the past year the total number of inmates attending sick-call has been 40 per cent. less than the year before.

These few facts are enough to convince us that we are working in the right direction toward the management of prison tuberculosis, and we feel that the results thus far obtained fully repay us for our work.

TONSILLECTOMY, THOROUGH, PAINLESS AND SAFE.*

E. FLETCHER INGALS, M.D.

CHICAGO.

"What is worth doing at all is worth doing well," is a truism especially applicable to surgical procedures, for no operation should ever be undertaken excepting for the patient's best interests. We are all searching, therefore, for something that is better, whether it be new or whether it be simply a modification of the old. That the ancient operation for tonsillectomy is susceptible of improvement goes without saying when we consider some of the important conditions and when we witness some of its lamentable results. An unusual case which recently came under my observation induces me to bring up again this well-worn subject in the belief that there are many surgeons, even among laryngologists, who are not familiar with the technic of an operation that to me appears more thorough and much safer than the methods generally adopted.

The case referred to was that of a gentleman about 30 years of age who had suffered from frequent attacks of severe tonsillitis and in whom both tonsils were enlarged to the size of a small English walnut. From the history there was no doubt of the desirability of removing these glands, but on inspection I discovered on both sides large branches of the carotid artery pulsating at the base of the tonsil immediately beneath the mucous membrane, so that the operation with a tonsillotome, which might have been easily done, would have been attended with great risk; whereas the operation that I have in mind and that I prefer, for nearly all cases, could have been done with safety.

In any case of hypertrophy of the tonsils the questions to be considered are: Is an operation necessary? And, what operation would yield the best results in this particular case, with the minimum amount of danger and discomfort to the patient?

In the great majority of cases in which the tonsil is not larger than an almond, provided it is not subject to frequent acute attacks of inflammation, no operation is desirable; but in many cases tonsils even much smaller than this by reason of acute attacks are a source of danger and of great discomfort to the patient; therefore, their extirpation becomes important. There are some tonsils even larger than this that give the patient no inconvenience and that never will become a source of any considerable danger; but in the majority of cases these hypertrophied glands, because of their liability to infection and acute inflammation, are a constant menace and should, therefore, be removed.

In many cases the so-called submerged or buried tonsil is scarcely perceptible on inspecting the fauces when at rest; but they are rolled out so as to show considerable dimensions with the act of retching. Whether these be small or large, if subject to frequent acute attacks of inflammation, they should be removed.

In children we may reasonably expect hypertrophied tonsils to gradually atrophy and disappear before puberty, but it should be remembered that in the meantime they offer an open portal for the entrance of numerous germs of disease, and in the majority of cases they are associated with hypertrophy of the pharyngeal or Luschka's tonsil, with all its painful results; therefore, when a child has suffered two or three attacks of acute tonsillitis, whatever the size of the glands, it is usually best to advise their removal.

The operation to be selected necessarily depends on various conditions which may be present in individual cases. The old operation performed by seizing the tonsil with a vulsellum forceps and dissecting it out with a bistoury is now seldom employed, but it would undoubtedly yield better results than frequently obtained from some more modern methods. An operation by means of some one of several good tonsillotomes is best in adults, and sometimes also in children in those cases where the tonsil is not adherent to the anterior pillar of the fauces and when it is of such form and in such position that it can be readily engaged and thoroughly removed; in children, in the majority of cases, Luschka's tonsil is also enlarged and should be removed at the same time, which fact may induce us to adopt some other operation. Furthermore, we should not forget that the fright and pain to the little one caused by tonsillectomy is often fully as great as that an adult would suffer from amputation of the arm.

