TRANSURETHRAL PROSTATIC RESECTION*

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A CENTURY has passed since Guthrie, in a lecture in London, called attention to the formation of bars at the neck of the bladder and advocated treatment by incision with a knife blade, concealed in or projected from a catheter. In describing the operation he said: "The knife being projected just as the instrument is felt to be passing over the bar will cut it, and after it has passed into the bladder and being withdrawn the little knife in coming back will enlarge the original cut."

Since that time, urologists have employed improvements of this instrument for overcoming various degrees of cicatricial obstruction at the neck of the bladder, until to-day the electrode knife devised by Collings is a perfect instrument for the purpose. However, this method of treatment is limited to contractions of the neck of the bladder and is essentially sphincterotomy. Since by it none of the obstructing tissue is removed, the field of application of this operation is limited. Realising these limitations, Mercier, in 1841, constructed an instrument designed to remove in small pieces obstructing tissue at the neck of the bladder, and he should, therefore, be considered the first to have practised transurethral prostatic resection. He evidently realised the fact that only a small portion of any hypertrophied gland causes the obstruction, and that hypertrophy of prostatic tissue adjacent to the urethra, if it does encroach on the lumen of the urethra, is of no significance and need not be considered in relieving the obstruction. Projection of the hypertrophied tissue into the rectum or bladder is of no more detriment to the patient than is grey hair or other signs of advancing age.

When one remembers that the diameter of the urethra is less than 1 cm., and that the normal distance from the verumontanum to the neck of the bladder is less than 2 cm., it becomes readily apparent how small an amount of such tissue is necessary completely to obstruct the urethra. To cite an analogy, let the bladder be considered as a flask and the urethra as its neck. A stopper that will completely close the outlet is comparatively small and that which will partially obstruct it is still smaller. Yet this self-evident fact seems to have been neglected in the treatment of obstruction of the urethra due to prostatic hypertrophy, principally, I believe, because the manner in which surgery of the prostate gland developed tended to erroneous conclusions.

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Early in this work, surgeons performed only partial prostatectomy, removing whatever intravesical hypertrophied tissue was discernible. If intra-urethral hypertrophy co-existed, their results were poor and the suprapubic wounds did not close. Therefore, Fuller, in America, and Freyer, in England, undertook to carry out what they considered complete enucleation of the gland, and as all obstructing tissue was necessarily removed, along with an enormous amount of non-obstructing tissue, their results were far superior to those of the surgeons who had done only partial prostatectomy. From then until the present time the surgical world, with comparatively few exceptions, accepted the doctrine that complete prostatectomy was the procedure indicated in cases of benign hypertrophy of the prostate gland and devoted their attention to efforts at reduction of mortality. Although marked improvement has occurred as a result of pre-operative preparation, the rate of mortality remains the highest of any surgical procedure directed toward relief of a benign condition. Furthermore, although the functional results following prostatectomy are common knowledge to the initiated, reviews of them are seldom published. That they are far from what one could desire is attested by the fact that as recently as last year the professor of urology in a State University told me that at one time 25 per cent. of the patients with prostatic disease on his service at the University hospital were admitted because of dysfunction following prostatectomy performed by surgeons throughout the State. That these facts are being recognised is further attested by the recent reports of two leading urologists, of a

TABLE I

CASES OF PROSTATIC HYPERTROPHY IN WHICH TRANSURETHRAL RESECTION WAS PERFORMED BETWEEN JANUARY 1ST, 1925, AND JANUARY 1ST, 1932.

	Cases.	Per cent.
Number	250	—
Hospital deaths	6	2·40
Number in which previous prostatectomy had been performed	15	6·00
Number in which subsequent prostatectomy had been performed	9	3·60

series of cases in which second prostatectomy was necessary because of recurring obstruction. In a series of 250 cases in which I performed

transurethral resection of the prostate gland between January 1st, 1925, and January 1st, 1932, fifteen (6 per cent.) of the operations were performed on patients who previously had undergone prostatectomy. These 250 cases form the basis of this paper (Table I).

