been attended with risk to the patient's life; but when I found a fistula and an old one at that, I felt sure there would be induced an acute exacerbation of the old labyrinth suppuration. However, the patient made an uninterrupted recovery. This patient should have had an operation on the labyrinth at the time of the ear operation, or no operation at all.

I relate this case in detail to accentuate the importance of repeated examinations, should the case not be operated within a few days.

At the time of examination the patient heard a whisper 3 inches; this was much reduced because of the opening of the vestibule. She still hears on this side but it is of no practical use. Had my labyrinth instruments been accessible, I would have destroyed the labyrinth at once; as they were not, I concluded the operation with a skin-graft. The patient made a good recovery which can be attributed to good luck rather than to modern otology.

**CASE 132.—Patient.**—A man, aged 46, a structural iron worker, had had discharge from both ears since childhood, had had pain repeatedly back of the ear, on both sides; attacks of vertigo increasing in frequency.

**Examination.**—Tenderness over the whole side of the head, especially over the mastoid, exquisitely sensitive over the tip. Temperature 101 F. Increased surface temperature of mastoid when compared with the other side. Pupils widely dilated and sluggish. The ear was filled with a mass of granulation tissue, foul discharge. Whisper, 2 inches. Weber to bad ear. Rinne, negative. Schwabach, normal. C', positive. C, negative. c', negative. Watch on bone, positive. Vertigo and tinnitus, positive. Spontaneous nystagmus, negative. Caloric reaction, positive. Fistula symptom, negative. Seven-foot hearing-tube whisper, positive.

**Operative Findings.**—Sclerosed mastoid, caries of attic and antral walls. Neumann plastic, graft and closed.

**Remarks.**—Skin-graft spatulae were forgotten and I applied the grafts from surface of round chisels. Patient entirely well twenty-eight days after operation. Whisper before operation 2 inches, after, 15 feet.

**CASE 133.—Patient.**—A woman, aged 34, was hooked by a cow when 3 years of age; the ear and scalp were severely injured. The ear discharged from this time for fourteen years, since this; two or three times a year it discharged for a day or two. Never had pain back of the ear or in the ear. When the ear stopped discharging, seventeen years ago, she began to have vertigo which lasted for some two years. There was no vertigo for a period of four or five years. Since that time there had been more or less at intervals, lasting as long as five days. For the last year she had scarcely been free from vertigo; there had been so much and it had been so severe that it has incapacitated her as a housewife. At times so dizzy she would fall; vertigo and attacks of vomiting which have lasted for several days. Intermittent tinnitus began at 14, for the last year preceding operation it was so severe that it annoyed patient very much, at times explosive in character.

**Examination.**—Marks of injury about ear and scalp, not sensitive to deep pressure or percussion. Drum membrane intact, hammer very much retracted, membrane shows marks of previous suppuration. Whisper, 3 feet. Weber to diseased ear. Rinne, negative. C', positive. C, positive. c', positive. Watch on bone, positive. Vertigo and tinnitus as described in history. Spontaneous nystagmus to the opposite side. Caloric reaction, positive. Equilibrium disturbances, positive. Fistula symptom, negative.

**Conclusions.**—From the fact that the discharge from the ear followed an accident, I was led to believe that there was either a possible fracture with a spicule of bone pressing on one or the other of the canals, or a possible mass (bony) pressing or pinching the membranous labyrinth, or lastly, an erosion induced by the chronic suppuration, such an erosion would be increasing in depth or magnitude. Such a picture could easily be drawn when one remembers that the patient said that she had a discharge from her ear two or three times during the year preceding operation and that it would last but a few days.

From this reasoning I concluded that a radical mastoid operation would relieve her of this distressing vertigo. Cerebellar tumor had been excluded by Drs. Newmark, Lennon and myself, as the only other condition that would be likely to produce such symptoms.

**Operative Findings.**—No fracture of temporal bone (more detailed history, discharge from ear started before accident). Sclerosed mastoid, otherwise healthy macroscopically, with the single exception that the facial nerve was uncovered by caries anteriorly, and that at this particular place there was an erosion or excavation. This latter condition was found only after very careful search; at the time of operation, I did not think it sufficient to cause so much trouble. However, it proved to be correct and the day after operation the patient said her vertigo was less.