In cases where the tonsil is hidden by the adherent

Fig. 1.—Tonsil separator.

anterior pillar of the fauces, a thorough operation is impossible with the ordinary tonsillotome unless the gland is first lifted out with forceps, and then serious hemorrhage is likely to result either from division of some large blood vessel within the tonsil or from cutting the anterior pillar. In these cases the glands may be cut out with biting forceps, but this operation is peculiarly liable to cause serious bleeding. In such cases we often resort to repeated cauterization, with gradual destruction of the gland rather than incur the dangers of tonsillectomy. Such cauterization, when properly performed and when the gland is not large, usually yields satisfactory results. It has also been recommended to dissect out these glands with the galvanic cautery, but the large area that is burned in this operation causes much pain and such extensive cicatrices that this procedure appears to me seldom justifiable.

The operation that I wish to recommend appears to me the best in most cases in children, and in many cases of the so-called buried or submerged tonsil in adults. It was first recommended by me several years ago and has since been adopted by a considerable number of laryngologists, but I fear that the technic is not thoroughly understood by most laryngologists or general surgeons. The instruments required for the operation are a mouth gag, tongue depressor, blunt hook, tonsil forceps, long

* Read in the Section on Laryngology and Otology of the American Medical Association, at the Fifty-fifth Annual Session, June, 1904.

pincette and two snares with wire. One should also have proper sponges. In most cases one should also have at hand Lowenberg's forceps or some modification of the same for removing the pharyngeal tonsil, or such other instrument as one may prefer for this purpose. I have also for use, when Luschka's tonsil is to be removed, a nasal bone forcep that I pass through the nostril to the nasopharynx for removing pieces of Luschka's tonsil from the vault of the pharynx close to the choanæ, which may be difficult to catch with the instrument in the nasopharynx; and also for the purpose of opening the posterior nares, which will be found considerably contracted in a considerable number of cases. Any good mouth-gag may be used, but I prefer the Allingham, or some of its modifications. Any satisfactory tongue depressor may be employed. I formerly used, for separating the anterior pillar of the fauces from the tonsil, a blunt hook originally designed for a palate retractor, but I have recently had made for this purpose a much better instrument, with two blades, which when closed and locked form a blunt hook. (Fig. 1.) When the catch is loosened the blades may be opened out so that the two ends forming the blunt hook thoroughly separate the anterior pillar of the fauces from the tonsil by a single movement, thus considerably facilitating the operation. The tonsil forceps is an instrument that I had made for this special purpose. (Fig. 2.) It is about eight inches in length, with a catch on the handles so that it can be locked after the tonsil has been seized. The blades of this forceps turn at an angle of 45 degrees to the long axis. They are nearly an inch in breadth at their broad-

Fig. 2.—Tonsil forceps.

est part and are rounded down toward the end so that when the loop of wire has been slipped over their broadest part it must necessarily slide toward their end to the base of the gland. The end of the blade consists of two blunt points, each about an eighth of an inch in width, separated about three-eighths of an inch from each other by a crescentic depression, which leaves an elliptical opening about three-eighths of an inch long by one-fourth inch in width, when the points of the two blades are brought into contact. At Dr. O. T. Freer's suggestion these forceps are sometimes made with three points at the end of the blade. The instrument is so made that when the handles are locked the points of the blades press firmly against each other, and the handles have enough spring to allow for what we might call the root of the tonsil between the ends of the blades. The pincette is about eight inches in length; it is designed to hold the end of the uvula to prevent it from being caught in the loop of the snare. The snare for removing the tonsil is the same as used for nasal polypi, but I have the handle five inches in length so that it will not be necessary to shorten the wire before the tonsil is cut off. With the snare I use No. 5 steel piano wire. For removing the pharyngeal tonsil I like best John N. Mackenzie's modification of Loewenberg's forceps. The nasal forceps (Fig. 3) are the bone forceps that I have recommended for trimming up spicula of bone in operations on spurs of the septum. I give the patient a general anesthetic and prefer chloroform for children. The

patient is placed in the prone position, with the face drawn out over the edge of the table, in which position there is no danger of blood flowing into the trachea. I prefer removing the right tonsil first, the patient being placed, when daylight is used, in front of a window; I seat myself, with my left hand toward the head of the table, on the opposite side of the table from the window, and reflect the light into the throat from a head reflector. After the first tonsil is removed the patient's face is turned toward the window, the face being kept downward during the turning so that no blood runs into the trachea, and the reflector is dispensed with. It is usually more convenient to use artificial light when we have an electric lamp that can be worn on the forehead, but even then I prefer to remove the right tonsil first, because this leaves the patient, when the left tonsil has been removed, in the position with my right hand toward the head of the table, in which I want him for removal of the pharyngeal tonsil.