Realising these unpleasant truths, leaders of the profession have ever been on the alert to find some better method of treatment than removal of an entire gland simply because a small portion of it was obstructing the urinary outflow in a channel as accessible as the urethra. Yet, to operate successfully in such a situation, it is essential that the instrument used shall satisfy three major requirements: (1) it must be capable of removing all the obstructing tissue at the time of operation, since to remove only a portion of the tissue in the presence of residual urine will aggravate, not improve, the symptoms from which the patient is suffering; (2) the operation must be carried on under such conditions that the obstructing portions of the gland can be seen and their relationship to other structures determined before their excision; and (3) the procedure must insure adequate control of bleeding either during or immediately following the excision.

The Various Instruments for Transurethral Resection

In describing the various instruments for use in transurethral resection I shall emphasise how adequately or inadequately each fulfils these three essential requirements. Obviously, until the application of electricity, only the first requirement could be met, namely, removal of tissue, and this to a limited extent only, for there was no means of controlling hæmorrhage and no possibility of seeing the portion of the gland to be removed.

Bottini was the first to employ electricity. In 1879 he designed a galvanocautery much like a lithotrite, the male blade of which became heated by the electric current. The obstructing portion of the prostate gland was engaged in a manner similar to that employed in crushing a stone. This instrument, by making use of the cautery, introduced the first attempt to control hæmorrhage. But it abandoned one principle that Mercier's instrument had possessed and which is essential and indispensable, namely, removal of obstructing tissue. True, it aimed at its removal by destruction with the cautery, but cutting of a narrow passage rather than removal of the tissue was the instrument's main purpose. It was used by its originator and his Italian associates with little change for the next twenty years, but received scant recognition until Freudenberg, of Berlin, modified and improved it, and made its use widespread by publishing his experiences with it in 1897. In an effort to overcome lack

of vision during the procedure, Freudenberg added a cystoscopic lens system to the instrument. He wrote that he obtained the idea from an instrument which Wassidlo had equipped with a lens system, but by Wassidlo's placing it beside the blades vision was lost as soon as the blades were engaged in the prostate gland. This objection Freudenberg overcame by placing his lens beyond the blades. He made the rather significant statement, after describing this instrument, that although vision was thus provided he had employed vision but once, preferring to carry on the procedure by sense of touch. In America the procedure attained its greatest usefulness by Chetwood, who carried on the operation through a perineal incision and so removed it from the transurethral field and made it so nearly a major surgical procedure that many felt that prostatectomy was preferable. When Keyes, Jr., who kept careful records of the ultimate results of the procedure, reported at the end of ten years that in all his cases recurrence had taken place, the method was generally abandoned.

In the meantime, the accessibility of the posterior urethra had been enhanced by Goldschmidt, in 1907, who perfected the first urethroscope and made it possible to examine the structures beyond the verumontanum through an irrigating fluid. What Nitze had done for visualisation of the bladder Goldschmidt did for the urethra. He also devised for use in his instrument an electric needle not unlike that employed to-day, but using, instead of the high-frequency current, the galvanic current.

Five years later, in 1914, Luys described his operation of forage or tunnelling of the prostate gland, which was carried on through an endoscope with an electric light. The procedure consisted of destroying the obstructing portions of the gland by either electro-coagulation or by the galvanocautery. Electro-coagulation he described as a scarification of the tissue by a high-frequency and low-tension current, the subject being placed in the oscillating circuit. This current, he explained, is obtained by the transformation of a continuous or alternating current to a current of high frequency and low tension. Although he employed this current to remove tissue by destruction rather than by excision, it is of interest to note the time of its first employment in transurethral work. The operation was done in a dry field through an endoscope, therefore vision was not as adequate as with the instrument devised by Goldschmidt. Thus Luys must be credited with meeting to a partial degree each of the three requirements for success. Obstructing tissue was removed by destruction to a limited degree. Bleeding was satisfactorily controlled because the limited removal of tissue did not make it excessive. Vision, although inadequate, was provided.

