Intracranial complications of otitis media

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"INTRACRANIAL COMPLICATIONS OF OTITIS MEDIA."

A THESIS
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by

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Before discussing the subject and in order to understand the complications more fully it is necessary to briefly outline the complicated relationship that the temporal bone has with the dura mater and sinuses.

GENERAL ANATOMICAL CONSIDERATIONS.

The dura mater is intimately attached to the temporal bone in places and loosely applied in other places forming the epidural space. The close attachments are at the margins of the various sinuses, internal auditory meatus, aqueductus vestibuli, the sutures and the apex of the bone where it forms a fossa containing Meckel's ganglion. Lying close to this area on the alisphenoid and basisphenoid and floor of the sella turcica, the dura is broken up into a loose arrangement of venous spaces forming the cavernous and circular sinuses, transversed by the 3rd, 4th and 6th nerves. The great lateral sinus is included in the posterior border of the tentorium grooving the occipital bone and the postero-inferior angle of the parietal. The lateral sinus in name is the Sigmoid sinus beginning at the angle of the parietal bone where the superior petrosal sinus empties into it, and ending in the jugular bulb immediately beneath the antro-tympanic cavity. In addition to the superior petrosal sinus the sigmoid sinus receives numerous small veins from the labyrinth and adjacent parts of the pyramid. The inferior petrosal sinus empties into the jugular bulb.

The intracranial complications of otitis media may be any
or a combination of the following.

I- Meningitis, which in turn is subdivided into pachymeningitis involving only the dura, and leptomeningitis involving the pia and arachnoid. The arachnoid and pia are sometimes supposed to be involved separately but practically they are always involved together. Under leptomeningitis we have the following forms; acute; chronic; basilar; epidemic cerebro-spinal; intracranial; external; infantile; purulent; non-purulent; serous and tubercular.

II- Epidural abscesses.

III- Subdural abscesses.

IV- Cerebral abscesses,

V- Cerebellar abscesses.

VI- Sinus thrombosis,

VII- Sinus phlebitis.

Leaving the types of intracranial complications we will first discuss the Etiology.

ETIOLOGY.

The exciting cause is practically always bacterial and leads to complications by extension either direct or indirect of purulent inflammation of the middle ear to the various intracranial structures. Sex seems to play no especial part in the etiology. Age. An intracranial complication may appear at any age. The condition usually occurring as the result of a chronic otorrhoea but may follow an acute process when it then most frequently occurs in infants, due no doubt to the fact that the sutures are not closed and that the tympanic
cavity is only separated from the dura by membrane instead of bone. A chronic otorrhoea per se is not so dangerous to life but the intracranial troubles arising from this condition are always most dangerous. According to various authorities the intracranial troubles occur in only a small percentage of all ear cases. As for instance Buchner¹ who found them in 0.31% of all his cases; Randall² who found only 0.03% of all his cases developing intracranial troubles; Schwartze³ found that in the Prussian army only 0.35% of the ear cases died of intracranial complications. Professor Gruber⁴ in the Vienna General Hospital found 0.58% of the deaths due also to intracranial complications.
MANNER OF EXTENSION TO INTRACRANIAL STRUCTURES.

After an infection has once become established in the tympanic cavity it does several things. During the first stage with serum and pus under pressure here extension backward into the mastoid antrum takes place and from there each and every cell in the mastoid process becomes rapidly infected. The pressure may or may not rupture the membrana tympani. If it does the ear begins to discharge. Now by the presence of these active microorganisms the mucous lining of the tympanic cavity and of the mastoid cells is gradually destroyed and the work of necrosing the bony tissue begins. If now the bone is adult bone and hard, and the infective agent not too virulent the process of necrosis is slow and when the inner table of the cranium is reached there is set up a localized external pachymeningitis. Pus may now form here between the dura and the bone forming an extradural abscess. A continuation of the same slow process results in a localized leptomeningitis and in the same way by disintegration of tissue a subdural abscess is now formed. Later superficial ulceration of the brain itself takes place. This infective material now may be confined by an abscess wall or may rupture into the subdural spaces causing a wide spread leptomeningitis. A leptomeningitis or cerebral abscess may be formed much faster by a thrombosis of a vein extending into thepia or brain in which case the infective material has been carried directly by the blood vessels from the point of infection to meninges or brain. In the same way the infection may be carried in by the perivascular sheaths of the vessels accompanied or unaccompanied
by a thrombus formation within their walls. Also cases are reported in which the infective material has followed in the sheaths of nerves as the 8th from the labyrinth through the internal auditory meatus to the meninges. Leptomeningitis rather than cerebral abscess is usually the rule in this route. The various lymphatic channels are also responsible for their share in the work of transporting infection from the middle ear to the intracranial structures. From the vascular transportation there is always the great danger of multiple abscess formation in distant parts of the brain caused by infective emboli breaking off of a thrombus and floating at will through the cerebral circulation.

Usually only the more chronic and severer forms of otitis media are subject to intracranial complications and then very often the complications are hastened by either the acute general diseases, i.e., scarlet fever, diphtheria, influenza, measles, and typhoid, or by the general chronic debilitating illnesses as, tuberculosis, diabetes, and syphilis. In infrequent cases however of grave purulent otitis media terminating fatally in intracranial complications we find cause enough in accidental, atmospheric, chemical and mechanical influences, as blizzards, sea bathing, foreign bodies in the ear, rough and unclean methods of removing the foreign bodies, forcible syringing in acute suppurations, in the use of tampons, powders, and coagulating, damming back the discharges and the presence of polyps, sequestra, exostoses, cutaneous membranes, cysts, and other tumors present in the middle ear and external canal. Microorganisms are of course the chief sources of intracranial
suppurations and among these the *Staphylococcus pyogenes albus* is found present most frequently; the *streptococcus* is very frequently found, then follows the *diplococcus pneumoniae*, *Micrococcus catarrhalis*, *Bacillus proteus vulgaris*, *Bacillus subtilis*, *Bacillus pyogenes foetidus*, *Bacillus butyricus*, *Bacillus fusiformis*, *Spirochaeta refringens*, *Bacillus mesentericus vulgaris*, *Bacillus coli communis*, *Bacillus pyocyaneus*, tubercle bacilli, *Micrococcus tetragenous*, *Bacillus of Influenza* and numerous others. The above mentioned microorganisms are by no means always found in pure culture or found alone in the discharges but usually two or more varieties are found together in a given case.
Section through left Temporal Bone.

Showing inner wall of tympanic cavity, etc.
AVENUES OF INVASION.

In studying the position and structure of the temporal bone we find three vital points where perforation, the result of osseous erosion, usually takes place, i.e.,

1- The tegmen tympani,
2- Tegmen antri, and
3- Into the sigmoid groove.

In some few cases erosion has actually taken place through the compact walls of the semicircular canals and the one canal in these cases usually is the external one. In a few cases also a retropharyngeal abscess has been formed by extension through the canal for the tensor tympani muscle and then has penetrated one of the numerous crevices at the base of the skull into the cranial cavity, e.g. in a case reported by Noltsch and one reported by Knapp. When perforation occurs in the first two instance we have tempo-sphenoidal abscesses developing and when perforation takes place along the third route sinus thrombosis and a cerebellar abscess is likely to be formed. In children the avenues of entrance may be erosion of the tegmen tympani and tegmen antri but oftentimes takes place by extension through the petrosquamosal suture and mastoquamosal suture. Leaving out of consideration caries of the bony structures we find that the tympanic cavity is surrounded by many small canals and fissures through which purulent material may extend and spread infection to the various intracranial structures, i.e.,

1- Petrosquamosal fissure running the whole length of the tegmen tympani, open in childhood and marked by numerous channels
in after life.

2- The fenestra ovalis and rotunda communicate with the vestibule and cochlea respectively, the former communicating with the internal meatus from whence infective material may readily gain access to the subdural spaces. A venous canal from the cochlea communicates with the pyramidal part of the jugular fossa.

3- The Fallopian aqueduct communicates with the tympanic cavity; in infancy by a defect in its anterior wall above the fenestra ovalis, and permanently by the aperture for the stapedius muscle and its small nerve twig; by the channel for the chorda tympani, which itself again pierces the wall of the tympanum at the canal of Huguier in the fissure of Glaser; by an arterial twig, the stylomastoid branch of the posterior auricular, which passes into the tympanum.

4- The foramen between the carotid canal and the jugular fossa for Jacobsen's nerve to the sympathetic plexus and inner wall of the tympanum.

5- The fossa subarcuata in childhood a wide foramen transmitting a vein to the cells under the superior semicircular canal, and at a still earlier period to the mastoid cells near the outer aspect of the infantile mastoid.

6- The lateral and sigmoid sinus, by means of numerous minute veins through the posterior and lower part of the tegmen tympani and through the mastoid antrum and cells.

7- The superior petrosal sinus, by means of numerous minute venous channels.

8- The inferior petrosal sinus, by means of veins from the labyrinth.
9- The tempromaxillary vein, by many minute veins from the anterior part of the tympanic cavity.

10- Free communication through the bony roof with the dura matral system of veins by many veins issuing from the antrum.

11- The carotid canal, pierced by several foramina for nutrient vessels and branches of the sympathetic nerves to the tympanum also by small veins.

12- The jugular fossa, the roof of which is pierced by a great number of veins communicating with the floor of the tympanum and the labyrinth, and also by the foramen for the auricular branch of the vagus (Arnold's nerve), communicating with the Fallopian canal in its course.

13- The tympanic branch of the internal maxillary artery which enters at the fissure of Glaser, to supply the fore part of the tympanum.
EXTRA DURAL ABSCESS.

Not all cases in which the infective material reaches the dura go on to the development of brain abscesses, etc., for the dura is quite resistant and providing the infection is not too virulent and is not led into the brain substance by thrombosed veins, usually at the point of contact between dura and infective material there is established a localized inflammation in the dura with the formation of pus and an extra dural abscess is formed. This is the first step accomplished in the tramp of intracranial complications. This extradural abscess may remain present for a long or short time depending on the other factors present. To illustrate the length of time pus may remain external to the dura, without piercing it the following case of Bergman's will afford a most interesting example:

A man was admitted to the hospital on Feb. 2nd with ear disease, which had already extended beyond the limits of the temporal bone. This was clearly shown by the fact that on irrigation of the ear until it was quite free from pus, the pus rapidly refilled the entire auditory canal and overflowed into the concha. The mastoid operation was done on Mar. 12th. The following day a fistulous tract was noticed. This was enlarged with a sharp spoon. Recurrence of symptoms took place. On April 11th a free opening was made by chiselling away sufficient bone, thus freely opening the extra dural abscess. From that time recovery was uninterrupted. In this particular instance evidence showed pus to have been in direct contact with the dura for a period of 9 weeks at least and
perhaps longer without any perforation taking place or any signs of further intracranial involvement.