TECHNIC OF THE OPERATION.

When anesthesia is nearly complete the patient is placed in the prone position, and the mouth-gag is placed between the jaws on the upper side of the face, and opened as widely as necessary. It is usually found necessary to continue the anesthetic for a few minutes afterward to complete the anesthesia, because these patients do not breathe well on account of the nasopharynx being filled with adenoid growth, and they do not come fully under the anesthetic until the gag is put in to hold the mouth open. For the right tonsil, sitting with my left hand toward the patient's head, I introduce the

Fig. 3.—Nasal bone forceps.

blunt hook between the anterior pillar of the fauces and the tonsil, while the tongue is kept down by the depressor held in the left hand. I then remove the tongue depressor and open the blades that terminate in the blunt hook widely enough to separate the anterior pillar thoroughly from the tonsil, by which act the tonsil is freed from a considerable part of its bed, so that it may be easily caught by the forceps. In cases where the anterior pillar is not attached to the tonsil this is not necessary, but the gland may be grasped at once with the tonsil forceps. In applying the tonsil forceps it is usually best to have an assistant press the tonsil inward with the fingers applied just back of the angle of the jaw, so as to make the gland as prominent as possible. In seizing the tonsil one should pass the blades of the forceps beyond the anterior pillar; otherwise it is apt to be slightly injured. When the tonsil has been seized the handles of the forceps are locked, the tip of the uvula is then secured with the pincette, which may be held by an assistant, and the loop of the wire of the snare is slipped over the handles and carried along them into the mouth and over the end of the forceps. If the tonsil is of fair size, so that it is held firmly, it may now be drawn on and lifted up so as to make certain that the wire slips under it; otherwise a little care will be necessary to make sure that the wire is beyond the broadest part of the blade, so that when it is tightened it will slide down to the end of the blade and slip under the gland, to cut it off at the lowest point. The wire loop is now drawn

tightly about the base of the tonsil by a moving bar on the handle of the snare; the pincette is then removed and the milled wheel on the handle of the snare is brought into use for the final tightening of the loop. In nearly all cases, if care has been taken in grasping the tonsil, every portion of the gland will be removed at once, and if it has not been necessary to separate the anterior pillar the bleeding will not have exceeded a dram. The patient is then turned so that the face projects over the left edge of the table, the blood is wiped out of the mouth, the left tonsil is caught and extirpated in a similar way; then, if the pharyngeal tonsil is enlarged, it is also thoroughly removed. In the latter case the after-treatment consists of the application through the nares four or five times a day of an antiseptic oily spray or of a 1-4,000 solution of adrenalin chlorid or suprarenalin in a saturated solution of boric acid, and if the child is large enough an antiseptic gargle is used several times daily. When only the faucial tonsils are removed it is desirable to have the throat sprayed or gargled with some non-irritating antiseptic about once an hour for two or three days, and afterward about half as frequently until healing is complete. The child should be kept in the house for nearly a week, for the whole wound can not be expected to heal within less than ten or twelve days.

34 Washington Street.

DISCUSSION.

DR. G. HUDSON MAKUEN, Philadelphia—Some years ago I saw Dr. Ingals do this operation in his office and was so impressed with the thoroughness of it that I immediately secured the instruments. The first case on which I operated was a child of five years, and I removed the tonsil with great satisfaction, but three or four days later, to my surprise, I found that the child had no uvula. I was interested in hearing that Dr. Ingals has had similar experiences and I should like him to explain how and why these accidents occur.