While this progress was being made in Europe, Young, in this

country, stated : " The amount of tissue removed at suprapubic operations is often so small that it seems ridiculous to have to perform suprapubic operation for its removal." He then devised his prostatic punch, which he presented at the International Urologic Meeting in 1911. This instrument, when first developed, allowed partial vision by means of light reflected down the lumen, so that the projecting pieces of tissue could be seen after they were grasped. He found this of such little assistance after the first piece of tissue had been excised, due to bleeding, that he abandoned guidance by sight and depended on the sense of touch, as Mercier had done earlier. Although the instruments in many ways resembled each other, and both were limited to removal of tissue without vision or means of hemostasis, still the presentation of the instrument did a great deal to stimulate transurethral work in America, and Young deserves all credit for initiating interest in the procedure among American urologists as well as adding the word " punch " to urologic nomenclature.

In 1918 Braasch described his median bar excisor, which permitted adequate vision of the vesical neck, before and during excision, through a direct cystoscope. There was, however, no means of controlling bleeding, and the tubular knife which he employed was of necessity small in calibre, for lack of hemostasis prevented removal of any considerable amount of tissue.

Although Young later described a modification of his punch, in which a cautery blade was employed instead of a tubular knife, technical difficulties evidently prevented its adoption, and it remained for Caulk, in 1920, to present an instrument which provided for hemostasis by cautery and, at the same time, for removal of tissue instead of burning *in situ*. Vision was also provided ; the reflected light of the original Young instrument was returned, and after the obstructing tissue had been grasped, by means of sense of touch, it could be seen projecting into the lumen of the instrument. It could not be found except by sense of touch, and its position in relation to other structures could not be determined by vision. The instrument was efficient in removal of tissue and partially efficient in the control of hæmorrhage, but inefficient in vision.

To John Caulk must be given full credit for keeping the attention of members of the profession centered on the problem of transurethral resection of the prostate gland during the past decade, and, under adverse criticism, demonstrating that this method of relieving prostatic obstruction was feasible in many cases.

While using Caulk's instrument in a series of seventy-two cases, I noticed the procedure was usually followed by an acute febrile reaction that generally subsided on the fourth or fifth day, but which was sometimes unduly prolonged. Reactions lasting more than three days occurred

in twenty-three cases (about 33 per cent.). Following the use of the knife punch, such reactions had been the exception. It appeared, therefore, that a cauterised area in the neck of the bladder was more prone to secondary infection than a cleanly incised area, and hence a better focus for secondary pyelonephritis. The interval required for healing of a burn, in comparison with healing of a clean incision, seemed about to double the time over which such an infection might take place. An unfortunate accident occurring as a result of the limited vision afforded by the instrument, together with the incidence of febrile reactions, led me to abandon

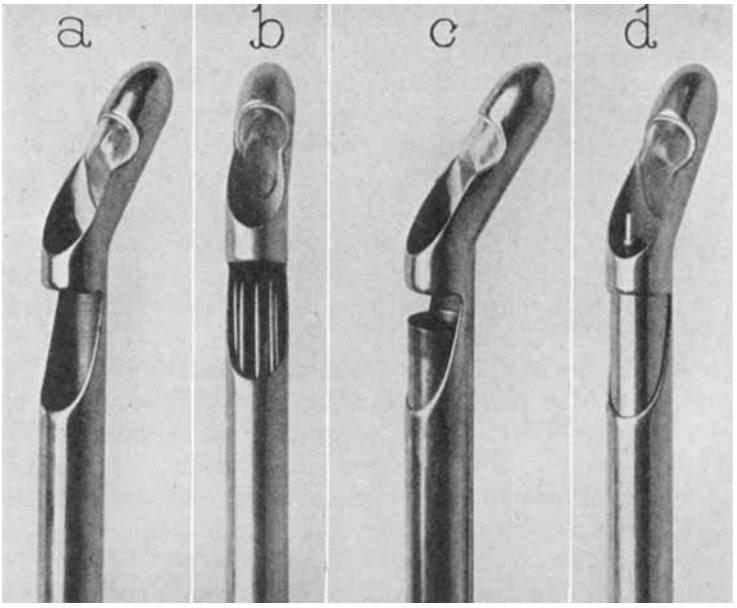

FIG. 1.—Distal end of Braasch cystoscope modified for transurethral resection.

the instrument, and in place I used a Braasch cystoscope of the same calibre as the Caulk instrument, in the barrel of which a fenestra similar to that in the Caulk instrument had been cut (Fig. 1, *a*).