In very striking contrast to the above case, both in regard to the time factor and also to the extent of structures involved, is a case, reported by Ballance\(^9\) of a man who died from acute meningitis within forty-eight hours after the onset of his illness. At the post-mortem examination, the temporal bones while the dura was still in place, looked normal, but on removing the dura the roof of the left tympanum looked a little darker than that of the right. It was not perforated nor carious, but a very tiny thrombosed vein was seen to issue from it. On breaking through the tegmen the tympanum was seen to be filled with a solid mass of granulation tissue which could be picked out all in one piece with forceps. The long process of the incus was necrotic. The tympanic membrane appeared as if about to slough. There had been no otorrhoea during life.

The case well illustrates how quickly infection spreads from the tympanic cavity when assisted through the bony wall and the dura by the blood vessels and shows how simple a matter it would be for vascular infection to follow such a condition. When the arachnoid is traversed the infection reaches the sub-arachnoid and the pia, and either a localized or a diffused inflammation results. The reason for the inflammation being limited to a small or even minute area, in one case and in another case spreading rapidly over the whole surface, undoubtedly lies in the fact that the infection is less virulent in one than the other.
Formerly medical men grouped all intracranial affections, accompanied by delirium together under the name "phrenitis" or "phrenzy". And we to-day include under the term meningitis many affections which though attended in their terminal stages by inflammation of the meninges will, as our knowledge of cerebral surgery and pathology advances, nevertheless be shown to be quite distinct diseases, exactly as abdominal surgery has shown us that diffuse suppurative peritonitis is but a terminal stage in several distinct affections, most of which can be recognised and arrested before that dangerous stage is reached.

For the present the surgeon classified meningitis as tubercular and non-tubercular; and recognises that in each variety the pathological effusion may be serous or suppurative, localized or diffused.

The anatomical distinction between tubercular and non-tubercular meningitis is quite clear, and the diagnosis can, moreover, be usually made clinically. The various forms of non-tubercular meningeal affection cannot be distinguished without bacteriological examination, though some points of difference both in the symptoms observed and in the lesions found have been noticed.
SYMPTOMS AND DIAGNOSIS.

As in many other diseases to-day there is in meningitis no pathognomonic symptom. The symptoms which arise are not the direct result of the meningeal lesion, but are largely due to the influence exercised by the inflamed meninges on the brain substance itself beneath. Meningeal symptomatology is a borrowed one.

Our present knowledge seems to show that the symptoms most directly referable to meningeal inflammation are the three symptoms:

1. Headache,
2. Vomiting,
3. Constipation.

These are regarded as the cardinal symptoms of meningitis, the headache is severe and persistent, the vomiting apparently purposeless and not accompanied by nausea, and the constipation obstinate, resisting purgatives, and neither accompanied by abdominal distension nor associated with abdominal pain. These three symptoms appear to depend mainly upon intracranial effusion, whereby the pressure relations are altered and the normal power of adjustment of the intracranial tension impaired, but in some degree also upon absorption of toxins. Tension of fibrous tissue gives rise to pain. Incision of the dura is painful. The headache of meningitis is comparable to the eyeache of glaucoma; both being due to tension of a fibrous envelope enclosing nervous tissue. Along with these three cardinal symptoms we see associated two other groups of symptoms;
1- Symptoms, such as temperature, and impaired nutrition, resulting from general infection, and depending more upon the variety of the infection than upon the distribution or degree of the meningeal lesions.

II- Symptoms which are the clinical expression, not of the meningeal lesions, themselves, but of irritation of the underlying cortex. These vary with the nature, degree, and distribution of the meningeal lesions, and also with the cortical irritability of the individual.

Most of the symptoms met with in cases of meningitis belong to this group. They are:-

1- Psychiæsymptoms - Irritability, change of disposition.
3- Sensory symptoms - Photophobia. Hyperæsthesia.
4- Sympathetic vaso-motor disturbances - tache cerebrale.
5- Symptoms due to exhaustion and death of nerve cells - Paralysis; anaesthesia, coma.

This group of symptoms being the clinical expression of irritation of the cerebral cortex, it is easy to understand that meningitis is by no means the only condition capable of so affecting the brain cortex as to give rise to them. An actual lesion of the brain substance, the absorption of toxic substances circulating in the blood, and that still unexplained disturbance of innervation known as hysteria may all give rise to symptoms more or less closely resembling those associated with meningitis. An absent knee jerk, a babinski reflex, or early changes in the optic disc would be pathognomonic of an
intracranial inflammation in cases in which the delirium and fever might have led to the suspicion of typhoid fever. During the past few years lumbar puncture has been added to the diagnostic methods and by this means the cerebrospinal fluid can be quickly examined. By this method we find:

1- The intracranial pressure.
2- The chemical composition of the fluid.
3- Its physical properties, such as the freezing point, etc.
4- The cellular composition.
5- The bacteriology.
6- The permeability of the meninges to chemical substances introduced into the blood.

Of these the cytological examination is, at present anyway, the most important. Normally, the cerebro-spinal fluid contains few or no cellular elements, but in inflammation of the meninges, the cellular elements are greatly increased; either leucocytes or polynuclear plasma cells may predominate. The general indications are that leucocytosis points to a slow or subsiding inflammatory process and abundance of polynuclear cells to an acute, active and intense inflammation.

Systematic examination of the cerebrospinal fluid obtained by lumbar puncture in a series of cases of acute diseases, whether symptoms of meningitis were present or not, has shown that:

1- Modifications of the cerebro-spinal fluid and symptoms of meningitis may be present together.
2- There may be symptoms of meningitis without modification of the cerebrospinal fluid; and

3- There may be modification of the cerebrospinal fluid without symptoms of meningitis.

Therefore it seems that there is no necessary and constant correlation between the symptoms commonly accepted as indicating meningitis, the lesions present, and the condition of the cerebro-spinal fluid.

The diagnosis of meningitis is in most instances still a matter of clinical observation and judgment, and is very difficult, in many cases, to differentiate from hysteria, organic brain disease and meningismus.
Brain abscesses in the temporo-sphenoidal lobe develop from points of suppuration which lead to the middle cranial fossa; and the seat of the abscess usually corresponds to the tegmen tympani and tegmen antri.

The abscess may be single and either small or large in size or there may be multiple abscesses communicating with each other or entirely separated one from the other. The shape of the abscess depends on many factors and may assume any shape at all. The white substance, is much less resistant to bacterial invasion than the gray substance, hence the abscess comes to assume more of a mushroom-like appearance, with the narrow portion or stalk attached to the dura at the original site of infection and the expanded portion extending out into the white substance.

The symptoms of brain abscess usually advance along the same lines as those of an abscess anywhere else in the body and may be classified as follows:

1- Those due to the presence in the body of deepseated pus independent of its locality. Such as the febrile state with perhaps shivering and vomiting.

2- Those due to increase of tension within the closed cavity of the skull. Such as purposeless vomiting, slow pulse, and torpor.

3- Those due to irritation or suppression of function of particular parts of the central nervous system, such as
epilepsy, anaesthesia, paralysis, and perversions or loss of one or other of the special senses. The cortical center for hearing may be in part or wholly involved.

Word deafness, optic aphasia, or disturbance in speech are principally seen in abscesses of the left temporal lobe, while involvement of the same lobe on the opposite side gives none of these symptoms.

The heat regulating centers are in the Rolandic area, probably in the precentral gyrus, and if the abscess is situated on the coronal plane through the Rolandic area, the temperature will rise on the opposite side of the body. If the lesion lies anterior or posterior to that plane, i.e. in the frontal, temporal or cerebellar regions, there will be no rise on the opposite side of the body. The presence of this sign may be indicative of the existence of multiple abscesses, since the second abscess in such cases is usually situated in the parietal region.

In motor paralysis or paresis we see that the pressure of temporal abscesses rise vertically and thus induce a graded hemiplegia, first and chiefly of the face, then of the arm, of the trunk and lastly of the leg. Since the posterior Rolandic gyrus is more sensory in function, when there is pressure bearing upon this area posterior to the coronal plane of the Rolandic fissure, the motor paresis may be almost unnoticeable there will be a detectable delicate loss of the sense of localization of position.

Paralysis of the third nerve on the side of the abscess is
important. The paralysis is rarely complete but a non-reacting pupil on the suspected side clinches the diagnosis beyond a doubt.

The superficial reflexes in meningitis disappear early and bilaterally whilst in abscess they disappear late and unilaterally. Changes in the abdominal reflex precede and last longer than changes in the knee-jerk. Regarding optic neuritis, constant examination has shown that vascular changes precede those of the nerve itself. In abscess over filling of the retinal veins occurs on the ipsilateral side, while in meningitis the eye changes are bilateral. Also in abscess the oedema and swelling of the disc is quite moderate when compared with meningitis which gives highly swollen and oedematous nerve heads. The patient may be able to answer questions perfectly, but on being asked to name various objects will respond very slowly or will name the article wrongly. This indicates involvement of that portion of the brain through which the fibers running from the visual centers to the word-centers pass. Again he may be able to repeat the name if given him but is unable to form it himself. A persistent low temperature and slow pulse are some of the most significant points to be gathered in brain abscess cases. In regard to cerebellar abscess and its symptoms we find the three familiar signs of intracranial tension, i.e., headache, vomiting, and optic neuritis. Again presenting themselves along with other more characteristic symptoms.

Optic neuritis is the most significant when present. But
in spite of its great frequency in the more chronic cerebellar lesions it is often absent in cases of abscess, and its absence is of no value as a sign. Vomiting is a more common symptom, so that its complete absence throughout would be distinct evidence against cerebellar abscess. The headache is by far most commonly occipital and practically never lateral, so that the substitution of occipital for the lateral pain is common in acute mastoid disease and is good ground for suspecting the development of intracranial suppuration. Giddiness is a sign of both increased intracranial pressure and cerebellar disease. In the former case and sometimes in the latter, it is quite unsystematized, but when it is due to cerebellar disease it sometimes shows constant characteristics, objects during the attack seeming to the patient always to be moving in a definite direction.

Wasting away may probably be regarded as an evidence of cerebellar involvement rather than a product of the infectious condition, for in some of the cases it is the only symptom. Apparently profound wasting in an adult should always make one consider the possibility of intracranial suppuration.

Spontaneous rotatory nystagmus present after the third day of the trouble and growing steadily more marked is a certain diagnostic sign pointing to trouble in the side towards which the quick component is directed.

The mental state is a very important symptom. All stages of impairment of consciousness from the slightest mental apathy to profound coma may be seen. The latter usually only
in advanced cases and all grades in the acute pulminating varieties.

Perhaps the most common early change is a slight dullness, in which all the less important matters of life are allowed to pass unnoticed as not being worth the painful effort to attend to them.

This evident painfullness caused by any kind of mental or physical activity is the keynote to the situation and as the symptoms progress it becomes more and more accentuated.