DR. WILLIAM E. CASSELBERRY, Chicago—In speaking of tonsillectomy before my classes, I divide it into tonsillectomy in children and tonsillectomy in adults. In children I divide again into operations with general anesthesia and those without it. Take first tonsillectomy in children with general anesthesia, I determine whether to use the snare or other instrument, observing whether the tonsil is of the pedunculated or of the submerged type. It is with the pedunculated type that I have found the snare particularly applicable. When they are loose and project well toward the median line, not being tied down to the triangular space, I find very little difficulty in enveloping them with the snare and making the enucleation of the tonsil. The method adopted in such cases on children under general anesthesia is by means of the curved vulsellum forceps, which occupies much less space than the one exhibited. I use No. 7 piano wire because it maintains its resiliency and cuts sufficiently well. The loop is applied to the tonsil and the vulsellum forceps takes it up, the tonsil is drawn into the loop of the snare; the same procedure is then repeated on the opposite side. This operation is usually done in conjunction with the removal of adenoids. In the second type of cases with general anesthesia we more frequently find the flat, adherent or submerged tonsil. I often find it difficult to break up these attachments and for this class of cases I believe the instrument exhibited would work admirably. All the easy cases seem to go to other men, leaving the more difficult cases for those of us who are specialists. They are usually divided into segments, one-half of which is adherent to the anterior pillar and the other to the posterior pillar. I find also that the lobe is higher developed and is covered with muscular tissue. I have not found it wise to use the snare to a great extent in these cases, but prefer to dissect them out. If there is any considerable part that the tonsillotome will take in bulk, I use that

first and then supplement it with the forceps in order to make a thorough tonsillectomy.

DR. J. A. STUCKY, Lexington, Ky.—I do not think I have used the guillotine a dozen times in the last three years. I use the snare entirely. I find I can do a cleaner operation in the first place, and that it diminishes the danger of subsequent hemorrhage. There is one difficulty I hope Drs. Ingals and Casselberry will tell us how to overcome; I refer to the necessity for an assistant to hold the tongue down. I find I have trouble in removing the right tonsil, where I have to hold one hand over the other; I need an assistant to hold the tongue down and use the forceps. It is astonishing how dexterity develops in the use of the snare, and after using it a number of times with a heavy wire it will be found much superior to the guillotine or scissors.

DR. GEORGE L. RICHARDS, Fall River, Mass.—I like this method very well, but, except in children, I do my operations without anesthesia. I have done it a number of times by injecting the tonsil with local anesthetics, using the Schleich anesthesia tablet, the operation is practically painless. I use the vulsellum forceps, drawing the tonsil through the loops and maintaining traction as the snare is tightened. The form of tonsil snare with a groove in the side of the ring, in which groove the wire loop is formed, answers admirably. It is somewhat awkward to use, but allows one to exert much firmer pressure against the side of the throat without bending of the wire loop, and is sufficiently powerful for all tonsils. I have found the tonsillar wound to be much more painful and the healing much slower than after operations with the guillotine. This would seem of necessity to be the case, as a wound made with a sharp instrument like the knife will heal quicker and be less sore than one made with a No. 7 or No. 8 piano wire.

DR. GEORGE B. WOOD, Philadelphia—I have had some experience in removing tonsils with a snare, and I want to indorse what Dr. Richards says about the reaction following the operation. I have found it to be almost threefold as great as that following the use of the tonsillotome.

DR. P. S. DONNELLAN, Philadelphia—As my experience with the treatment of enlarged tonsils becomes more extensive, I get more and more away from the use of the guillotine and use the snare or the forceps and scissors. I do not believe that any one operation can be used in every case. I believe the snare operation to be one of the very best.

