There are, therefore, reasons for believing that the sphincter of the bladder (the internal prostatic sphincter) plays a far more important part than Finger and Guyon credit it with, and that under ordinary circumstances it is by this muscle that the bladder is closed whether distended or not. And there is evidence¹³ that when the internal sphincter does yield, it does so, not because it is overcome by the mechanical pressure of the urine in the bladder, but because its muscular fibres relax as a vital act in response to a nerve impulse preliminary to the evacuation of the urine.

The normal act of micturition would appear to be as follows: As the bladder becomes distended with urine the vesical nerves are stimulated and evoke stronger and stronger contractions of the detrusor muscles, giving rise to the desire for micturition. To withstand the increased pressure of the urine the tone of the internal unstriated muscular sphincter is increased and, if necessary, even the accessory voluntary urethral muscles are called into play. When a favourable opportunity for micturition occurs the internal sphincter is voluntarily relaxed, together with the rest of the unstriated muscular tissue of the posterior urethra, and the urine is expelled by the contraction of the detrusors.

The objection which has been raised to an unstriated muscle, like the internal sphincter, being under the influence of the will is fairly met by a reference to the accommodation muscle of the eye, which, whilst unstriated, is completely under the control of the will.

In conclusion, I wish to acknowledge my indebtedness to Mr. Hall-Edwards for the care and skill with which he has produced the radiographs to illustrate this paper.

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THE MODERN MASTOID OPERATION.*

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THE mastoid operation as now performed has only been developed during the last few years, and one cannot but wonder that it was not described and carried out many years ago. This may be due partly to the fact that otology was formerly looked upon as of no importance, that the otologists had little or no knowledge of surgery, and that the surgeons who operated on the ear had no knowledge of otology. In his interesting paper on mastoid operation¹ Ballance says:

The operation for the cure of chronic suppuration in the temporal bone is practised abroad almost exclusively by highly skilled operators, who have devoted special attention to the subject. In this country it would appear to be considered within the competence of all. In skilled and careful hands it is attended by no more risk than other great operations, but, to quote a remark from a French book on surgery about another operation: if it is undertaken by "the rash, the ill-informed, and the ill-equipped," there is grave risk of disaster or injury to the patient, or perhaps still greater risk of failure to cure the disease, from the operation being ill-conducted and incomplete.

The operation for mastoid disease is in fact very tedious and difficult, and as the position and size of the important parts, facial nerve, lateral sinus, antrum, and mastoid cells vary so much in every patient, and are quite different in children and in adults, every case has to be treated on its

own merits, and we can never tell, until we explore the parts, how far the operation will extend, and what we shall have to remove. For these reasons it is much more difficult than many other important operations, and becomes dangerous if the surgeon is not perfectly acquainted with the topography of the surrounding parts.

The real history of mastoid operation begins with the publication of Schwartz's 59 cases in 1873. Schwartz opened up the mastoid antrum and a few cells in acute and chronic cases. At the present time this operation is only performed in acute cases, and in chronic cases we perform the so-called Stacke-Schwartz or complete mastoid operation.

There are three varieties of the mastoid operation: (1) Opening of a mastoid abscess and removal of any diseased bone; (2) opening of the mastoid process and the mastoid antrum—Schwartz's operation; (3) the radical operation in one of its forms, by which the middle ear, attic, mastoid cells, and antrum are reduced to one smooth-walled cavity—Stacke-Schwartz operation. This involves also the removal of the posterior wall of the meatus, the outer wall of the attic, and of all the bony ledges which overlap the antrum. I only intend to deal with the complete or radical operation.

A large skin incision should be made extending from the top of the ear to the apex of the mastoid (in cases of extensive disease an additional horizontal incision is made backwards), the periosteum is then carefully stripped off. Many operators make the incision much too small. We now carefully examine the exposed bone and look for a fistula. If there be one, it is generally found either just over the suprameatal triangle or near the apex of the mastoid, or further back on a level with the auditory meatus, when the lateral sinus or cerebellum is involved. If a fistula is found we, of course, follow this up, carefully exploring with a probe any cavities there may be. In some cases the antrum is lined with a thick membrane which may be mistaken for the dura. If no fistula is found, we chisel open the antrum from the posterior wall of the meatus, or in the area of the suprameatal triangle, cutting towards the centre of the triangle, thus making a conical cavity which points towards the antrum.