This instrument gives adequate vision of the operative field, so that one can determine what portions of the obstructing tissue to remove first, and what their relative size and position is to nearby anatomic landmarks such as the verumontanum, ureteral orifices and interureteric ridge. The problem of adequate vision seems solved, and there is no difficulty in removing whatever obstructing tissue is necessary.

To control hæmorrhage, I at first removed the instrument and replaced it with a cystoscope and, employing a Bugbee electrode through

a catheterising guide, lightly electro-coagulated the bleeding areas (Fig. 2), and individually touched the large arterioles which could be seen spurting in the irrigating fluid. This method of resection and of control of hæmorrhage I described in the *Journal of Urology* in July, 1926,

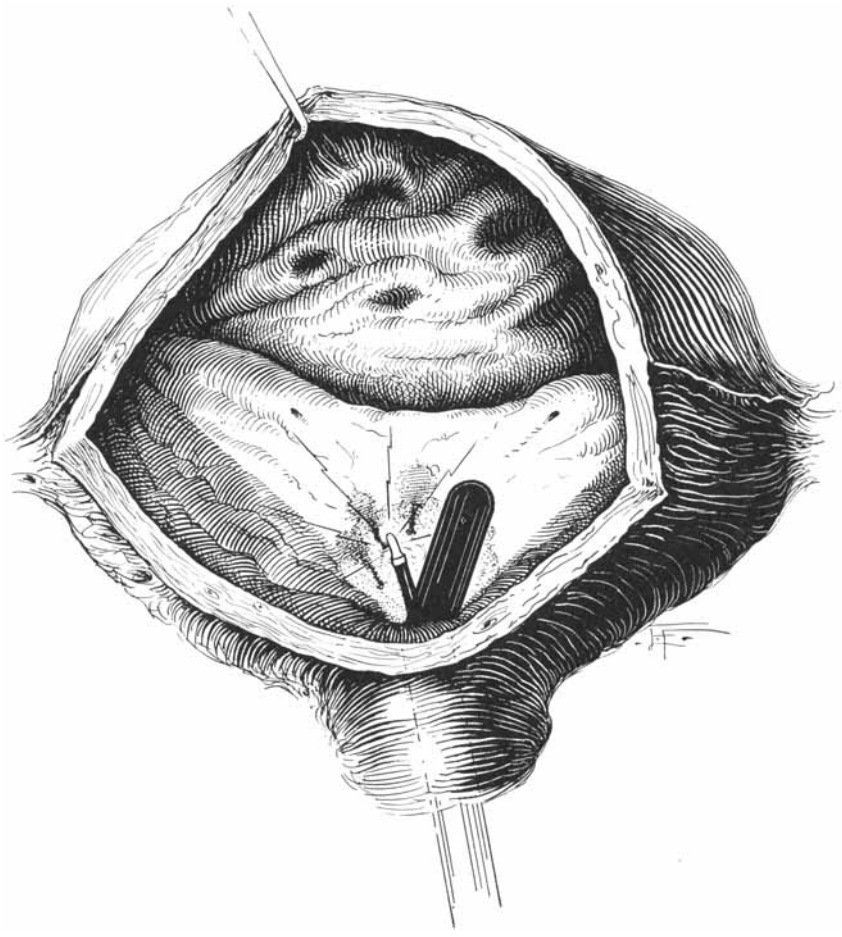

FIG. 2.—Control of bleeding following resection.

but, since few urologists are familiar with the use of any but lens instruments, the method received scant attention.