DR. S. H. LARGE, Cleveland—Two months ago I recorded 100 cases of operations on the nose and throat with ethyl chlorid anesthesia, but the guillotine was used. This method of anesthesia would not do for the snare operation, since the anesthesia would not be sufficiently prolonged. We had no bad results and the patients experienced no unpleasant symptoms in taking it.

DR. E. PYNCHON, Chicago—In my experience the indications for this operation can be classified into, first, those appreciated by the patient, and secondly, those recognized by the physician. The call for operation may be recognized by observing the escape of secretions from the diseased tonsils, or by some condition of the gastrointestinal tract, due to the swallowing of such secretions. The size of the tonsil is no criterion for its removal. I understand Dr. Ingals to advocate the use of a general anesthetic. I think the dangers of anesthesia are sufficiently grave to contraindicate its use except in cases where it is absolutely necessary. If the patient is 13 years old, or older, I invariably use cocaine. At this time we are much at sea as to the physiology of the tonsil. I have operated on as many as a thousand cases and never yet have had a patient afterward make any complaint due to the loss of the tonsil. As to the line where the separation from the anterior pillar should be made, I would call attention to the line of demarcation where the redness of the tonsil changes to the pinkness of the pillar: that is my line of separation. As to the method of procedure, I am guided by the age and tolerance of the patient. With small children I do a tonsillotomy. The tendency of the snare is to cut along the line of least resistance and, therefore, the dissection must be made sufficiently deep to leave only a pedicle re-

maining. The greatest disadvantage of the cutting operation in adults is the matter of hemorrhage, and for that reason a bloodless operation is better if it can be done. Dr. Ingals mentions the use of electricity; by the use of the cautery I am frequently able to do a bloodless operation. Dr. Ballinger of Chicago has been using the snare a great deal, and he says that one of the worst hemorrhages he ever had was following the use of the cold snare.

DR. OTTO J. FREER, Chicago—I have done this operation many times and think that it is an ideal method for the removal of the class of tonsils called buried or submerged. It takes these out so cleanly from the very bottom of the tonsillar niche that nothing could be more perfect. It removes projecting hypertrophied tonsils quite as well and in children, where adenoid vegetations are to be cut away simultaneously under an anesthetic, it is the method I prefer to all others, but where projecting tonsils alone need ablation the tonsillotomy is preferable. I added the third tooth to the forceps because I found that the two-pronged one slipped off from the tonsil at times. The kind with the third tooth does not let go. I also cut off the uvula once, but since I have used Dr. Ingals' uvula forceps I have no fear of a repetition of the accident. The operation is a good one for submerged tonsils, because the tonsillar forceps is a strong instrument and may be crowded in above the velar lobe and under the bottom of the tonsil and thus be made to lift the tonsil completely from its bed. My greatest trouble used to be the application of the snare, because I seized the forceps with it instead of the tonsil. To overcome this I devised a snare guard which contains the wire while it is being carried over the forceps on to the tonsil. The wire used in this guard should be No. 6 piano wire, so that it may have stiffness enough to be crowded into the groove of the guard to keep it from slipping out. Many other operators have mentioned to me this same trouble of catching the forceps with the snare. I never have the tonsil pressed up, but prefer to crowd in beneath it with the tonsillar forceps. As to the anesthetic, I prefer ether to chloroform because I have had several cases where the latter anesthetic caused me much alarm. I have never had any trouble from ether and find that children often go to sleep more rapidly under ether than under chloroform. Tonsillectomy by cautery dissection is a bloodless operation so far as its immediate results are concerned, but I know from personal experience that secondary hemorrhages of an alarming nature quite often follow it.

DR. ROBERT C. MYLES, New York City.—Dr. Ingals has originated and explained the use of the snare, and when we shall have mastered all the details, this operation will be considered the best of all. He speaks of separating the anterior pillar from the tonsil. If the throat be examined carefully, it will be found that the tonsil does not touch the anterior pillar except at one spot; in the upper portion inferiorly it is not more than half an inch from the anterior pillar. If the tonsil can be cut from its surroundings, mucous membrane and investing sheath, there will be very little reaction. This is the most perfect operation, but it is limited in its application.