In the early stages is noticed a certain dazed expression, which is, no doubt, partly the product of pain, and partly that of drowsiness. This condition is in fact recognized as quite a characteristic feature. It will also be found true that while the apathy and dullness gradually deepens, as long as the patient can be made to respond, the intelligence will be quite normal. It is quite unusual for any true delirium or confusion to develop as is so common in meningitis or other conditions which produce a diffuse involvement of the surfaces of the hemispheres. More important, probably in the production of confused mental states is the rapidity of the progress for in the stage of acute onset of abscess there may be confusion which ultimately disappears.

Thrombosis of the lateral sinus is of two kinds, primary or marasmic and secondary or infective. Concerning the former we have nothing in this paper to say. The secondary or infective occurs chiefly in adults, rarely in old people and only exceptionally in children. It is usually the effect of direct
extension of the inflammatory process from the middle ear through the mastoid bone, but occasionally it may occur through the medium of a septic thrombus of some of the emissary veins extending into it, as for instance thrombosis of the emissary mastoid vein, etc.

The walls of the sinus become inflamed, the blood in its interior coagulating and adhering to its inner coat thus establishing phlebitic thrombosis. This process of coagulation continues until the lumen of the vein is usually entirely filled. Since the thrombosis is due to an infection the clot soon begins to disintegrate and particles drop off to float free in the general blood stream and to lodge in some distant part of the body or septic material gains entrance to the general current through the reversal of the blood stream in the tributary small vessels. Thirdly the clot may disintegrate so rapidly that a partial reestablishment of the blood stream through the affected sinus is brought about and then follows a very direct extension of the infective material to the general circulation. In well-marked cases the thrombus may be found extending backwards to the torcular Herophile or even up into the superior longitudinal sinus, and downward along the internal jugular vein to almost any point. It may result in necrosis of the surrounding tissue. Subcranial abscess, meningitis either simple and localized or septic and diffuse, cerebral abscess or even cerebellar abscess. The cavernous sinus may become involved or the superior petrosal or inferior petrosal sinuses or in fact all the sinuses of the
cranium may be involved in a general septic phlebitis or thrombosis. The most marked symptom in a case of sinus thrombosis is the sudden appearance of a high temperature, which is usually remittent in character and associated with vigorous vomiting and usually localized pain in the head, perhaps being most marked over the point of emergence of the emissary mastoid vein at the posterior border of the mastoid process. The pulse is usually slow and easily compressible and in the latter stages the patient is drowsy and dull, probably from serous exudation within the meninges. Discharge from the ear which may have been previously affected usually cases.

Optic neuritis may or may not exist and is often preceded by photophobia. If the thrombus extends downward along the internal jugular vein, a firm, tender, elongated swelling may be felt along the usual course of this vein. The face is often quite dusky in color due to the interference with the venous return in the neck.

Stiffness of the muscles at the back of the neck is good evidence of a certain amount of associated basal meningitis, as is also the optic neuritis.
Case Reports - Case I.

Miss S., age 7, Anamosa, Ia., Referred by Dr. Sigworth, Sept. 25, 1911. Entrance complaint. Discharge from both ears, both eyes and difficulty for breathing.

History, the trouble began about a year ago following scarlet fever when a couple of boil-like swelling appeared in region of each tear sac, and which shortly ruptured and discharged. Have been discharging intermittently ever since. About the same time mother noticed that both ears were discharging. There had been little if any complaint of ear ache. A swelling soon developed back of right ear which was lanced a couple of times discharging pus each time and has since closed up. Patient has never had any dizzy or fainting attacks and has had little trouble from the ears outside of the offensive discharge. Child breathes mostly through the mouth. Past Medical, measles, mumps, and scarlet fever. Examination showed chronic abscess of each lachrymal sac. Both external auditory canals filled with a yellowish offensive discharge. Whispered voice about one foot right and 6 feet left with alarm. Tuning fork tests unsatisfactory owing to mental attitude and age of patient. Caloric tests revealed normal functionating labyrinths both sides. Bacteriological examination showed Staphylococcus aureus present in both the discharge from right and left ears. Diagnosis - double sided chronic otorrhoea. Double sided chronic dacryocystitis. Diseased enlarged tonsils. Adenoids. Operation Sept. 29, 1911, the radical mastoid operation was performed on the right ear. Pathology - As the mastoid cortex was chiseled away yellowish pus welled up into the wound. Every mastoid cell was found
necrotic and full of pus and all were thoroughly removed. A few wall remnants of the hammer were found, the rest of it had sloughed away. The tympanic cavity was found filled with granulation tissue and the drum head was completely gone. The necrotic bone led straight up to the dura mater above the antrum of the mastoid. The dura here was found covered with granulations. No extra dural collection of pus and no evidences of trouble inside the dura was found. The lateral sinus was exposed but its walls appeared normal. The wound was packed with iodosyl gauze after cutting the plastic flap, dressings applied and patient returned to bed. Sept. 30th, patient in good condition; is bright and clear mentally. Complains some of a sore ear but has no headache; temp. 99°; pulse 130; resp. 28. October 3, the wound found discharging some this morning. Quite an odor to the discharge. Patient is otherwise in good condition and has a good appetite. Temp. 98.8; pulse 112. Resp. 20. Oct. 4 - 25. Patient in good health. The wound gradually cleared up until now very little discharge or odor is present. Temp. 100; pulse 110; Resp. 20. Operation Oct. 27, 1911.- A meato mastoid operation done to-day in the hopes of preserving as much hearing as possible. Pathology, practically the same condition was found within the mastoid on this side as was found on the other side. The mastoid cells were all necrotic and filled with pus. The drum head and hammer were found absent. Necrotic bone was found up to the dura in the middle fossa. The dura was found quite firmly attached to the inner table of bone here by granulations, the bone was carefully removed with as little disturbance of the granulations
as possible. Wound packed and the child returned to bed.

Oct. 28th. Patient in good general condition. Is mentally all right. Wound not disturbed. Temp. 99.8. Pulse 118, Resp. 22. Oct. 31, patient doing nicely. Looks and says she feels better than any time since entering the hospital. Both wounds are doing nicely and are fairly clean. During the rest of her stay in the hospital she continued to improve steadily. Both lachrymal sacs were removed subsequently and by the time she was discharged Drc. 13, 1911, an entirely different girl was made out of her. Up until the present time she had had no further trouble with her ears and no symptoms of intracranial troubles.

CASE II.

Miss B., age 11, Buffalo Center, Ia., Referred by Dr. Russ, April 5, 1912. Entrance complaint. Pain in and discharge from right ear. History - About five weeks ago patient had a heavy cold during which she developed pain in her right ear. This ear ache lasted about a week before the ear "broke" and began to discharge. At first the discharge was light in color but in a week or so it became yellowish and thick. The discharge has always had a marked odor. For the past three weeks there has been some swelling behind the affected ear. At first only slight in size but gradually increasing until its present size which is that of half a walnut. This swelling has always been exquisitely tender. Has had no chills or rigors, and outside of the ear symptoms has felt quite well. Past medical. Mumps is the only childhood infection she remembered having. Examination- marked swelling over right
mastoid process. Its tip is very indistinct. Deep down the canal contains a yellowish watery discharge. The drum head cannot be distinctly seen because of the great bulging of the postero-superior wall of the canal. Webber's test localized to right ear. Rinne negative. High notes not cut down. Hearing with alarm one foot, loud spoken voice. The left ear is quite normal. Fundi- Retinal veins neither dilated nor tortuous. No edema of the discs. Knee-jerks and superficial abdominal reflexes normal. Caloric tests on right ear revealed a normal functioning labyrinth. Heart and lungs apparently normal. Urine contained no albumen or sugar. Blood count, whites 10,900; polys. 73%; l.l. 10%; s. l. 17%. Temp. 98.8. Pulse 100. Resp.20.

Diagnosis - suppurative mastoiditis with periosteal abscess. Suppurative otitis media. Operation April 5, 1912. The area posterior to the right ear was prepared as usual by a preliminary moist bichloride dressing and thoroughly painted with tincture of iodide immediately before the incision was made. Preliminary paracentesis tympani. The skin incision made through the swollen area revealed a very much infiltrated area in which only a slight amount of pus was present. Great difficulty was experienced in elevating the periosteum from the mastoid process since the elevator broke repeatedly through the necrotic cortex, the remaining cortex was rongeured away and the underlying necrotic cells and pus were simply wiped out with sponges, no chiseling or rongeuring necessary. As soon as this was accomplished the great lateral sinus was seen at the bottom of the wound lying fully exposed. Many granulations were present on the sinus wall both above and below its knee. The vessel was
pulsating normally, and no trace of a thrombus could be found. The granulations were not disturbed and the rest of the necrotic cells and debris was thoroughly cleaned out. Normal bone was found in the roof of the antrum of the mastoid and so it was decided not to expose the dura. The wound was then thoroughly dusted with iodoform powder and packed with iodoform gauze. Moist bichloride dressings applied and patient returned to bed.


April 7, patient feels well. Appetite good. No headache or chills of any kind. Wound clean. Sinus pulsating normally. Blood count, whites 9,800; polys 69%; l.l. 12%; s.l. 19%.

April 10, patient in good condition; no headache or chills. Appetite good. Wound clean and sinus still pulsating. Temp. 98.6; pulse 90; resp. 20. April 14, patient has had no headache or chills and feels perfectly well. Patient up in a chair one hour, and is to be up more and more until she is out of bed all day. Wound clean and granulating nicely. Sinus only faintly pulsating. Temperature 98.2; pulse 90; resp. 20.

May 7, up to the present time the patient has had no symptoms of other intracranial troubles and no symptoms of sinus thrombosis. She has increased in weight and feels much better than on admission. The wound is almost entirely healed and the hearing has returned to normal. Temp. 97.8; pulse 100; resp. 20.
CASE III.

Miss R, age 22 months. Complains of swelling under and discharge from left ear. History,—about four weeks ago there appeared a swelling under left ear which gradually grew to size of half a small orange. The following week the ear began to discharge a foul smelling yellowish pus. Mother thought child ran a temperature after the first two weeks. No ear trouble previous to this time. Mother says child seems to breathe well through her nose. Past medical—had chicken pox last spring. Examination revealed a marked swelling in upper cervical region just below mastoid tip on left side. Fluctuation present and marked discoloration present over swollen area. The canal was discharging slowly a yellowish white material. Temperature on admission 103.2; pulse 103; respiration 24. On account of the age and extreme illness of child other examinations were not made. A diagnosis of Betzold's mastoiditis was made and the abscess in the neck lanced in order to get the child in as good a condition as possible for an operation. The temperature the following day returned to 98.8, but the pulse increased to 120 and the respirations remained about the same. Operation Dec. 15, 1911. A preliminary paracentesis tympani was done, then the usual incision posterior to the ear was made except that the incision was much smaller than ordinarily made. The mastoid cortex which was very thin was then removed exposing a mastoid filled with pus. Every cell was filled with pus and was necrotic. All were removed. The necrosed bone led right up to the dura mater which was exposed
in two places, the dura appeared a trifle red but otherwise seemed to be quite normal. The lateral sinus was not exposed. A large bunch of adenoid tissue was removed from the nasopharynx following the operation on the mastoid.

