in which on account of the patient's poor condition even spinal anesthesia did not seem to be practicable, I have opened the bladder under local anesthesia with gratifying results. I use a 0.5 per cent. solution of novocain, to each 10 c.c. of which is added one drop of epinephrin. A rhomboid figure is described by infiltrating the bladder region above the pubes, in the center of which the incision is made. This method of anesthesia seems to be particularly indicated for the purpose of rapidly opening the bladder as the initial step in the two-stage prostatectomy.

DR. G. G. SMITH, Boston: In order to get at growths in the very base of the bladder or in the prostate and so that we can see what is going on at the prostatic orifice, it is essential to carry the incision well down to the pubic bone.

I should like to ask Dr. MacGowan whether that lower edge of the rectus fascia does not prevent one from getting down into the pelvis.

DR. A. L. CHUTE, Boston: I should like to ask Dr. MacGowan if he thinks that constant irrigation is essential. I have never had any trouble with clotting, and it has always seemed to me that the continuous irrigation tended to keep up the bleeding. I should like to ask him if he has had any trouble in that way. It seems to me that the bladder distention ought to open up the vessels and cause more bleeding. The other method works satisfactorily. When continuous irrigation is used, moreover, you are not able to estimate the amount of urine. If the patient is in bed it seems to me it is essential to know how much urine he is excreting, and I do not see how that is possible with continuous irrigation.

DR. GRANVILLE MACGOWAN, Los Angeles: I think you refer to the incision that I saw Cabot make in Boston this year. What struck me most about that incision was that it was so unnecessarily large. It is easy to obtain everything you desire without it. I do not know how many bladders I have opened suprapubically, a thousand at least in my lifetime, and I have tried all methods to make it easy and safe. One can pull the bladder up and out on the abdominal wall through the incision which I have recommended. It is not necessary ordinarily to see the mouth of the bladder, but, if it should be desired to see it directly with the eye, the lower flap of this wound can be pulled down with a retractor after the central tendon is slightly snipped along under the sheath of the rectus muscle. I have removed tumors from the bladder extraperitoneally and intraperitoneally through an incision of this kind. You can get more room by going out further on the fascia, even out beyond the rectus muscles, if it is desired. The edges pull wide apart readily. There are a few cases in which I should prefer the incision which Dr. Cabot uses. It is surprising how much can be done through a small incision made transversely, and, if a small incision through the skin and fascia gives all the room necessary for an operation, why make a larger one? If a larger one is needed, it can always be made.

It has been my unfortunate situation during the whole progress of my surgical career to be dependent on myself. The surgeons who are in large hospitals have at all times skilled interns to look after their cases. Getting up in the middle of the night to take clots out of a bladder is probably something that many of you have been called on to do. When a surgeon has to nurse the cases himself, continuously watch them, or have them looked after by persons who are not trustworthy and skilled, he spends a great many anxious nights if he does not have some way to prevent the accumulation of clots in the bladder. The only sure method that I know for preventing such an occurrence is the procedure of Dr. Freyer, who sticks in an extraordinarily large tube, so that if there is tenesmus from the clots the bladder muscle cannot close. This very large tube, or my own, which is just as efficient and much more comfortable, prevents its closure. Continuous irrigation by the drop method is a great boon to the patient, to the nurse and to the surgeon. The nurse knows practically what she is doing, the patient does not have excessive hemorrhage and the surgeon does not lose his rest. It does not seem to me that it is at all necessary to know how much urine the patient is passing. If the eye

is trained, a good observer can tell the minute he comes into the room of a man who has been operated on if there is any lack of kidney function by the general look of his face, and an examination of his tongue; the latter always waves the danger flag.