This is the old Schwartz operation, now only adopted in acute cases. In the modern operation for chronic cases the attic is also exposed, the posterior wall of the osseous meatus removed, and all the mastoid cells opened up and cleared out. We first turn our attention to the remaining bridge of bone which separates the mastoid antrum from the middle ear and attic. This is practically the posterior and upper wall of the auditory meatus. In the upper part we find the aditus to the antrum—that is, the communication between the attic and the antrum. The chisel is applied to the upper wall of the meatus, and thin layers of bone carefully removed. We thus open the so-called attic, or upper part of the middle ear, which contains part of the ossicles, and the aditus to the antrum. We then turn our attention to the posterior wall of the meatus. In its lower part lies the facial nerve, and near it the external semicircular canal. This part is very hard, and of a pale, shiny colour. We have to be very careful not to remove too much of this posterior wall, or we shall damage the facial nerve and the external semicircular canal. The assistant must carefully watch for any twitching of the face. For this part of the operation an electric forehead lamp is absolutely necessary. We then open up all the mastoid cells very carefully. These vary very much in extent, sometimes they extend forward into the zygomatic process, and backward well over the lateral sinus. All overlapping and rough bone should now be carefully removed by the forceps and gouge, or burr, and the walls of the cavity made as smooth as possible. At one time the burr was extensively used, but it is now practically discarded by most surgeons as unnecessary and tedious. Most of the operation can and should be performed with the help of bone forceps of various sizes, and the gouge. The chisel should be used as little as possible. We have now formed one large cavity consisting of the middle ear, attic, mastoid antrum, and mastoid cells. During the operation I frequently apply hydrogen peroxide, which not only arrests the aggravating haemorrhage from the bone or granulation tissue, but also cleanses the cavities and removes small pieces of debris which obscure the field of operation.

Instead of opening up the mastoid cells through the

* This paper was read before the Leeds and West Riding Chirurgical Society, and illustrated with numerous lantern slides.

suprameatal triangle we can do so from the posterior upper wall of the auditory meatus (Zaufal). This is much more difficult, but there is less risk of wounding the lateral sinus.

We next turn our attention to the soft parts. As the posterior wall of the bony meatus has been removed, the cutaneous meatus now projects into the newly-formed cavity and its posterior part must be cut away or utilized as a flap. Several methods have been suggested: Stacke makes a horizontal incision through the meatus into the concha and then turns the knife and cuts downwards. The lower large flap is then stitched into the lower angle of the post-auricular wound and helps to fill up and cover the cavity. This in my opinion is the most satisfactory method. Korner makes two horizontal incisions; Panse one horizontal, and then a T-shaped vertical incision, upwards and downwards. Ballance makes a horizontal incision in the lower part and then a vertical incision upwards, cutting round the edge of the meatus into the concha. In many cases the healing process is very tedious. Ballance had suggested grafting a large piece of skin from the arm or leg and fixing it over the whole of the large cavity, and two smaller ones on the posterior wall of the ear. He now does not graft the whole of the cavity, but only the upper part. He has discarded gold leaf, and uses small pellets of cotton-wool to keep the grafts in position. He grafts eight or ten days after the operation, and removes the grafts a week later. The objections to this method are, that practically two extra operations are necessary, and the skin grafting is not appreciated by many patients. I do not think that it reduces the time of healing very much, except in cases in which very much bone has been removed.

Another very important question is whether we should close the posterior auricular wound at once, or leave it open, and for how long. I think it advisable in severe or chronic cases not to close the wound at once. I generally put in three stitches and do not tie the middle one, but leave a central opening in the wound; through this and through the external meatus I pack the cavity. It is of great importance to keep the cutaneous meatus well open and dilated. This can be done by plugging, or by inserting a tube, metal or rubber. If we are not careful we get a stricture of the cutaneous meatus, which makes the after-treatment much more difficult. If things do well and there is no rise of temperature, no pus, and no pain, I tie the suture in the posterior wound after five to ten days, and only plug through the meatus. At first I dress the wound daily as long as it is septic, or if there is any rise of temperature. It seems to me to be a most unsurgical proceeding not to dress such a septic wound daily, especially as there is danger of the disease spreading into surrounding vital parts. Hydrogen peroxide is very useful: it cleanses the diseased parts in a most remarkable manner, and is a strong antiseptic. It is essential that the bandage should be as comfortable as possible. I never put it round the neck as, apart from the discomfort, this often causes severe headache.