Post-operative history. Dec. 15, patient recovered from anesthetic well. Temp. 99.2; Pulse 100; Respiration 35. Dec. 16, patient is getting normal salt and brandy per rectum. Child has been sleeping most of the time. Temp. 100.6; pulse 132; respiration 26. Dec. 17, patient sleeps most of the time. Salines discontinued. Baby looks fairly well. Temp. 102.8; pulse 148; respiration 38. Wound draining well. Dec. 18, patient still sleeps most of the time. Given a little bread and butter to-day. Patient appears restless this afternoon. Temperature 100.8; pulse 132; resp. 30; Dec. 20, patient in fair condition a trifle restless at times. Diet consists mostly of liquids, some bread and butter given.

Dec. 24, patient resting easy. Left ear in the same condition. Right wound clear and healing nicely. Temp. 100°; pulse 136; resp. 24. Dec. 28, patient seems to be improving generally, left ear still discharging freely. Right wound in good condition. Temp. 100.4; pulse 126; resp. 24. Irrigation and ice coil continued. Dec. 30, patient appears fairly well, is resting well and takes nourishment well. Left ear still discharging. Right wound healing nicely. Temp. 98°; pulse 120; resp. 20.

Jan. 5, patient seems to be in good condition, left ear still discharging some; right wound healing nicely, irrigation and ice coil continued. Temp. 98°; pulse 100; respiration 24.

Jan. 10, patient is in fairly good condition; left ear still discharging some; right wound not discharging is granulating nicely. Patient rests and eats well; is to leave the hospital and have Dr. Ray H. Dean at Washington treat the ears. Jan. 18, patient reentered the hospital with the left ear still discharging quite freely and seemingly in a much worse condition generally than when she left Jan. 10th. Temp. 100.6°; pulse 123; respiration 26. Jan. 19, patient slept all last night. Temp. before second operation was 99.8°; respiration 26; pulse 126.

Operation 2:20 P.M. Jan. 19, 1912- Simple mastoidectomy right. Upon removal of the mastoid cortex practically the same condition existed here as was present on the opposite side. Mastoid cells all filled with pus and were necrotic. Every mastoid cell thoroughly removed. The lateral sinus was exposed below its knee and appeared normal. Its color was a little darker red than normal but the walls were elastic and expanded well with each pulse beat. The dura mater was also exposed in the middle fossa but found normal. Iodoform powder was dusted into the wound and
packed with iodoform gauze. Dressings applied. Temperature following operation 93.6; pulse 138; respiration 26. Jan. 20, patient had considerable pain during the night but was given paregoric m.x. Quinine suppository gr II early this morning, Temperature range 102.4-104.4; pulse 156-170; respiration 36-38. Calomel purge given. Blood count showed whites 14,600; reds, 3,100,000; polys 83%; s.l. 15%; l.l. 3%; Jan. 21, baby quite drowsy and sleeping most of the time. Left wound is clean. Bowels moved good. Soft diet. Temp. range 102.6-104.4; pulse 158-178; respiration 32-43. Jan. 22, patient appears about the same as yesterday. Soft diet. Bowels open well. Wounds both clean this morning. Temp. range 102-104.6; pulse 158-172, resp. 36-48. Mother advised to have sinus opened up. Refused operation. Jan. 23, baby sleeps quite a lot seems dull and listless. Lime water added to the milk. This afternoon the child developed a cough. Cough syrup ordered. Tepid sponge bath ordered, and mother would not allow more than one to be given. Blood count showed whites 12,400; polys 70%; l.l. 12%; s.l. 10%; large mononuclears 8%; temp. range 102-105; pulse 112-188; resp. 30-50. Jan. 24, patient more dull than yesterday. Cry's when awakened and immediately drops back to sleep again. Bowels moving good. Liquids per mouth. Salines started. Strychnine gr 1/120 hypo, tepid sponge baths for temperature. Temp. range 101.6-106; pulse 140-188; resp. 38-54. Operation Jan. 24, 1912- with both mastoids operated and the symptoms of sinus thrombosis and meningitis present, the great question to be decided was which sinus is in trouble. Statistics show that in cases of double otorrhea where both mastoids are operated
and sinus trouble then develops it usually develops two out of three times in the right sinus. So with this fact in view, the old simple mastoid wound on the right side was opened up and curreted out good and clean. The lateral sinus appeared bluish and no pulsation of its walls could be seen. It was opened up. Upon opening the sinus no blood flowed. The opening was extended upwards and downwards. No flow from below and only a little from above. The bulb was filled with a clot, but no pus was present. The internal jugular vein was dissected out in the neck and ligated. The vein being very difficult to recognize on account of its collapsed condition, the neck wound was sutured but the mastoid wound only packed and left open. Jan. 25, patient recovered from the anesthetic in good shape. Seemed to rest easier. Temperature fell to 100.4; pulse 144; resp. 38; salines were mot well retained. Temp. later went to 101.2 and on up to 103.4. Pulse 130-150. Respiration 42-48. Blood count showed, reds, 2,080,000; whites, 13,600; polys 25%; s, 1. 23%; 1, 1. 11%; 1. mononuclears 18%; transitionals 23%; Jan. 26, baby does not look very good. Is dull and sleeps most of the time. Baby began to vomit last night at 12:30, has vomited four times during the 24 hours. Salines have not been retained. Strychnine gr 1/120 was given at intervals during the night. Temperature range 102.6 - 103.4; pulse range 132-144; resp. 36-42. Blood count revealed whites 44,200; polys 32%; large mononuclears 37%; transitionals 17%; 1, 1. 5%; s, 1. 9%; Jan. 27, child appears about the same only more septic if anything. The vomiting has continued during the past 24 hours and at more frequent intervals. Bismuth subnitrate failed to control vomiting. Salines are still not retained.
Takes small amounts of water per mouth. Temperature range 102.2-103.6; pulse range 106-110; respiration range 30-36.

Jan. 28, child appears to be much weaker. Cheynes stokes breathing has been noted nearly all day. Child appears very restless and sleeps with its head drawn backward. Wakes up frequently and always with a sharp cry. Has been taking orange albumen water and gruel. Salines discontinued. Vomits little amounts occasionally. Both wounds are clean, no discharge.

Blood count showed reds, 2,530,000; whites 57,400; polys 57%; s.l. 23%; l.l. 9%; l. mononuclears 4%; trans. 7%; temp. range 101.6 - 103.8; pulse range 100-170; resp. 30-40. Jan. 29, 9.45 P.M. - child appears very weak. Respirations are irregular and of the cheynes-stokes type. Child is restless, sleeping with head drawn backward and cries out sharply then rouses slightly. Most of the time lies in a comatose condition. Has had strychnine gr 1/120 at intervals during past 24 hrs. Has vomited frequently and did not retain its salines well. Tr. digitalis in every 4 hrs. Temp. range 100.8 - 104.6; pulse range 112-170; resp. 38-49. Jan. 30, temperature pulse and respirations kept going up last night until at 12.10 the baby died. Temperature 105.8, pulse 140 plus; respiration 110.

Autopsy at 10 A.M. - Patient died night of Jan. 29th. Body previously embalmed with formalin. Clinical History - patient entered Mercy Hospital Dec. 23, 1911 with a Bezold's mastoiditis pointing in the middle of the neck on the left side. Operation was performed on the left mastoid, and on Jan. 19 a second operation was performed on the right mastoid. Clinical diagnosis - Sinus thrombosis with meningitis. Only a partial autopsy,
of the brain was permitted.

Description. Body of a well nourished white female child of nearly two years. Over the left mastoid was a granulating wound about 1 inch long with healing borders; over the right mastoid region was a large recent operation wound between two and three inches long; triangular in shape and packed with iodoform gauze. Membranes - The dura on its superior aspect was thin, shiny and transparent, no congestion of the blood vessels. Over the region of the right mastoid and lateral sinus, the dura was much thickened and roughened. An obstructing thrombus distended the right lateral sinus from its point of exit from the skull to the torcular and extends for some distance into the superior longitudinal sinus and gradually diminishing in size. The thrombus at a distance between its exit and the torcular appears rather loose in the sinus and on section is composed of stratified layers of red and white in which the white is streaked by thin layers of red. The left lateral sinus is nearly collapsed and contained only a small amount of blood fluid. Brain- the anterior portion of both temporo-sphenoidal lobes is covered by a thick purulent exudate in which appear the distended and tortuous blood vessels. This exudate rises as high as the region of the fissure of Sylvius on both sides. Through this the engorged middle cerebral arteries appear distended with blood. The vessels of the arachnoid on the parietal areas of both sides are markedly congested. On the upper surface the congestion extends to a lesser extent over the occipital lobes of both sides and only slightly into the great longitudinal fissure. The vessels on the border of the cerebro-
cerebellar fissure are only slightly congested and but a few of those on the upper surface of the cerebellum; otherwise the cerebellum and pons appear normal. A section into the right temporal sphenoidal lobe thru the purulent exudate shows an engorgement of the blood vessels of the cortex extending for nearly a quarter of an inch into the brain substance. Pathological Diagnosis - A diffuse meningitis of the purulent type, secondary to mastoiditis of both sides together with a sinus thrombosis of the right lateral sinus.

Microscopic Pathology - Section through exudate in larger sphenoidal lobe; exudate consists chiefly of polymorphonuclear leucocytes lying in a network of fibrin, which also contains some round cells. The capillaries in the cortex are congested and also contain numerous pus cells. The brain substance around the capillaries contains may pus cells. Section thru thrombus in lateral sinus. The thrombus is firmly adherent to the walls of the sinus. Around the periphery is a relatively small amount of red blood corpuscles containing a few leucocytes. The center of the thrombus consists of polymorphonuclear leucocytes in large amounts lying in fibrin and having a marbled appearance.

CASE IV.