When after operation the bladder is sewed up tight—I will confess that I have been venturesome enough to do this a few times after prostatectomy and do it successfully, though I should not like to recommend such a practice in general to surgeons—an accurate account of the fluid which comes out of the bladder can be kept, but even then you do not know how much is blood and how much is urine, and you have to squirt water continuously through the catheter to keep it open. If a tube of the kind that I have described here is used, you will know how much fluid has gone into the bladder, because the nurse keeps track of it, and you will know how much comes out of the bladder, and you can deduct one from the other and have a fairly accurate idea as to how much urine the patient has passed.

VASOSTOMY—RADIOGRAPHY OF THE SEMINAL DUCT*

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Vas and vesicle usually accommodate from 4 to 6 c.c. of a non-irritant liquid, such as 5 per cent. argyrol solution, injected through a scrotal vasostomy. None of the solution escapes through the ejaculatory duct until

Fig. 1.—Pus infection of vesicle; gleet. For this and the following radiograms, vasa deferentia, seminal vesicles and ejaculatory ducts were injected with collargol solution through vasostomy.

vas and vesicle are filled, because this exit is closed by a sphincter. This muscle yields to overfilling of the seminal ducts, the solution passing into the prostatic urethra and thence usually backward into the bladder, but occasionally forward into the anterior urethra, escaping at the meatus. An unlimited quantity of solution may thus be used to irrigate vas, vesicle, ejaculatory duct, prostatic

urethra and utricle; and this irrigation may be repeated at the discretion of the operator.

For days after such filling of the seminal duct, peristalsis of vas and vesicle occurs, shown by the constant presence of argyrol in the urine, and sometimes demonstrable through the urethroscope as an intermittent discharge from the ejaculatory ducts. Since this occurs without subjective perception, peristalsis must be regarded as a normal function of the seminal, as it is known to be of the urinary, duct; and the prostatic urethra as the natural catch-basin for the seminal duct, as is the bladder for the urinary canal.

Retrograde urination, that is, the escape of urine through the vasostomy incision when a strong desire to

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urinate was resisted by the patient, has been observed in three of my cases; in two of these, argyrol solution injected into the bladder was forced through the scrotal incision, proving the source and course of the clear fluid previously observed to issue from the cut. Two of these patients had suffered from frequently recurring epididymitis during several years following a gonorrhea; in each the corresponding ejaculatory duct was patulous and easily catheterized. Although this passage of urine from the urethra into the vas seems hitherto to have been unobserved except after operations on the prostate (by Voelcker in two operative cases), yet it seems probable that such retrograde passage of urine into the seminal duct may be the not infrequent cause of recurrent epididymitis and vesiculitis following gonorrhea, as in these cases.

The normal peristalsis of the seminal duct explains certain hitherto obscure phenomena, including the phosphaturia so frequent in the subjects of sexual neurasthenia. These men usually exhibit an infection of the vesicles with hypersecretion and active peristalsis of their contents. Since the vesicular secretion is known to precipitate lime-salts when mixed with urine, it is apparent that the constant discharge of such secretion into the

That such arrest of spermatogenesis, without impairment of sexual power, may be caused by exposure of the testes to the Roentgen ray, and that it commonly exists in cryptorchids and hybrids (for example, the mule) is generally known; but that it may result also from certain infectious diseases should be understood. For the delusion is still prevalent that sexual power is dependent on spermatozoa; and that the absence of these from the semen of a potent man must be due to occlusion of the seminal ducts. The fact is that sperm production may be abolished by the toxins of general infections, such as typhoid, without diminishing the subject's sexual power; he becomes sterile, but remains potent.

In two of my patients a chronic colon bacillus infection of the seminal duct has caused chronic toxemia, shown by continuous high temperature and progressive loss of weight, exceeding 20 pounds in one case. In both patients irrigation of the seminal ducts through vasostomy was followed by rapid return to normal temperature and gradual recovery of usual weight, as well as disappearance of a chronic gleet discharge sometimes tinged with blood.

The juxtaposition of ureter and infected vesicle, already shown to be capable of causing obstruction of

Fig. 2.—Colon bacillus infection of vesicles; chronic toxemia.

Fig. 3.—Pus-tube on the right; tortuous vas on the left side.