Neumann plastic, grafts. Uninterrupted recovery. Hearing before operation, whisper 3 feet; after operation, whisper 26 feet. Healing, twenty-four days. Vertigo and spontaneous nystagmus entirely gone.

**CASE 134.—Patient.**—A school-boy, aged 17, had had a discharge from the ear for the last eight years. One year ago had pain deep in ear; no headache or vertigo.

**Examination.**—No pain on deep pressure or percussion. Complete destruction of drum membrane; foul, offensive discharge. Whisper, 6 inches. Weber to good ear. Rinne, negative. Schwabach, normal. C', positive. C, negative. c', positive. Watch on bone, negative. Tinnitus, positive. Vertigo, negative. Slight spontaneous nystagmus. Caloric reaction, positive (hypersensitive). Fistula symptom, negative. Seven-foot hearing-tube, positive.

**Operative Findings.**—Caries of the attic and antrum. Neumann plastic, graft, closed.

Hearing before operation, 6 inches. After operation, 6 feet. Duration of after treatment, twenty-four days.

**CASE 135.—Patient.**—A school-boy, aged 9, had had a discharging ear for several years past; never had pain back of ear or deep in ear.

**Examination.**—Painful over the tip of mastoid, granulation tissue filling meatus, foul, offensive discharge. Whisper, 1 inch. Weber to opposite ear. Rinne, negative. C', positive. C, positive. c', positive. Watch on bone negative. Vertigo and tinnitus, negative. Spontaneous nystagmus, positive. Caloric reaction, positive (hypersensitive). Fistula symptom, negative. Hearing-tube whisper, positive.

**Operative Findings.**—Attic and antrum were full of granulation tissue, no mastoid cells. Neumann plastic, graft, closed.

Hearing before operation, whisper 1 inch, after operation, 4 feet. Twenty-eight days, cured.

The reason there is not more improvement in this case is easily understood when one examines the fork findings prior to operation.

**CASE 136.—Patient.**—A girl, aged 7, had had a discharge from her ear "on and off" since 1 year old; six months previous to operation had an acute exacerbation, also considerable pain back of ear at that time.

**Examination.**—Whisper, 3 feet. Weber to bad ear. Rinne, negative. Schwabach, normal. C', positive. C, positive. c', positive. Watch on bone, positive. Vertigo and tinnitus, negative. Spontaneous nystagmus, negative. Caloric reaction, positive. Fistula symptom, positive. Hearing-tube, positive for whisper. Not painful on deep or superficial pressure; great amount of offensive discharge from ear; bulging of the posterosuperior wall, mass of granulations coming from above.

**Operative Findings.**—Pneumatic mastoid entirely destroyed by caries. Pyogenic membrane the size of a half dollar which pulsed when uncovered, looking very much like diseased dura. This cavity was almost as large as half an English walnut. The membrane must have been one-sixteenth or one-eighth of an inch in thickness and was more or less dense. The under part of the cavity was the dura mater which was covered by small granulations. The dura was uncovered until healthy dura made its appearance. Neumann plastic; grafts covering all but the diseased dura, closed.

Hearing before operation, whispering 3 feet, after operation, whisper 25 feet. Duration of after treatment twenty-eight days.

**CASE 137.—Patient.**—A school-boy, aged 17, had had a discharge from ear for three years previously.

**Examination.**—No tenderness on percussion or pressure over mastoid. Entire destruction of tympanic membrane. Small polypi coming from above; partial destruction of bony attic

wall. Whisper, 6 feet. Weber to diseased ear. Rinne, negative. Schwabach, normal. C', C, c', positive. Watch on bone, positive. Vertigo and tinnitus, negative. No spontaneous nystagmus. Caloric reaction, positive. Fistula symptom, negative.

**Operative Findings.**—Caries limited to the walls of the antrum. Dura covered by caries, the size of two thumb-nails, in the region of the attic. Neumann plastic, grafts over all, closed. Hearing before, whisper 6 feet, after, whisper 20 feet. Complete dermatization twenty-one days.