Mr. C.H., age 20, Muscatine Island, referred by Dr. Apple, July 13, 1911. Entrance complaint - discharge from right ear. Past medical - measles as a child - no other illnesses beside tonsilitis occasionally. Tonsils were removed eight weeks ago by Dr. Clapp. History - Began seven or eight years ago with a slight discharge from the right ear. Discharge has been intermittent ever since. At times patient noticed a slight odor to
discharge. Says hearing was but very little affected except when he had a cold. This condition continued for past seven or eight years without any noticeable change until four weeks ago when discharge became less in amount and a swelling appeared behind the affected ear. At this time he experienced his first pain which was quite sharp and affected the whole right side of the head. Also had severe pain on pressure over the mastoid. During the last four weeks the ear has not discharged. About two weeks ago he noticed a swelling appearing in upper portion of neck just below the mastoid. Pain then radiated down that side of the neck. During last four weeks patient has had fever at various times but has had no chills, rigors or even chilly sensations. July 12, 1911, Operation, Dr. Dean. The area for operation was prepared by preliminary bichloride pack after shaving. Tincture of iodine applied just preceding operation. Usual incision for tympano-mastoid exenteration made. When the knife penetrated the skin there was a gush of thick yellow pus. No marked odor. On completion of the skin incision the major portion of the mastoid was found gone. The wound had very much the appearance of a crater having at its bottom the lateral sinus exposed from the knee to the bulb. Through two small holes in the lateral sinus pus escaped. The sinus wall was white, not covered with granulations. The head of the table was lowered and the sinus incised below the knee. Pus escaped but no blood. The external wall of the sinus from the knee to the bulb was removed (Specimen number 41). The middle portion of this part of the sinus contained pus, having above and below a white, well organized antemortem clot, a portion of which was removed (Specimen number 1). The thrombus above extended to just
external to the knee. Below it extended into the bulb and into the upper part of the internal jugular vein. The sinus was packed beyond the upper end of the thrombus and then it was removed. A thorough flow of blood was secured on its removal. Below the internal jugular was ligated just below the bulb and two inches above the sternum its branches were ligated. The neck wound was left partly open and packed with sterile gauze. The tympano-mastoid operation was not complete because of the desire to lessen shock as much as possible. The sinus and mastoid wound were dusted with iodoform powder and packed with iodoform gauze.

Bacteriological report smears show staphylococci, cultures showed staphylococcus aureus and albus. Specimen No. I. Pathological report on sections of portion of sinus wall removed, specimen number 41. Endothelial coat gone. Subendothelial tissue thickened and infiltrated with round cells. Round cells thickly scattered throughout the entire sinus wall. Wall thickened, necrotic material and blood found adherent to inside of sinus wall.

Post-operative history. July 12, 1911, patient recovered well from anesthetic. Voided that night. Temp. ranged between 100 and 104.4°F. Pulse 100 to 103. Resp. 22-26. Blood count 6 P.M. showed, Reds 4,540,000; whites 19,400; polys 85%; s.l. 13%; l. l. 4%; July 13, patient appeared drowsy, tired and disinclined to converse. Said he had no pain in his head and that he felt comfortable. Fundi were examined and were negative. Wound discharged very little. Temp. ranged from 99.6 to 101.4; pulse range 99 to 102; respiratory cycles ranged 22-28; liquid
diet. Voided. Blood count, reds, 4,120,000; whites 14,000; polys 79%; l. l. 18%; s.l. 3%; July 14, patient appears brighter and is more talkative. Says he has no pain in head or headache but that from eight o'clock last night till four o'clock this morning his head throbbed considerably. Wound discharged very little. Voided. Bowels moved. Liquid diet. Temp. range 99 - 101.6; pulse range 90 - 108; resp. 22-28; slight discharge from wound. Blood count reds, 4,300,000; whites, 14,400; polys 77%; l. l. 4%; s. l. 10%. July 15, patient looks bright and is cheerful, says he feels stronger and has no pain or headache. Complains of head throbbing in the evening and through the night. Wound discharging slightly. Voided. Bowels moved. Liquid diet. Blood count reds, 3,950,000; whites 10,900; polys 80%; s.l. 17%; l.l. 3%; temp. range 99 - 101.6; pulse range 92-103; resp. range 18-26. July 16, patient appears bright and moves about in bed actively. Still complains of no headache. Head continues to throb through the night. Little discharge from wound. Voided. Bowels moved. Soft diet. Temp. range 98.6 - 101.4; pulse range 96-108; resp. range 18 to 22; July 17, patient seems to be steadily increasing in strength. Appears brighter. Still no headache but has the throbbing in head during night. Complains of tender areas upon left upper back and side and left hip. Seems to be a tendency to develop bed sores. Wound discharging slightly. Voided. Bowels moved. Soft diet. Temp. range 99-101.4; pulse range 96-110; resp. range 18-24. Blood count reds 4,580,000; whites 9,900; polys 76%; l.l. 22%; s. l. 2%; July 18, patient is bright and appears perfectly well. Still has throbbing in head at night. Has no pain except when moving head around very far to sides. Tendency
to develop bed sores on left upper back; side and hip. Slight discharge from wound. Voided. Bowels moved. Soft diet. Temp-range 97.8 to 101.6; pulse range 93 to 112; resp. range 18-24; blood count reds, 4,650,000; whites 9,800; polys 75%; l.l.3%; s.1.22%. July 19, patient appears well. No headache. Still complains of throbbing in head at night, otherwise has no pain. Areas on left upper back and hip are red but have not broken down. Wound discharge very little. Voided. Bowels moved. Soft diet. Temp. range 98.4 - 101.6; pulse range 98-114; resp.18-24. Blood count, reds 4,580,000; whites 9,600; polys 74%; l.l.5%; s.l. 21%; iodoform pack removed from above in sinus. No hemorrhage is being cultured. July 20, patient appears well. Was up in a chair one hour this morning. No headache. Slight pain in neck on lateral movements. Throbbing still continues at night. Wound is discharging very little. Voided. Bowels moved. Soft diet. Temp. range 100 to 101.4; pulse range 102- 120; resp. range 18-22. Blood count reds, 4,670,000; whites 11,200; polys 77%; l.l. 3%; s.l. 20%; urine has been negative. July 21, skin cultures removed from cervical wound this morning. Condition of patient steadily improving. Was up in a chair five hours to-day. Bed sores are improving nicely. Temp. range 99 - 101.6. Pulse range 100 - 114; resp. range 18 to 22; mastoid wound discharging very little. Voided. Bowels moved. Soft diet. Blood count reds 4,860,000; whites 10,900; polys 75%; l.l. 21%; s.l. 4%. July 22, patient was up walking around all day. Says he has no headache or pain of any kind. Slept well last night. Upper right neck somewhat swollen. Bed sores nearly healed. Temp. range 99-101.4; pulse range 96-114; resp. range 20-22; slight discharge from wound
July 23, 1911, patient steadily improving. Up and around all day. Temp. range 99.2 - 101.4; pulse range 96-110; resp. range 18-20; wound discharge slight. Swelling in upper right neck still present has pain on pressure over the area. July 24, patient appears perfectly well. Has no ache or pain anywhere. Spent the whole day up and around. Temp. range 99.8 to 101.8. Pulse range 90 to 110; resp. range 18 -20. Neck still swollen but not increased over yesterday. Blood count reds, 4,460,000; whites 9,600; polys 78% s.l. 19%; l.l. 3%; July 25, patient up and walking around. Has no headache. Complains of pain on pressure over swollen area in neck. Temp. range 99.4 to 102.4; pulse range 96 - 112; respiration range 18-24; blood count reds 4,460,000; whites 9,600; polys 78%; s.l. 19%; l.l. 3%. July 26, 1911, patient feeling well in the morning and taken to operating room in afternoon for operation. Operation - right upper neck sterilized thoroughly with tincture of iodine and abscess below mastoid tip opened by an incision posterior to sterno-cleido mastoid muscle and an inch and a half below mastoid tip. An ounce or so of yellow pus escaped. Abscess was located beneath the sterno-cleido-mastoid muscle so an anterior incision was made directly through the muscle and an iodoform strip drawn through and packed in the wound. The old mastoid wound was next exposed and the radical mastoid operation completed. A plastic operation was also done and the cavity packed with two strips of iodoform gauze, the skin and fascial surfaces were approximated by fine silk work gut sutures, interrupted, and patient returned to bed. Patient recovered from the anesthetic but had considerable oozing of blood so the neck wound was repacked with sterile gauze. No facial paralysis. Temp. range during night 98.6-100.6;
pulse range during night 89-120; resp. during night 20-22; blood count- reds 4,480,000; whites 10,900; polys 76%; s.l. 19%; l.l. 5%; July 27, patient looks well and appears cheerful. At 5 o'clock Dr. Boiler changed outside neck dressing on account of oozing and at 6:30 the wound was repacked to control the bleeding. Temp. range 99.8-101.6; pulse range 109-112; resp. range 18-20. Blood count reds, 4,200,000; whites 10,900; polys 75%; s.l. 21%; large 1. 4%; July 28, 1911, patient looks a little anemic. Gums and mucous surfaces are a little paler than normal otherwise looks well. Has no headache, Dr. Boiler repacked the ear this morning during which the blood flowed rather freely. Temp. range 98.8 to 99.6; pulse range 100-112; resp. range 18-20; Blood count reds 4,020,000; whites 9,800; polys 74%; s.l. 23%; l.l. 3%; July 29, patient had a good night. Feels much better today. Has no headache. Wound discharging very little. Mastoid wound doing nicely. Temp. range 98.3-99.8; pulse range 90-114; resp. range 20-22; blood count, polys 72%; s.l. 22%; l.l. 6%; July 30, patient complains of no pain, and apparently is feeling very well. Temp.range 98.3-100.2; pulse 86-114; resp. 18-22; July 31, patient still feels well and says she feels stronger. No pain or ache. Temp. range 97.3-99.8; pulse range 88-112; resp. range 18-20; Aug. 1st, patient well. Up in chair about one-half the day. Temp. range 93-100; pulse 102-108; resp. 18-20. Blood count- whites 10,000; poly 75%; s.l. 19%; l.l. 6%; Aug. 2, patient slept well, has a good appetite and was up all day. Temp. range 97.3-99.6; pulse 90-108; resp. range 18-24; Blood count whites 9,800; poly 71%; s.l. 23%; l.l. 6%; Aug. 3, patient complains of nothing and seems to be improving rapidly. Wounds discharging a very little.
temp. range 98.3-99; pulse 90-108; resp. 18-24. Blood count, whites 9,700; poly 69%; s.l. 24%; l.l. 7%; Aug. 4, patient apparently improving nicely. Wounds healing nicely. Up and out of doors most of day. Temp. range 98.4-99.6; pulse range 90-116; resp. range 18-20; Aug. 5, patient rested well and looks healthy. Wounds discharging very little. Temp. range 98-99.6; pulse range 90-116; resp. range 18-20; Aug. 6, patient still looking well, out of doors greater part of day. Temp. range, 98.2-99.6; pulse range 78-102; resp. range 18-20. Aug. 7, patient well and is wanting to go home. Wounds doing nicely. Temp. range 98-99.6; pulse range 86-104. Respiration 18; Aug. 8, patient well, no pain. Temp. range 98-99.6; pulse range 90-108; resp. range 18-20; Aug. 9, patient well, wounds healing nicely. Temp-range 98.2-99.8; pulse range 88-110; respiration 18-20; Aug. 10, patient well, has no pain, looks well. Temp. range 98-99.2; pulse range 89-100; respiration range 18-20; Aug. 11, patient in good health, temp. range 97.8-99; pulse range 84-100; resp. 18. Aug. 12, patient looks well. Has a good color, wounds discharging very little. Temp. range 97.8-99.2; pulse range 84-100; resp. 18. Aug. 13, neck wound closing rapidly, patient feels well and appears healthy. Temp. 98-99.2; pulse 76-104; resp. 18. Aug. 14, patient well and spending time out of doors. Temp. 98-99.6; pulse 76-104; resp. 18; Aug. 15, patient well and has no pain. Looks very well. Temp. 98-99.2; resp. 18, pulse 72-100; Aug. 16, patient apparently in best of health, says he never felt better in his life. Neck wound healed. Mastoid wound discharging very little. Temp. 98-98.3; pulse 84-96; resp. 18; Aug. 17, patient well and healthy; temp. 98-98.2; pulse 84-106; resp. 18.
Aug. 18, patient very well, temp. 97-99.2; pulse 88-100; resp. 18; Aug. 19, patient in excellent condition, patient to go home and have his ear treated by Doctor Apple. Temp. range 97-98.4; pulse 88-90; resp. 18. May 6, at the present time the patient is in perfectly health and is working every day. The ear is entirely well and troubles him no more.