Fig. 4.—Bilateral gonococcus infection; stilet catheter in right ureter.

prostatic urethra and thence into the bladder can throw the lime compounds of the urine out of solution in the bladder, causing phosphaturia. That this was the correct explanation in two patients I proved by catheterizing both ureters while the urine in the bladder was cloudy from undissolved lime-salts; from these catheters clear urine escaped. Blood and pus mixed with urine may be derived from the vesicles.

Anastomoses between the dilated extremity of the vas (ampulla) and the associated vesicle are not rare. Since these must furnish direct passage of spermatozoa into the vesicle, this observation seems to prove that the vesicles may be not only secretory organs, but also reservoirs for spermatozoa, contrary to the current assumption.

Experience with vasostomy has shown that sterility may be due to occlusions not alone of the epididymis, but also of the vas and of the ejaculatory duct; also that the absence of spermatozoa from the emitted fluid is sometimes due not to an obstruction of the ducts but to arrest of the spermatogenic function of the testis through an infectious disease, such as mumps or typhoid fever.

the ureter and consequent damage to the associated kidney, is illustrated in some of my radiograms. The ureter is shown to lie approximately over the central axis of the vesicle; the usual text-book illustrations, made from dissections of the dead subject, apparently do not represent the relations existing in the living body.

Infections invading the seminal duct from either end (urethra or epididymis) may produce (a) occlusion or (b) a patulous condition of the ejaculatory duct. In the former event a closed abscess results; in the latter, vesicle and epididymis are liable to recurrent invasions by infection and even by urine from the prostatic urethra. The result in either event may be a pus-tube with chronic toxemia. This can usually be successfully treated by injecting the vesicle through vasostomy, sometimes also from the urethra.

In medicating the vesicle through vasostomy, a preliminary injection of some non-irritating liquid, such as 5 per cent. argyrol solution, should be made to test the patency of the entire seminal canal. Should this reach the urethra in a few minutes (shown by blackening of the urine), collargol solution, 1 to 3 per cent.,

may be immediately injected. If the argyrol does not appear in the urine, the more irritating collargol should not be used; for it will be regurgitated into the scrotal tissues around the cut, and there produce a tender induration which is slow to disappear.

The radiograms were made by Dr. Potter and Mr. Ball of the Presbyterian Hospital, and Drs. Case and Van Horn of St. Luke's Hospital, Chicago.

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TRANSPLANTATION OF THE TESTICLE*

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The first experimental work on transplantation of the testicle was done by Berthold¹ in 1849. He used completely castrated roosters and transplanted the testicle into the abdominal cavity. The transplanted testicle grew, maintained its peculiar character as a sexual organ, and the male habits of the chicken continued.

Other investigators have confirmed this result in chickens. In frogs, Herlitzka² transplanted testicles into the peritoneal cavity, and found that they degenerated and became absorbed.

Meyns³ worked with frogs and implanted parts of the testicle into the dorsal lymph-vessel of the frog and found that these transplants grew and developed new mature spermatozoa.

The size of the transplanted organ has a great deal to do with the success or failure of the operation. If the testicle is transplanted *in toto*, it is almost certain to necrose. If it is cut into thin slices from 1 to 2 mm. in thickness and then transplanted into a vascular bed, such as in the substance of a muscle or in the liver, it will grow. In frogs and chickens the spermatogenic cells retain their function and produce spermatozoa. In warm-blooded animals, the spermatogenic function seems to be lost and the spermatogenic cells disappear in less than thirty days. The Sertoli cells and the Leydig cells, however, do not degenerate but seem to maintain their life and function.

EXPERIMENTAL WORK

In the first group three adult dogs were castrated and at the same time their peritoneal cavities were opened. Dog 1 had the two testicles from a week-old puppy dropped free into his peritoneal cavity. Dog 2 was treated in the same manner. The spermatic cord and the tunica vaginalis testis were cut away from the puppy testicles, but the epididymis was left attached to the testicle. In Dog 3 the two puppy testicles were wrapped up in the omentum. These dogs were killed six weeks after the operation. The peritoneal cavities were explored but no trace of the transplanted testicles could be found.