DR. J. A. STUCKY, Lexington, Ky.—What is Dr. Ingals' experience with the self-retaining tongue depressor?

DR. E. FLETCHER INGALS—I have one, but never use it. I did not speak of the benefits of a general anesthetic in the case of hemorrhage. I formerly thought a hemorrhage would never occur when the tonsils were removed with the snare, but I had one case in which it would have been very difficult to control had not the patient been under a general anesthetic which enabled me to grasp and tie the bleeding point. I think the uvula gets into the snare, especially in cases where the tonsils are large and in close apposition. I cut it off in my early cases before I adopted the plan of catching it with a pincette, but never have the accident occur now. One of the speakers suggested that there would be great difficulty in using the forceps in submerged tonsils, but it is in these very cases that it is of the utmost value. With the use of the hook, or tonsil dissector, the glands are dissected out with one motion, and they can then be easily grasped with the forceps. The anterior pillar should be caught with the hook at the upper part at the point

where it is in apposition with the capsule. I very rarely use an assistant excepting to give the anesthetic. I used to have some one press up the tonsil just as I caught it with the forceps, but I seldom do this now, as in nearly all cases it is easy to catch it without. The use of heavier wire in order to avoid catching the forceps might possibly be some help. I have had the wire catch the forceps a good many times, but when the tonsil is large enough to be grasped firmly it can be lifted out so that the wire loop must necessarily slip under it. I am not sure about the reaction being greater by this method, but it has not seemed so to me.

Special Article.

IMMUNITY.

CHAPTER II.

INFECTIOUS ETIOLOGY.

The microbic cause of a disease must be in hand before any logical attempt can be made to prepare an immune serum for the disease. It is not in all cases necessary that the organism be cultivated artificially, however; the conditions in rinderpest may be cited in which the body fluids of a diseased animal, known to contain the infectious agent, are used for immunization, although the microbe itself can not as yet be cultivated or recognized.

There are so many possibilities of error, and so many errors have actually been made in regard to infectious etiology, that certain requirements in the way of proof are now habitually demanded before an organism can be accepted as the cause of a disease. These requirements are most frequently expressed in the form of Koch's laws, which may be stated as follows:

1. The suspected organism must be found constantly in the proper tissues of an animal suffering from the disease, or which has died from it. 2. The organism must be cultivated artificially in a pure state. 3. It must be possible to reproduce the disease in a suitable animal by inoculation with the pure culture. 4. The organism must again be cultivated in a pure state from the tissues of the experiment animal.

Since these laws were formulated another procedure has been developed which may give valuable evidence as to etiology. This pertains to the agglutination test,

Agglutination Test.

or as we speak of it in connection with typhoid fever, the Gruber-Widal reaction. This principle, that in the acquiring of immunity to a microbic infection the serum of an individual gains in agglutinating power for the micro-organism, has been found to hold true in many infections. Consequently, if one has in hand the specific micro-organism for a disease, he would expect the patient's serum to have a stronger agglutinating power for this micro-organism than for others which were accidentally present; and this power would also be greater than that possessed by the serum of one who had not had this particular disease. In spite of some possibilities of error this test has been of distinct value in enabling us to recognize the specific microbe of a disease, as was the case in the identification of the germ of epidemic dysentery (Shiga).

All Koch's laws have not been complied with in certain cases, because of various difficulties which have been encountered.

First, the pathogenic protozoa can not be cultivated on artificial media (we must except the success of Novy and McNeal with certain trypanosomes); second, certain bacteria which may be found constantly in a given disease (spirillum of recurrent fever) have not been cultivated artificially; third, there are a few diseases which are peculiar to man and accordingly can not be reproduced in experiment animals (leprosy, influenza, scarlet fever, measles, etc.); fourth, some infectious agents are pathogenic for experiment animals, but do not reproduce in them a clinical or ana-