Case No. V-

Mr. H.H. age 49, Ainsworth, Ia. Occupation Tinner, Referred by Dr. Laird, Feb. 20, 1912. Entrance complaint discharge from left ear. History, when a child he says he had ear ache quite frequently. Pain was always in left ear. The first he remembers of any discharge was about the age of 15 and then his attention was called to this ear by the odor. Says the ear must have discharged before this time but doesn't remember anything definite about it. Left ear has discharged almost continuously ever since and is still discharging. Ear has always discharged about the same amount. Odor of discharge has always been foul. About two years ago noticed a dull headache on wakening in the mornings. These headaches passed off usually after working for an hour or so. During the past year has been practically free from headache. Last May he lost his memory for a full day, the next day he knew something had been wrong the previous day but could not recall anything that had happened. His wife told him what had happened. Worked all the day and only his wife noticed he was acting a little peculiar. Wife says he had to more spells where he lost his memory before July 7, when he had his first convulsion. Frothed at the mouth, and all his limbs became rigid. Regained consciousness about 9 or 10 A.M. of that day. Says he had two
convulsions during that morning. Following these epileptiform attacks had temporary loss of memory at different times but no more convulsions until Sept. when he had four convulsions following each other. Usually is in bed when attacks come on. Makes a peculiar noise which is followed by the epileptiform attack. During January then had six more attacks. The attacks follow closely on one another. Has had loss of memory since he has been here but no convulsions. Right ear never has discharged. No eye, nose or throat trouble. Past Medical, mumps, measles when a man, whooping cough, typhoid, malaria as a child.

Feb. 13, bacteriological examination - culture from left canal yielded diplococcus lanceolatis, diplococcus catarrhalis and a long slender unknown bacillus. Smears showed abundance of pus cells. Feb. 14, blood count, reds 4,620,000; whites 13,400; Hb. 90%; polys 69%; l.l. 7%; s.l. 24%; slightly positive caloric after irrigating left ear 108 seconds with water at 78°F. Feb. 17, this morning while talking to the patient, Dr. Boiler was fortunate enough to witness one of his typical attacks of amnesia and he describes it as follows: "The patient and I were talking about one of his first fits of amnesia and he was describing it in great detail when he suddenly stopped talking and his face assumed a vacant stare. For approximately five minutes he could make no answer or response of any kind to any questions asked him. Then slowly the vacant look disappeared from his face and he began to talk. But it was half an hour before he could realize what had happened. At first his answers were limited to "yes" and "no", and very gradually his memory and reason returned. He had no headache following. Was glad I witnessed one of his attacks,
so I could understand his case more clearly».

Feb. 19, blood count 13,000; polys 70%; s.l. 25%; l.l. 5%; Feb. 20, caloric slightly positive in 110 seconds with water at 78°F. Rotatory nystagmus lasted about 50 seconds. Diagnosis otorrhoea chronica left with abscess in the temporo-sphenoidal lobe. Operation Feb. 22, 1912, the area for operation prepared by preliminary bichloride pack after shaving. Tincture of iodine liberally applied just before the operation. The usual incision made for a tympano-mastoid exenteration. The outer table of the mastoid was chiseled away and the burr used to destroy the cells. The mastoid was found very hard and the cells diseased. The lateral sinus was found to occupy a position quite far forward and making its curve quite high up so as to make the antrum and roof of attic very difficult to reach. The tegmen tympani and roof of antrum was found to be very rough. A very small sinus apparently led upward through the bone to the dura through the roof of the attic. Two pieces of necrotic bone, one from the tegmen and the other from the roof of the antrum are preserved under the laboratory number 169. A large area of dura was exposed after cleaning out the tympanic cavity, the dura bulged downward like a blister. There was no pulsation of the brain that could be felt. A necrotic piece of dura was removed after which the whole cavity of the mastoid was thoroughly irrigated with bichloride of mercury one to ten thousand parts. Just before incising the dura it was thoroughly painted with the straight tincture of iodine. A linear incision one-half to three-quarters of an inch long was then made through the dura from without mesially. There was little or no escape of brain fluid or
bulging of brain substance. The double bladed brain searcher was then introduced into the area above the incision and this portion of the brain thoroughly explored. No pus was found. The brain did not bulge into the space between the blades of the seeker as does a normal brain, but gave one the impression of a thickening or fibrous change in the brain substance as in a very thick wall surrounding an abscess cavity. A specimen was taken for microscopical examination No. 227. A small pack of iodoform gauze was carefully inserted up into this area and iodoform powder thickly dusted all over in the whole wound. The mastoid itself was packed with iodoform gauze and the wound left open. Sterile moist dressings were applied, and the patient returned to his bed. Dr. Edlavitch reported on the specimen from the brain that "there was some fairly normal and some broken down neuroglia with a few large brain cells and quite a few mononuclear cells scattered about almost everywhere. Nothing definitely purulent, no fibrin, and no organisms were found."

wound dry. Brain pack pulled out 1/4 inch. Slight amount of serous fluid on drain. Patient became dizzy on turning quickly in bed. Nystagmus. Complained of ear ache in left ear. Wife said he had a severe headache which however he does not remember and denies having had it. Still unable to void and has to be catheterized. Patient sat up in bed. Feb. 26, patient in good condition, says he is tired of being still, turned his head during the dressing and became quite dizzy. No nystagmus or nausea followed this. Voided when allowed to stand up. Mental condition good. Complains of a little pain in the left ear. Feb. 27, says he had a bad pain in left ear all night. Says he slept all night and later said he dreamed the ears hurt him and awoke frequently with the pain. Seems quite nervous and worried this morning. Mastoid pack moist. No pus or serum apparent on brain pack; 4 P.M. complains of a headache between the eyes at root of nose. Feb. 28, patient feels well and seems to be in good spirits. Says he slept all night. No nystagmus, no headache, no dizziness, wound clean, no discharge of pus; 6 P.M. patient has complained of some frontal headache all day. Breath quite sour. Blood count whites 11,400; poly 69%; l.l. 18%; s.l. 13;

Feb. 29, patient looks well, says he feels well and slept fairly well during the night. Mental condition good. No dizziness, dressings soaked this morning, drainage very free. Culture and smear taken from region of dura. Bacteriological report—culture yielded staphylococcus albus and an unknown coarse beany spore bearing coccus, apparently a contamination. 5 P.M. patient complaining of a little pain down his left side. Blood count whites 10,000; polys 68%; l.l. 20%; s.l. 12%; urine negative for sugar
or albumin. March 1, 1912, patient complaining this morning of considerable pain through left side of head most all night. Says he slept fairly well in spite of the pain. Quite a little discharge around brain drain. Drain withdrawn slightly; 7 P.M. told Dr. Boiler that to-day was the first day since the operation that he has had trouble in remembering names of old friends. Says that for over an hour could not remember the name of a man for whom he had worked for 15 years. Cannot remember names of any of his old friends. Told Dr. Boiler he knew his name but was unable to speak it for several minutes. Blood count, whites 9,700; poly 68%; s,l. 15%; l.l. 17%. March 2, patient complaining of pain in left ear. Not dizzy. Mental condition apparently good. No nystagmus. Packing was quite moist, more so than any preceding morning. When drain from dura was removed it was followed by a white discharge completely filling up the tympanic cavity. After tympanic cavity was filled there was a distinct pulsation seen in the dura. Cultures and smears again taken and Staphylococcus albus reported. Gauze drain replaced in dura and wound packed with iodoform gauze. Breath quite sour. Blood count whites 10,200; poly 70%; l.l. 18%; s.l. 12%; 6 P.M. patient felt well all day. Wife says he has been much brighter to-day and recalls names much faster. March 3, looks well this morning. Says he slept well during the night. Packs quite moist this morning. No pulsation palpable to the dura. No headache or nystagmus. Still complains of a little pain in left ear; 5 P.M. has had no headache to-day. Slight pain at times in wound. Wife says he is quite active mentally. Patient says he is feeling fine, not dizzy. Appetite good. Blood count whites 10,300; polys 69%, l.l. 16%; s.l. 15%; March 4, patient had a
good night. No headache and feels well; 7 P.M. patient has a frontal headache. Says memory is a little bad to-day; says he has too good an appetite. Breath is foul. Blood count whites 9,800; polys 69%; l.l. 17%; s.l. 14%; March 5, patient complained of a severe frontal headache during the night. Says he only slept at intervals. Refused his breakfast. Breath still foul. Thinks he has been eating too much. Cultures from the wound yielded statphyloccoccus albus, many pus cells both intra and extra cellular organisms. Wound clean this morning. Some serous discharge on dressings. No drainage from brain, no nystagmus or dizziness; 6:15 P.M. patient complained all day of the same frontal headache which as usual seems to run down into nose. Has been nauseated all day. Has not vomited but just felt like it. Ate a little supper. Breath still foul. Following an enema says he feels better. March 6, patient looks better this morning. Says he is feeling fine. Had no headache last night. Has a fair appetite this morning. Stomach feels better. Wound clean this morning. Mental condition appears good this morning. Blood count whites 9,600; polys 68%; l.l. 15%; s.l. 17%; March 7, 1912, patient looks well and happy this morning. Says he feels much better. Has no headache or nystagmus. Breath is not so foul. Gauze pack removed was quite moist. No odor. Wound clean and no especial discharge. Blood count, whites 9,800; polys 70%; l.l. 17%; s.l. 13%; 6 P.M. patient has had a fine day, no headache, feels good, stomach good, no nystagmus. March 8, patient is well and happy, says he had a good night. Mental condition this morning is good. Small amount of pus in tympanic cavity, otherwise wound is clean; 6 P.M. has had no headache during the day. Feels well, sat up in bed all day. Blood count whites 10,800; polys 67%
s.l. 18%; l.l. 15%; March 9, patient complaining of having pain in left side of head, ontop and also in occipital region. The pain is not severe. Drain left out of dura. Wound clean. No dizziness or nystagmus. Mental condition seems good. Blood count, whites 10,200; polys 67%; l.l. 19%; s.l. 15%; 6 P.M. has spent a good day, no headache. Appetite good. March 10, patient looses well this morning. Says he had a good nights sleep and no headache save an occasional pain in region of wound. Patient is bright and quick mentally; 6 P.M. has had a good day with no headache. Blood count, whites 9,900; polys 68%; l.l. 17%; s.l. 15%; March 12, patient looking well. Says he has had a good night and feels well this morning. No new mental symptoms. Wound is clean, and rapidly healing up, making it difficult getting into tympanic cavity. Appetite good; 6 P.M. patient says he has had a severe pain in superior temporal region left today. No dizziness or nystagmus. Blood count, whites 9,900; polys 71%; l.l. 16%; s.l. 13%. March 13, patient feels well and is bright and talkative this morning. Mentally he seems all right, no headache, no nystagmus. Wound is clean and healing nicely; 6 P.M. has felt good all day. No headache. Has been up walking around. Blood count whites 9,600; polys 68%; l.l. 19%; s.l. 13%; March 14, patient looks well, is feeling well. Had a good night undisturbed by any headache. Is not dizzy and has no nystagmus; 7 P.M. has a slight headache this evening. Has been up all day. Blood count, whites 9,400; polys 67%; l.l. 17%; s.l. 16%; March 15, patient looks well, say he feels good and slept all night. Had no headache, mentally he is clear. Wound clean and healing; 6 P.M. patient feels well this evening. Has no headache, blood count whites 8,900; polys 68%
March 16, patient not so clear mentally this morning. Says he knew me but couldn't call my name. Said he didn't know where he was when first awakening this morning. Wound clean. Healing nicely. No nystagmus.