**CASE 138.—Patient.**—A school-boy, aged 9, had had discharge from left ear since infancy.

**Examination.**—Not painful on deep pressure or percussion over the mastoid. Foul-smelling discharge; entire destruction of drum membrane. Whisper, 3 feet. Weber to non-suppurating ear. Schwabach, normal. C', C, c', positive. Watch on bone, positive. Vertigo and tinnitus, positive. Spontaneous nystagmus to opposite side and same side, more to opposite side. Caloric reaction, positive. Equilibrium disturbances negative. Fistula symptom, negative.

**Operative Findings.**—Caries extending to tip of mastoid. Neumann plastic, grafts, closed in usual way. Dressed in four days, every graft adherent.

More nystagmus to either side than he had before operation. Did not speak of vertigo. Left hospital in eight days.

#### ABSTRACT OF DISCUSSION

**DR. HUGO FREY, Vienna, Austria:** The after-treatment of surgical operations is very important and any advance along that line must be welcome to us. Many do skin-grafting after the operation; very often, of course, not primarily but later on. In the clinic we have given up skin-grafting in these cases, because the results did not seem to be very satisfactory. Since I have been in this country I have seen a number of cases, especially in the hands of Dr. Welty, and I am induced to try skin-grafting again after the method advocated by him, because his cases have impressed me very much. Many of his patients show good hearing. It seems to me that the problem of the radical operation now is practically solved. But the question of the function after the radical operation has not been so well settled, as it seems to depend largely, not on the scars on the outer wall, but on the growth of the granulation tissue on the inner wall. Often we find considerable production of scar tissue in the inside as the result of operative work. It seems to me better to simplify matters by confining the healing process to the outer labyrinthine wall. The patients operated on in this way look better than when treated with simple plugging. It has been recommended to give up tamponading, but I must say the results then have not been so successful. The method of immediately tamponading the cavity with the patient's own tissue seems to be the method which will give the more favorable result and shorten the time, in comparison with the other methods. I find Dr. Welty did tamponading the first time only. It may be for this reason that the hearing function is so favorable after his operation.

**DR. H. B. GRAHAM, San Francisco:** My results in skin-grafting are about the same as those of Dr. Welty. The hearing in my patients is about the same as he has recorded. Alexander and Mackenzie, in Vienna, some two or three years ago made an examination of their patients in the polyclinic, as far as hearing was concerned. Whereas it was formerly thought there was a certain percentage of cases in which the hearing was made better by operation, they found that universally a year afterward the hearing was worse than before the operation. Dr. Welty has a good many cases in which he operated over a year ago, so that the lapse of time has evidently had no influence on the hearing in his patients, and he is to be congratulated on that point. Not only has the hearing been made better, but it has remained better. I think the after-treatment with the skin graft is just as long drawn out as the after-treatment in the other procedure. The patient is called healed in two or three weeks, but he has to be followed up for a long time after the operation. The

tube is the responsible factor, I think, in a good deal of this delay in healing after a skin-graft. Even after the healing of the cavity with epidermis, there is often still a discharge of pus, which comes from the tubal region. If the tube is washed out for two or three months the patient will eventually recover. But we must keep track of these patients for a month or possibly a year or even longer.

**DR. HENRY HORN, San Francisco:** The results of Dr. Welty are exceedingly interesting and the value of those results are just in proportion as they can be obtained by other men. The more witnesses the more convincing the conclusions appear. Dr. Graham has reported his cases. I have had, since I returned, only twelve cases of radical operation in which I could use skin-grafting and my results were uniformly good. The question arises, why are these results so good when men all over the world have tried skin-grafting only to give it up. Surgeons have already used petrolatum and oil and the application of pieces of cotton and various other methods somewhat similar to this have been applied in skin-grafting, but it seems that in this particular technic there is a fortunate combination and unless the operation is done exactly as described in the paper you will not get the same results. On looking into the wound after operation, it looks like an aseptic operation. The wound is practically healed when we take off the dressing. Of course, I do not agree with Dr. Graham at all when he says that the after-treatment is as difficult with the skin-grafting as it is otherwise. That is perfectly absurd. In fact, that is the most valuable part of this operation. One who has had to treat a nervous patient for a number of weeks by the older method can appreciate what a boon this technic is in the after-treatment.