Since then the addition of a sheath (Fig. 1, *c*) to cover the fenestra, constructed on a guide for carrying the electrode, has made it unnecessary to remove the instrument when fulguration is necessary. More recently, Tyvand, a Fellow of the Mayo Foundation, has constructed a multiple

needle electrode (Fig. 1, *b*) which is thrust into the tissue before the knife is passed, and so renders the course of the knife blade through the tissue

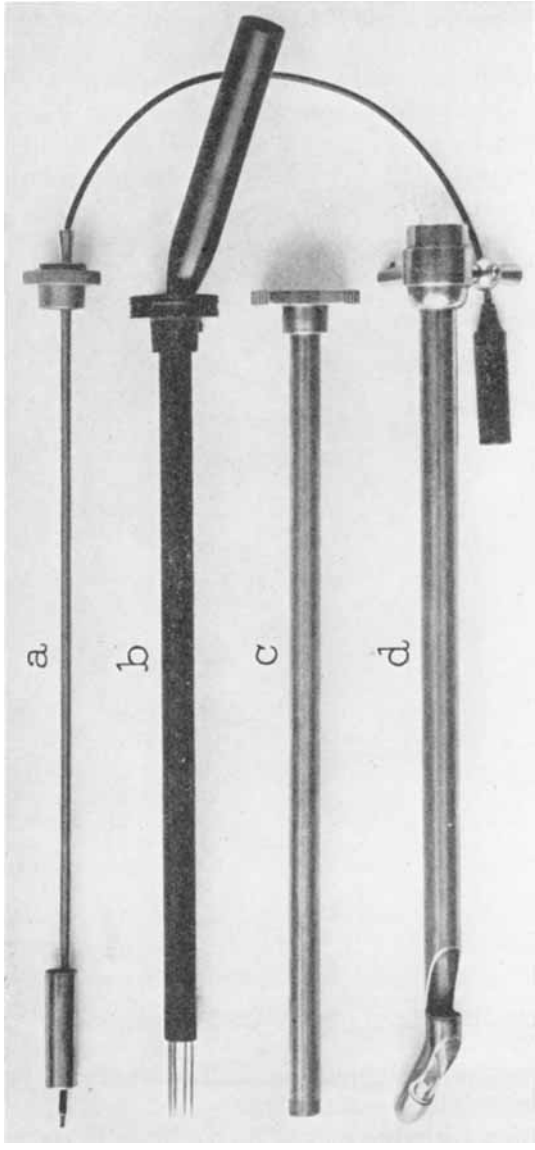

FIG. 3.—Bumpus modification of Braasch cystoscope with attachments for prostatic resection.

more or less bloodless, and reduces to a minimum the necessity of electro-coagulation after resection.

Of the 250 cases on which this report is based, in 154 (61·6 per cent.) this instrument was used (Fig. 3), and, although many new instruments have become available and have been tried, with none can I remove tissue as rapidly, and cause as little destruction by coagulation to the remaining tissue, as with the tubular knife, followed by electro-coagulation to control bleeding.

In 1922 the Wappler Company commenced experimenting with a high frequency current of low voltage, which by its tremendous number of oscillations, estimated at millions per second, seemed to destroy the tissue when it passed through the tissue cell in sufficient concentration. When properly applied, this instrument apparently could cut under water as well as in the air.

A few years after this, Stern, of New York, with the co-operation of the Wappler Company, developed the " resectoscope " for application of this new form of current to transurethral prostatic resection. Although the instrument, consisting essentially of a sliding wire loop, would remove small pieces of tissue and hemostasis was partially controlled, it did not prevent the larger vessels from bleeding, and when a lens system is used hæmorrhage of course obscures the field of vision. So the new instrument might be judged on the basis of the accepted criteria of merit as enabling vision, removing tissue, and controlling hæmorrhage, all to a limited degree.

Davis, however, made some fundamental improvements in this instrument. He enlarged the wire loop electrode and made it less fragile, and arranged a double foot switch by which he could pass a coagulating current through the cutting loop electrode if bleeding occurred after excision with the cutting current, and so by drawing the loop back and forth over the denuded surface could render it bloodless.

In describing his operation he wrote : " The author has often been accused of having an unlimited amount of patience. It is true that it may require more time and perseverance in the management of these cases by resection than with an open operation. Which is more preferable ? A certain amount of patience on the part of the surgeon during the operation that has had no mortality, a hospitalisation of several days usually without physical discomfort, or a rapid operation with a recognised high mortality, a hospitalisation of several weeks with its economic considerations, weeks of untold suffering and a disability of several months following the discharge from the hospital with an end result that is certainly not any better than that obtained by the minor operation of resection ? "

Following Davis' success, McCarthy had his panendoscope equipped with a sliding loop which reaches out beyond the end of the instrument and cuts tissue as it is drawn back into the sheath. The loop is larger

than in Stern's instrument. Therefore, the operation can be carried on more rapidly, and since vision with the instrument devised by McCarthy is unsurpassed, it would seem that it would probably replace the former in popular favour. It remains to be seen how large a mass of tissue can be removed by this method without causing sloughs and secondary infection from the extent of the coagulation produced. Certainly, from the standpoint of evaluation given, the instrument is excellent, for it removes all tissue desired, under adequate vision, with control of bleeding, and for those who prefer a lens system it seems ideal.