March 17, patient looks well, but says his head does not feel good. No headache but just a sense of uneasiness. Appears a little restless. Mentally he is clear. Wound clean.

March 18, patient looks well and says he feels better to-day. Mind is clear and he remembers well. Wound clean no discharge.


March 21, looks well but is again complaining of pain over left side of head above left ear. No nystagmus, no dizziness. Mentally he appears clear; 6 P.M. plastic flap made on left ear. Posterior wound closed. Patient recovered from anesthetic nicely.

March 22, patient complained of severe headache over whole head during the night. March 23, 8 A.M. Patient says he doesn't feel so well. Has quite a lot of pain through left side of head. Was restless all night; 5 P.M. still complaining of headache over left side of head. Seems quite dull to-night. No nystagmus. Blood count, whites 17,800; polys 31%; l.l. 13%; s.l. 6%; March 24, patient seems restless this morning, is complaining of intense pain over left side of head and in frontal region; 5:30 P.M. has had severe pain in frontal and left parietal regions all day. Was drowsy and unable to express his thoughts at times. Ice bag greatly relieved pain. No spontaneous nystagmus. Right inferior retinal vein dilated to twice the size of superior retinal vein but not tortuous. Urine negative.
for albumin or sugar. Blood count, whites 15,000; polys 81%
1.1. 9%; s.l. 10%; March 25, patient does not look well this
morning, says he has had severe headache all night; shrieks
with pain when ear was dressed. The least touch with cotton
causes him to cry out. Blood count, whites, 14,700; poly 81%;
1.1. 11%; s.l. 8%; March 26, mastoid wound and tympanic cavity
exquisitely tender this morning. On account of pain it was not
packed satisfactorily. Patient says he can't talk right. Is
unable to say what he wishes to say. Vomited three times to­
day. Each time a bilious vomit. Blood count, whites, 15,200;
polys 83%; 1.1. 9%; s.l. 8%; 6 P.M. patient irrational. March 27,
1:30 A.M. Dr. Boiler. Patient unable to talk. Could not put
out tongue when asked to. Opened his mouth wide and drew tongue
from side to side but could not protrude it. Recognized Dr. Boiler
and called him "Doc". Could not answer questions. Patellar re­
flexes very sluggish. Plantar reflexes were present, no babinski.
Pulse slow. Pupils 3mm in diameter and oval. React to light.
March 27, 8 A.M. Patient looks pale and haggard. Patient rouses
when spoken to and is rational then but sinks back to sleep
quickly; 2:45 P.M. Patient has been sleeping all day until now
when he began to breathe heavily and frothed at the mouth. Be­
came quite cyanotic. Pulse and respiration rapidly weakened.
Pulse could be felt after respiration had ceased. Eyes were
closed during the attack. Patient died at 3 P.M., 15 minutes
after attack started. During that time was given strychnine
gr 1/30 hypo and hypos of camphorated oil m 15 each time.

Autopsy- Body is that of a well-built and well-nourished
adult male. Skin and mucous membranes are very pale. Pupils are
equal and moderately dilated. Rigor mortis present, and livor mortis is well marked all over back, buttocks, and dependant parts. Behind left ear is a curved linear incision and in left auditory canal there is an iddoform drain. On cutting into body the subcutaneous fat is moderately abundant. None of the serous cavities contain any excess of free fluid and their surfaces are all smooth and glistening. The heart weighs 310 grams. The epicardium contains much fat. The heart looks strikingly pale. Its cavities are not dilated, but the wall of the left ventricle is somewhat thickened, measuring about 2.6 cm. in diameter. The tricuspid, pulmonary, and mitral valves are delicate. The aortic valve shows a small round sclerotic nodule on one of its cusps. The aorta has lost much of its elasticity and is studded with many small and large atheromatous plaques. The left lung weighs about 540 grams. The pleura is thin and shiny. The lung feels soft and crepitant everywhere. On section air-containing tissue is found throughout. The bronchi are not congested and the glands at the hilum are not enlarged. The right lung is in general like the left, except that on the surface of the lower lobe are found a few hard, round, almost calcareous patches about the size of the head of a pin.

The spleen weighs 170 grams. Its surface is smooth and the capsule is not thickened. It feels soft, cuts easily, and on section shows a dark-reddish pulp in which there is some increase of the connective tissue trabeculae. The malpighian bodies are visible, and the vessels are not congested.

The liver weighs about 1740 grams. Its surface is smooth and regular and its margin is sharp. The organ looks rather pale, but feels firm, and cuts without difficulty. On section
it presents a uniform light-brownish surface in which the lobular structure is distinct. The interstitial stroma is not increased and the vessels are not especially congested. The gall-bladder is full, and contains clear, dark-colored bile. The biliary passages are patent. The pancreas is not large, it feels soft everywhere, and shows nothing of importance. The ampulla of Vater is not occluded. The stomach is greatly distended, and contains about 800 cc. of hemorrhagic fluid. The stomach-wall is nowhere thick. Its mucosa is uniformly smooth and regular, but contains a number of small and large hemorrhagic patches. There is quite a marked congestion of other parts of the bowel, but otherwise nothing definite is found anywhere else in the gastro-intestinal tract.

The left kidney weighs about 160 grams. The perirenal fat is abundant. The kidney feels firm and elastic. Its capsule strips easily leaving a smooth surface. The organ cuts easily, and on section shows a pale surface in which the vessels are rather congested. The pyramids are all well-preserved, the striations are prominent, and the glomeruli are plainly seen. There is quite an abundance of fat extending up into the renal parenchyma. The right kidney weighs 165 grams and shows the same general characteristics as the left. The bladder is distended and contains clear, yellowish urine. The right testis is almost twice as large as the left, otherwise nothing striking is found upon examination of the genitalia.

The brain is removed without special difficulty. It weighs 1390 grams. Its meninges are everywhere free and smooth, and there is no excess of fluid or exudate of any sort over the convexity or at the base of the brain. At about the middle of
the left temporal lobe there is present a large abscess cavity containing about three ounces of thin, creamy purulent material. Smears of this pus showed the presence of a staphylococcus and a streptococcus. The outer wall of this abscess is very thin, friable, and adherent to the temporal bone, so that on slight manipulation it ruptured, and the contained pus was discharged very freely. The cavity is lined throughout by necrotic brain substance; it measures about 5 x 2.5 cm and extends down to a depth of about 3 cm into the temporo-sphenoidal lobe. The rest of the brain reveals nothing definitely striking. Spinal cord not examined.

Anatomical Diagnosis - Cerebral abscess, involving left temporo-sphenoidal lobe; chronic splenic tumor; slight cloudy swelling of liver and kidneys; marked arteriosclerosis; beginning sclerosis of aortic valves; slight cardiac hypertrophy; hemorrhagic gastritis, chronic pleuritis.

Case No. VI.

Miss K, age 9, Wilton Junction, occupation, School girl
Referred by Dr. Cooling, Dec. 26, 1912. Entrance complaint-
Discharge from right ear and sharp pains through the head, especially marked in frontal region. History, about one year ago after having mumps she had some pain in right side of head and held her head with the right side toward the front. Ear did not discharge. About three days before entering the hospital the ear "broke" and discharged through the canal. Discharge was a watery "sopy" substance without any characteristic odor. Discharge continued until the operation. Held her head somewhat to the left side and had shooting pains through right side of
head usually. No trouble with left ear. Has breathed through her mouth during past two or three years. Tonsilitis once or twice. No eye trouble. Past medical- mumps, measles, scarlet fever, whooping cough, and catarrhal fever. Dec. 25, blood count, reds, 3,840,000; whites 20,000; poly 95%; l.l. 3%; s.l. 12%. hemoglobin, 90% sahli. Bacteriological report, smear from right canal showed staphylococci and apparently short-chained streptococci, diplococci. Culture showed staphylococcus albus and pneumococci.

Examination, right ear discharging freely. Muscles of back of neck very sore. Pupils react sluggishly to light. Patient has evidently had morphine hypodermically quite recently. Upon examination of the fundi the veins of both fundi are distinctly dilated. Knee jerks are normal. On account of condition of patient other careful examinations could not be made. Diagnosis—acute suppurative mastoiditis with brain abscess on extra dural abscess, no metastasis. Adenoids.

Operation, Dec. 26, 1911, simple mastoidectomy right; myringotomy, adenoidectomy. Pathology- Upon removal of the mastoid cortex the mastoid cells were found necrotic and filled with pus. All the cells were completely removed. The dura was exposed over the roof of the mastoid antrum for an area of three cm. in diameter. An extra dural abscess was found and drained. The lateral sinus was exposed throughout its entire length. The bone covering the sinus was found necrotic throughout. The dura was found badly inflamed and reddened. There was extensive necrosis of the bone covering the attic and roof of additus. Wound was packed and not sutured. No indication of
a brain abscess was found and since a fair sized extradural abscess had existed it was thought best not to open the dura. The wound was dressed and not sutured. A large bunch of adenoids was removed, the probable initial cause of the otitis.