There is one point yet to be solved, which would make this procedure an ideal one. In a few of my patients the entire cavity was practically healed at the first dressing. The exception is always in the region of the tube. In spite of most careful curettement with the Yankauer instruments, the closure of the tube is not always certain. I doubt very much if the grafts take in this cone-shaped cavity. On the other hand, I doubt very much if a graft could be spread across the cavity, thereby closing it off from the rest of the tympanum. My impression is that healing in this locality takes place by the filling in of granulations and the epidermization from the surrounding grafts. If this were not so and the technic was perfect, we should get a complete healing every time in about two weeks.

**DR. J. F. BARNHILL, Indianapolis:** I want to congratulate Dr. Welty on his results. They are certainly better than anything I have obtained. In regard to the hearing, granting that the grafts stick, I cannot understand why these patients should have better hearing than after natural epidermization. We know that after natural epidermization the patients do not hear so well as before the operation. Dr. Welty speaks of doing a smooth, clean operation and in that I agree with him, but it is often impossible to remove all of the disease. It is in my opinion unwise to guarantee this in any case. I have a specimen in which the cells go one-half inch deeper than the facial nerve and we know that the diseased cells often extend deep into the petrous portion of the temporal bone.

**DR. M. W. FREDRICK, San Francisco:** The brilliant results which Dr. Welty achieves have impressed me also, but I fear that, as in many other cases, their brilliancy will exceed their permanence. I object to the use of the word "cured" in this connection. I do not consider a patient cured until he can leave his physician and go wherever he chooses. Recently I have seen two or three patients operated on according to Dr. Welty's method, although they were not operated on by Dr. Welty. In all of these cases the resultant cavity was filled with a mass of debris and cholesteatomatous-like bodies that were removed with some difficulty. When a tissue that is foreign to the locality is used in repair one must expect these masses to form and to require attention several times a year. I prefer the somewhat more tedious process of allowing the cavity to obliterate itself, then the patient may be allowed to go at will.



DR. FRED STAUFFER, Salt Lake City: I would like to ask whether Dr. Welty selects his cases for this operation, and, if so, what kind of cases he selects. In our part of the country we have a great many cases of cholesteatoma, in which the dura and lateral sinus are often exposed, and in removing the diseased bone we often find that the facial nerve is exposed. In such cases the method Dr. Welty uses, of employing hydrogen peroxid and hot solutions, would cause paralysis of the facial nerve. It seems to me it would be difficult in some of these cases to make a skin-graft. I would like to know how he would treat such patients. I do not think his method would be applicable to all cases requiring operation.

DR. E. C. SEWALL, San Francisco: Before I heard Dr. Welty's communication before the San Francisco eye, ear, nose and throat surgeons some months ago, I had been using primary skin-grafts for a considerable length of time. At that meeting Dr. Welty made the statements he has made here, except that at that time he was doing his skin-grafting secondarily, and insisted that it should be done on the fourth day and never on the third or fifth. That evening I criticized his paper, because I felt that the readministration of an anesthetic is not desirable if it can be avoided. Since then Dr. Welty has adopted the primary skin-grafting. I have used the small pledgets which he recommends. He says that they should be counted and that is very necessary, but it is difficult to remove them by count, because they stick together and it is often difficult to know whether you have removed one, two or three of them. I have sometimes left some of those plugs and removed them later, to my chagrin. I found once after the third day a beginning facial paralysis. There was no paralysis immediately following the operation. It developed on the third day and was almost complete. On searching the cavity and removing some hidden pledgets, the paralysis gradually cleared up. There are certain objections to the applications of the grafts. I consider it absolutely unsurgical to do what Dr. Welty says, namely, to cover the exposed dura with skin-grafts. We all know that safety, after exposure of the dura, depends on the completeness of the exposure. If we make a puncture here we make a larger opening for safety. I am quite in sympathy with Dr. Barnhill's entire speech, in regard to facial paralysis, and more in sympathy with the point of view that there is danger in operating on a chronic suppurating middle ear. We will all get deaths if we operate often enough. The use of the cotton pledget is a difficulty. It is the best we have, but it seems to me it would be better if we had something else to use in applying the skin-grafts. I have even thought of something along the line of bismuth paste.