Technic of Operation

For those who are familiar with the use of the direct cystoscope, or, if not, are willing to learn the simple technic, the removal of the obstructing tissue with a tubular knife affords a simpler and more rapid procedure.

The urethra being well dilated and lubricated, the instrument (Fig. 3, *d*) is passed and after the obturator is withdrawn the electrode guide which carries the short tubular shield (Fig. 3, *a*) for closing the fenestra is passed, converting the instrument into a direct cystoscope. The prostatic urethra from the verumontanum to the trigone is carefully examined to determine what portions of the enlarged lobes of the prostate gland are obstructing the urethra, and what is their relationship to other structures. When this examination is completed the guard sheath is withdrawn, and under full vision the portions of the obstructing tissue are forced into the lumen of the sheath through the fenestra (Fig. 1, *a*). When thus grasped the multiple needle electrode (Fig. 3, *b*) is thrust through the base of the projecting tissue and the high-frequency current is allowed to flow long enough to electro-coagulate the course that the tubular knife is to follow. The object is not to desiccate completely the tissue that is to be excised, but simply to render ischemic the course of the knife and so diminish bleeding. When this has been done, which requires about ten seconds, the needle electrode is withdrawn and the obstructing tissue is excised with the tubular knife (Fig. 1, *c*).

If some bleeding follows this excision, the single electrode guide is again placed in position (Fig. 1, *d*) and the bleeder vessels are electro-coagulated individually, after which the procedure is repeated.

As the aim of the operation is to re-establish an adequate channel through the urethra, from five to fifteen pieces (Fig. 4) of tissue are usually all that it is necessary to remove, and the total weight will seldom exceed 10 gm.

In the past, hæmorrhage undoubtedly has been the greatest factor in retarding general adoption of this operation. Since employing electro-

coagulation before and after resection of individual pieces, this has seldom been an alarming complication. Delayed hæmorrhage will not occur if sloughs are not produced by too deep electro-coagulation. It is a feature that must be guarded against when instruments are used which employ the high-frequency current for resection of the tissue as well as for the control of bleeding.

The amount of bleeding encountered during resection varies greatly with the different types of tissue removed. In benign adenomatous hypertrophy bleeding is easily controlled, as the individual vessels are readily discernible. When an inflammatory condition is associated with

FIG. 4.—Pieces of tissue removed by transurethral resection.

the benign hypertrophy the bleeding is much more profuse. Malignant tissue also bleeds freely, but since diathermy has a detrimental effect on the tumourous cells the needle electrode may be kept in position longer. The bleeding is usually greatest in cases with considerable associated prostatitis ; it is always most profuse following the first incisions, after which repeated applications of the needle electrode produce a cumulative effect. Care must be exercised to see that the tubular knife is very sharp, for torn mucosa bleeds freely, and such bleeding is difficult to control ; a clean cut is easily cared for. The cut vessels can be seen spurting individually (Fig. 2), and a single application of the electrode tip usually suffices for their control. Greater ease of operation will be obtained if the bleeding, however slight, is controlled after each incision rather than if

the policy is to wait and coagulate the individual spurting vessels after all tissue has been removed.

It is preferable, when the operation is complete, that the irrigating fluid be a little pinkish, for if all oozing is completely controlled, and the wash water clear, coagulation has been continued too long. When all individual spurting vessels are cared for, one need not worry about general oozing ; this will cease with the patient's return to bed, with an indwelling catheter. If too much electro-coagulation is done to produce complete hemostasis, convalescence is going to be prolonged, for all tissue destroyed by electro-coagulation must be gradually absorbed, or dissolved in the urine, and the less there is the sooner the mucosa becomes normal.