Postoperative history. Dec. 26, 7 P.M., patient rallied from the anesthetic well. Feels well, Temp. 101, pulse 130; r. 26; Dec. 27, patient complaining of pain behind right ear. No headache, temp. 99, pulse 120, R, 20; Dec. 28, patient feeling well, has no pain or headache of any sort; Temp. 98.2-99.6. Pulse 102-128. R. 24-28; Dec. 30, patient complained of headache during the day, otherwise feels well. Temp. 98.8, pulse 96. R. 20-26; Dec. 31, towards evening patient began to complain of headache again. More severe than yesterday. Temp. 98.6, pulse 100-120, R. 20-26. Jan. 1, complaining of frontal headache the same as the one before the operation. Laxative and enema relieved the headache. Temp. 101.2, pulse 90-100; R. 20-24. Jan. 2, patient feels well and seems quite bright. Temp. range 98-100, pulse range 90-100, R. 20-26. Jan. 4, patient's temperature 103, accompanied by vomiting. During the night of Jan. 4, patient slept soundly but woke up several times during night complaining of a severe pain in her head. On Jan. 4, there was a chill and the frontal pain continued during the day. Her neck muscles were noticed to be quite stiff this morning. Blood count, whites 17,600, polys 86%; l.l. 3%; s.l. 11%; Jan. 5, patient still complaining of severe headache. Examination of the fundi showed the retinal veins enlarged and tortuous in the right fundus while the left remained normal. Neck muscles distinctly more rigid than last night. Temp. range 98.6-103.4; pulse 92-110, Resp. 24-26. Patient
became semicomatose towards morning. Jan 6, a diagnosis of brain abscess made this morning and operation advised as soon as home physician can get here. During the afternoon the patient became very stupid. Could not be roused, and impossible to get her to drink water. Pupils reacted to light and were equal. Occular rotations were normal. General reflexes were normal. A very little anesthetic was necessary for the operation. Blood count, whites 24,400; poly. 38%; l.l. 3%; S.L. 9%.

Operation Jan. 6, 1912- The original mastoid wound opened up and the sinus carefully examined. It apparently was quite normal and not responsible for the present trouble. The dura mater was incised external to the roof of the tympanum about 1-1/2 inches. Internal to this it was seen to be stretched and bulging down into the wound. The pulsations could be readily felt. The dura was again incised just internal to the thickened area the incision being about one half inch long. The meninges were found firmly bound together by many adhesions at the point of incision. No fluid escaped. An exploratory puncture was made upwards over the roof of the antrum and tympanic cavity. No diseased condition was found. A second exploratory puncture was made upwards over the area where the dura was thickened. Here the brain substance was found broken down and softened so that it would flow slowly down between the blades of the brain seeker. A single strip of unwrapped iodoform gauze was introduced into this cavity two and one half inches. A moist dressing was then applied and the patient returned to her bed. Jan. 7, Fundus examination by Dr. Dean revealed the retinal veins markedly less dilated and tortuous.
in right fundus since the operation. Mental condition good.
Patient hungry. Patient complaining of headache very slight and
then only on voluntary movement. Temp. 97.8-100.4; pulse 70-100.
Respirations 20-22; Canal dry, wound clean. Gauze drain pulled
out a little. No discharge from brain. Blood count, whites 23,200;
poly 86%. L.L. 4%; S.L.10%. Jan 8-9-10-11, patient complains of
no pain in her head whatever. Mental condition the best it has
been since admission. Movements are not restricted. Feels per­
fectly well. Sleeps well and has a good appetite. Drain in brain
abscess pulled out a little at a time and the rest left in. A
slight mucopurulent discharge on brain wick. Jan. 12, blood
count whites 18,400, poly 81%; L.L.4%; S.L. 15%. Patient not
complaining of any trouble. Wound is clean. No discharge. Canal
dry. Last of abscess pack removed and a small drain reinserted.
Jan. 13-14- Patient well and seemingly quite happy. Is bright and
active in her movements. No headache. Jan. 15, patient feels
well, no headache. Blood count, whites 13,600; poly 80%; S.L. 17%
L.L. 3%; temp. 99-100, pulse 86-100, respiration 22-24. Wound
still seems perfectly well. Complains of no pain. Blood count,
whites 15,200; polys 79%; L.L. 7%; S.L. 14%; Temp. 98.4-99.2;
pulse 86-119; R. 20-24. Jan. 19, patient woke up complaining of
a frontal headache which lasted until 12 P.M., when she went to
sleep and slept the rest of the night. No headache in the morning.
Temp. 98.4-101.6, pulse 90-110, Resp. 20-24. Jan. 20, patient
feels perfectly well this morning, says she has no headache. Blood
count, whites 16,600; polys 79%; L.L. 6%; S.L. 15%. Jan. 21-22-23,
patient gaining strength rapidly. Has no headache or pain of any
kind. Sleeps well and eats well. Wound dry and clean. Jan. 24, patient feels perfectly well this morning. Blood count whites 16,000; poly 78%; L.L. 3%; S.L. 19%; Jan. 25-26-27, patient feeling well, sleeps well and does not complain of any pain in her head. Wound is healing nicely. Jan. 29-30-31, patient in good condition. Feels perfectly well. Wound clean and dry. Canal dry. Feb. 1-2-3-4, patient well, walking about. Wound healing nicely. Wound clean and canal dry. Feb. 14, the whole wound is covered except for a little depression a quarter of an inch in width. Patient is in excellent health and perfect mental condition. Is to go home and Dr. Cooling is to apply iodogorm under the strictest asepsia and then to return in a week. March 26, Last week Monday about 4 P.M. the patient complained of severe pain in front of right ear. In an hour her father says she did not know anyone. Head turned to the left. Eyes rolled up, fingers stiffened and she frothed at the mouth. She had one convulsion after another. Dr. Cooling gave her chloroform about 11 P.M. She relaxed and opened her eyes. The next day she did not know anything that happened the previous day. Dr. Cooling painted the mastoid region with iodine and on Wednesday the wound broke open. Father says one of the other children younger than she is was sick at the same time with vomiting etc., and was sick for several hours. The children had been eating canned tomatoes and Dr. Cooling diagnosed their cases as ptomaine poisoning. May 6, since then and at the present time the patient has been enjoying the best of health. Mental condition is perfect and the ear is entirely well.
Case No. VII.

Miss R, age 19, referred by Dr. Love, April 10, 1912.

Entrance complaining, pain in back, limbs and fever.

History,— at the age of five years she developed a left-sided acute otitis media following scarlet fever and the discharge has continued up until a few months ago. For the past two years the ear has been treated by syringing and local applications. For the past number of years she has been troubled with left lateral headaches unaccompanied by chills or known fever. Her hearing has been practically nil on this side for some years. During the past three or four months the discharge which until this time was yellow-is and very offensive, has ceased.

Dr. Love saw her March 26, 1912, when she complained of pain in her back, limbs, general headache, sore throat, some stiffness in muscles of back of neck on both sides and fever. She was put on aspirin and general treatment under which the symptoms subsided and the temperature returned to normal. She was also slightly jaundiced at the time and the jaundice also cleared up.

On April 3d, Dr. Van Epps was called in consultation for she began to have chills and rigors lasting five to thirty minutes coming at irregular intervals and followed by rises in temperature varying between 102 and 104.5 with fluctuations in the pulse and respiration curves accordingly. Nothing of especial significance was found excepting in the lumbar puncture.
The fluid was found markedly increased. The fluid reduced Fehlings solution and contained no increase of the cellular elements. She had no mastoid tenderness or discharge from the ear.

Patient entered the University Hospital April 7th, and continued to have chills and exacerbations of temperature until April 10th when Dr. Dean was called in consultation. A terrific choke disc was found in both eyes much more marked on the left side. Her temperature at this time was 106.4; pulse 140; respiration 110. A diagnosis of thrombosis of the left lateral sinus was made and immediate operation was advised.

Operation April 10, 10:30 P.M. - Very little anesthetic was required for the operation. The usual incision for tympano-mastoid exenteration was made. When the chisel penetrated the mastoid cortex thick yellow very foul smelling pus escaped. The lateral sinus was immediately exposed. The sinus was found shrunken and filled with a firm clot. The bony outer wall of the sinus was rouged away nearly back to the torcular and after curetting the lumen of the sinus back further a fair flow of blood was established. The clot was found to extend on down through the bulb. The internal jugular was ligated in the neck and the wound packed with iodoform and left open to drain. Patient returned to bed. Temp. 103.8; Pulse 130; resp. 56;

Post Operative History - April 11, patient seems somewhat stronger this morning. Temp. 102; pulse 130, resp. 80;
April 12, patient looks very ill. Does not feel well. Temp. 103.4; pulse 112; resp. 75. Patient gradually grew weaker until respirations ceased before 12 A.M. The last temperature per rectum was 103.8; pulse 140; respiration 96.

No autopsy permitted.
CONCLUSIONS.

Case No. I- As far as symptoms were concerned Case I presented nothing suspicious of any intracranial involvement yet at the time of the operation on both sides a localized pachymeningitis with numerous granulations was found. If this process had not been stopped when it was, it is easy to see how within a few weeks a brain abscess would surely have developed.

Case No. II- presents a very interesting picture. Here we have pus and good active organisms in direct contact with the walls of the lateral sinus two or three weeks without any trace of thrombus formation and without the slightest symptom of any intracranial trouble appearing. Another curious fact is that the floor of the brain cavity proper resisted the attack of the invading organisms while the sinus wall seemed to be readily broken down.

Case No. III, MacEwen in his splendid work says that "Sinus thrombosis occurs only exceptionally in children" and yet in this case we see a most extreme example of sinus thrombosis. The thrombus extended from the bulb, and slightly below it, up past the torcular into the great superior longitudinal sinus. The case also follows out the statistics on the subject of sinus thrombosis in double-sided otorrhoea. Both sides being operated and symptoms of sinus trouble arise the chances are it is the right sinus giving the trouble. The purulent meningitis was very well marked, the pus rising as high as the fissure of Sylvius.

Case No. IV- entered with a history of chronic suppurative
otorrhoea and that was all. He had had absolutely no chills, rigors or even chilly sensations and yet at the operation the mastoid was found gone and the wound presenting the shape of a crater with the great lateral sinus lying at its bottom exposed and with two small holes in it from which thick yellow pus could be seen escaping. Above the knee was a firm thrombus and also below in the bulb. The remarkable fact was that he must have had actual pus present within the walls of his sinus for at least two weeks without giving the slightest general symptoms of its presence there.

Case No. V- Presented some typical abscess symptoms along with definite amnesic attacks dating back to May 1911. At the operation was found a sinus through the tegmen tympani to the dura but no discharging sinus from the brain. The overlying dura and brain substance was very fibrous. At the autopsy a large abscess cavity filled with light creamy pus was found whose walls above and laterally were only lined by necrotic brain substance.

Case No. VI- On examination showed signs of increased intracranial pressure and when the extra dural abscess was found and drained the symptoms subsided for a few days only to return later. No pus was found in the brain at the second operation, but a definite area of softening was discovered. The area was drained and the child made an uneventful recovery.

Case No. VII was an unfortunate case in coming under observation after practically all hope had been wisely abandoned.
The operation showed a most extensive thrombosis of the left lateral sinus. The bony wall having to be removed almost to the torcular before a fair flow of blood could be established. The thrombus extended down through the bulb into the great jugular vein. Unfortunately autopsy was not permitted.
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