DR. C. F. WELTY, San Francisco: Of course, it is easy to find objections, but I have considered the various points brought up to-day and no doubt shall be able to answer the criticisms, if not in accordance with your notions, at least in accordance with my own. The only thing I have considered is the oiled dressing. In quite an extensive article Alexander and Mackenzie showed that all their patients have diminished hearing after one year. Now, the two series that I have shown here comprise thirty patients operated on in the last year, and in my report next year I expect to analyze the cases. I have patients who hear a whispered word 25 feet after more than a year. When I say that such results are better than anything before presented, you can readily understand my enthusiasm in this improved technic. The hearing is one of the important reasons that I present this particular improved technic. And the reason the hearing is good is that the cochlea is covered with a delicate epidermis. In the other process it is covered with cicatricial tissue from one-sixteenth to one-half inch thick. You can imagine what would result. In a series of thirty cases of this particular procedure the patients are all well. There have been relapses from the accumulation of debris, etc., and in that way pus may form and require care. A patient may require care once in a month, another once in two months and another once in a year. Much depends on the personality of the patient. In passing I will give you something that in my practice has worked very well. After clearing the ear of epidermis and

débris, provided there is no pus, mop the cavity out with oil. I have seen patients treated that way, after six or eight months, without the formation of new epidermis. In regard to facial paralysis I have had now eight cases of facial paralysis prior to operation, one in an acute case and seven in chronic cases. Of those patients six recovered and the patient who did not recover was unconscious forty-eight hours before he was operated on and died. I have had no case of facial paralysis following an acute or radical ear operation, except a case of temporary facial paralysis due to pressure, which disappeared in ten days. The after-treatment is concise and precise. You must dry your cavity and you must do it in a delicate way and not put in the gauze in a reckless manner. You will possibly spend more time in the after-treatment than in the after-treatment of the other class of cases. But your time is well spent, for in a few weeks your patient is well. Dr. Sewall said occasionally your patients will die. But remember what I said: If the labyrinth is intact you can do pretty much as you please and the patients will not die.

## THE RATIONAL TREATMENT OF FURUNCLES \*

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While the treatment of furuncles seemingly may be summed up in two words—incision and drainage—yet I apprehend that a thorough, complete and permanent cure involves a broad survey of many principles, based on a brief consideration of their cause and pathology.

A furuncle, as described by Da Costa, is "an acute and circumscribed inflammation of the deep layer of the true skin and the subcutaneous tissue following bacterial infection of a hair-follicle or a sebaceous gland." The exciting cause is usually *Staphylococcus aureus*. Burrowing down into the hair-follicle and invading the adjacent sebaceous gland, the bacteria excite the surrounding subcutaneous tissue to inflammatory defensive reaction. The blood-vessels dilate and become engorged, resulting in active hyperemia. Leukocytes transmigrate and serum exudes into the zone of defense resulting in a little tumor which is hard, painful and tender. In the center of this little tumor, corresponding to the position of the hair-follicle, is a pinhead-sized vesicle containing clear or slightly turbid serum and projecting hair-shaft. The little tumor grows for three days until it becomes a relatively formidable looking object, harder, more painful and more tender. Regional lymph-nodes become acutely hypertrophied and equally hard, painful and tender. This unwelcome state of affairs causes the patient no little discomfort and a varying degree of septicemia brings on fever and malaise. On the fourth day, strangled by the great pressure of the acute tissue hyperplasia, the hair-follicle and sebaceous gland begin to ulcerate, and liquefaction necrosis sets in. The skin immediately around the hair is slowly dissolved. Liquefaction now proceeds more rapidly and the tumor, from being hard, becomes softened in its center, and fluctuation is palpated. The furuncle, while less hard, is still painful and tender. Left to itself the softened center projects more and more and on about the seventh day bursts, and seropus escapes, affording the patient some relief. Shortly a white slough composed of the destroyed hair-follicle and sebaceous gland and bacteria is loosened and expelled from the central cavity of the furuncle. It

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