One of the great difficulties in the after-treatment, is the excessive growth of granulations. These are often brought on by the too-prolonged use of iodoform. After a few days I now plug with aluminium-acetate gauze, and insufflate aristol, isoform, or xeroform, instead of iodoform. In many cases I apply 10 per cent. trichloroacetic acid to the granulations, or 20 per cent. silver nitrate solution.

It is of very great importance that the after-treatment of mastoid cases should be most carefully watched by the surgeon. Many a successful operation has been completely spoiled, and the patient has died, owing to careless or bad after-treatment.

I have no time to discuss all the indications for performing the complete mastoid operation, and will only briefly mention the most important:

1. In all cases of recurrent or chronic mastoiditis with external swelling.
2. Recurrence of granulation masses or caseous matter (cholesteatoma) in the attic or antrum, or persistent otorrhoea, after careful local treatment.
3. Recurrence of pain in the mastoid process, if accompanied by rise of temperature, especially if the pain is in the apex of the mastoid.
4. Fistula over the mastoid process.
5. Cases of chronic otorrhoea with marked stenosis of the auditory meatus.

The points to which I should like to have drawn special attention in this very incomplete paper are:

1. That operations on the mastoid process are often very difficult.
2. That every case is different, and that there is no typical mastoid operation, but the plan and extent of every operation must depend on the area of the diseased bone, and on the topography of the various parts: lateral sinus, mastoid cells, and mastoid antrum.
3. The chisel should be used as little as possible, and the bone forceps and gouge as much as possible.
4. In all cases it is absolutely necessary to open up the attic, remove the posterior wall of the meatus, and carefully explore and open up all the mastoid cells.
5. The great importance of preventing stricture of the cutaneous auditory meatus, and of making a flap or flaps from its posterior wall.
6. The use of skin-grafting when much bone has been removed.
7. The use of hydrogen peroxide for arresting haemorrhage during the operation, and for cleansing the cavity in the after-treatment.
8. The danger of the prolonged use of iodoform in the after-treatment, and the use of isoform or xeroform, and of aluminium acetate gauze.

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¹ *Lancet*, April 11th, 1903.

THE MICROSCOPIC CHANGES IN THE NERVOUS SYSTEM IN A CASE OF CHRONIC DOURINE,

OR "MAL DE COIT," AND A COMPARISON WITH THOSE
FOUND IN SLEEPING SICKNESS.*

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DR. LINGARD, of the Imperial Bacteriological Laboratory of India, who has published an interesting monograph on dourine, forwarded for microscopic investigation the nervous tissues of an Arab stallion which acquired the disease by infective coitus; after exhibiting 156 characteristic cutaneous plaques, together with marked symptoms of paraplegia, it died 27½ months after infection.

Dourine is due to a specific form of trypanosome which has the power of penetrating the mucous membrane, affects equines, and is transmitted, like syphilis, by coitus. This is of especial interest, since Schaudinn has demonstrated the *Spirochaeta pallida* of syphilis. It is also of interest because, like some other trypanosome infections—for example, sleeping sickness—it may run a very chronic course, and, as in the case under consideration, more than two years may elapse before a fatal termination.

A comparative examination of the nervous tissues of this disease with those of animals infected with *Trypanosoma gambiense* and with the tissues of human beings dying of sleeping sickness appears to show that chronic trypanosome infection causes a chronic lymphadenitis, followed later by an interstitial inflammation of the connective-tissue structures of the nervous system.

This morbid change is due to the presence of an irritative agent in the lymphatic system, which, in the case of dourine, starts in one seat of primary infection, extends to the inguinal glands, thence presumably by the pelvic lymphatics to the lumbo-sacral plexus, and the posterior roots to the central nervous system; consequently, the lower part of the spinal cord, and especially the root zone of the posterior column, is first and most affected.

Laveran and Mesnil refer to the observations of Marck, who showed the presence of a degeneration of the nerve fibres of the posterior columns, the other parts of the spinal cord being healthy. Marck therefore named dourine infective polyneuritis of the horse.

Dr. Mott was unable to examine the peripheral nerves, because they were not sent, but a very complete examina-

* Abstract of a paper read before the Royal Society on March 8th, 1906, and published in full in the *Proceedings of the Royal Society*, vol. 78, No. B 522.