In the second group adult dogs were castrated. The testicles freed of the epididymis, cord and tunica vaginalis testis, were then cut in slices from about 1 to 2 mm. in thickness transverse to the long axis of the organ. The central slice, which was the largest, was then taken and placed among the fibers of the rectus abdominalis

muscle. These animals were killed in six weeks' time and the transplanted tissue examined. It had shrunk to from approximately one-quarter to one-third the original mass, and had changed to a yellowish color. In some of the dogs the transplant could not be found at all.

Experimental transplantation of the testicle with blood-vessel anastomosis is practically impossible by either a suture method or magnesium ring method of blood-vessel anastomosis applied to the spermatic artery.

The ideal method is that of patching—removing the section of the abdominal aorta, baring the opening of the spermatic artery, and removing the piece of the vena cava, baring the outlet of the spermatic vein.

My search of the literature revealed no experimental work done by this technic. There is, however, one human case on record by Hammond and Sutton⁴ of Philadelphia, who operated by making an end-to-end anastomosis of the spermatic artery and vein. This case was an apparent technical success, but the ultimate result was a marked atrophy of the transplanted testicle. The person into whom the testicle was placed has one sound testicle, and hence it is impossible to determine the functional value of the transplanted organ.

It is a generally current opinion that a graft of an organ has a better chance to grow in an individual that needs the secretion from this organ than in one with a normal organ already.

REPORT OF CASE

A man, aged 38, consulted me in January, 1911, to find out if anything could be done for the loss of both testicles. One testicle which had been retained was removed during a hernia operation; the other had been lost by an accident about two years previous to his consultation with me. He was unable to have intercourse, which was his chief reason for coming to me.

A testicle from a normal man was easily obtained. In fact, I was surprised at the number of testicles that are available for transplantation purposes.

The two patients were anesthetized at the same time, and the recipient prepared as follows: The scrotum was opened high up and a bed prepared in the same way as we prepare the bed for the reception of an undescended testicle. Hemostasis was carried out with great care. Another incision was made over the rectus abdominalis muscle; this incision was carried down through the skin and fascia. The fibers of the rectus muscle were exposed and these fibers separated by opening an artery forceps plunged into the muscle. Hemostasis was carried out and then the testicle to be transplanted was removed. It was immediately stripped of the epididymis, cord and tunica vaginalis, and then sliced transversely to its long axis, these slices being approximately 1 mm. in thickness. The central slice and the one next to it were taken out and placed among the fibers of the rectus muscle. Another slice was placed in the scrotum. The wounds were closed without drainage and healed by first intention throughout.

On the fourth day after the operation the patient had a strong erection accompanied by marked sexual desire. He insisted on leaving the hospital to satisfy this desire. The desire and power of erection have continued for two years. It is now two years and six months since the operation, but I have not seen the patient for six months.

CONCLUSIONS

Transplantation of the testicle is a perfect operation in frogs and chickens; spermatogenesis and sexual characteristics are preserved. In guinea-pigs, rabbits and dogs the results are variable. Some experimenters report that there is no success at all; others assert that the interstitial cells remain and functionate. In the two

* Read in the Section on Genito-Urinary Diseases of the American Medical Association, at the Sixty-Fourth Annual Session, held at Minneapolis, June, 1913.

1. Berthold: Transplantation der Hoden, Mueller's Arch. f. exper. Med., 1849, p. 92.

2. Herlitzka: Transplantation des testicules, Arch. ital. de biol., 1890, ix, 140.

3. Meyns: Froschhodentransplantation, Arch. f. d. ges. Physiol. (Pflüger's), 1910, cxxxi, 433.

4. Hammond and Sutton: Case of Transplantation of Testicles, Internat. Clin., 1912, xvii, 150-154.