Since excessive post-operative bleeding is usually due to accumulation of clots, a catheter of large calibre should be placed in the urethra immediately after the operation. This insures emptying of the bladder, hence encourages clotting, and is of sufficient size to allow to pass any clots that may form ; this last feature prevents the bladder from going into repeated spasm in an attempt at expulsion of clots. A large catheter also gives the prostatic tissue a form about which to reorganise, and prevents obstruction from post-operative œdema. Depending on the amount of tissue removed, and the extent of post-operative bleeding, the catheter should be allowed to remain in place for from forty-eight to seventy-two hours. The hæmorrhagic tinge to the urine usually clears up on the second day if the catheter has not become obstructed. Great care must be exercised to see that the bladder does not become distended, for the chief cause of bleeding is that the incised area becomes torn by over-distension. When a bladder in which bleeding has occurred is emptied of clots it is rare to find a bleeding point.

Causes of Failures

Failures are usually the result of not removing sufficient tissue to permit the bladder to empty completely. The amount of residual urine present in a case in which urinary obstruction is the result of prostatic hypertrophy is not an indication of the type of operation to be done for relief of the obstruction, for it varied (Table II) from 30 c.c. to complete retention in this series, but it is an absolute indication of the success or failure of the procedure after transurethral resection.

When a suprapubic drain allows all residual urine to be removed from a bladder obstructed by prostatic hypertrophy, the prostate gland shrinks rapidly in size during the next few months, and the œdema and congestion incident to the obstruction and irritation of retained urine are relieved. Caulk has expressed the belief that the same process occurs

TABLE II

AMOUNT OF RESIDUAL URINE FOUND BEFORE OPERATION IN 250 CASES.

	Cases.	Per cent.
30 c.c. or less	9	3·98
30 c.c. to 150 c.c.	114	50·44
150 c.c. to 300 c.c.	58	25·66
300 c.c. to all	45	19·91
Average 148 c.c., total	226	90·03
Not stated	13	5·20
None	11	4·64

following transurethral resection if the patient is relieved of all residual urine, but if sufficient tissue is not removed completely to relieve the obstruction this shrinkage of the gland does not occur and failures will result. Therefore, it seems advisable to confine the procedure to removal of only sufficient tissue to give an adequate channel from the bladder to the verumontanum, so that at completion of the operation one should be able, with the instrument at the verumontanum, to look directly into the bladder at the level of the trigone. To construct such a channel usually requires removal of but 5 to 10 gm. of tissue, although in a few cases in which there is greater hypertrophy, more tissue may have to be resected. To remove the greater portion of the gland seems to me to defeat the purpose of the operation and to be contra-indicated, for a new and adequate passage through it, not its removal, is what is required. If the enlargement is so great as to require extensive and prolonged resection, I believe that prostatectomy is preferable.

At the Mayo Clinic in 1931, of the 210 cases of prostatic hypertrophy in which surgical treatment was given, eighty-seven (41·42 per cent.) operations were by the transurethral method. In 1932 the percentage undoubtedly will be higher, but that the procedure will completely replace prostatectomy I doubt, although as operations are performed earlier fewer large glands will be encountered.

In the series of 250 cases reviewed in this paper, in which operation was done between January 1st, 1925, and January 1st, 1932, nine patients (3·5 per cent.) underwent prostatectomy subsequently and fifteen (6 per cent.) had previously undergone prostatectomy; the transurethral resection was undertaken for the improvement of functional results. At first thought one might be led to believe that the subsequent operations were the result of a continuation of the hypertrophy of the prostate gland

with recurring obstruction of the urethra. This was true in five of the cases undergoing prostatectomy during the ensuing four years. In the other four cases, however, the subsequent prostatectomy was the result of failure to remove sufficient tissue at the time of the original operation and prostatectomy was performed before sufficient time had elapsed to permit of recurrence. If recurrence of the obstruction takes place in even a larger percentage of the cases in the future, I do not feel that it should be considered as a contra-indication to this type of operation, for the procedure usually requires less than an hour, frequently less than half an hour. The patient is generally confined to the hospital from seven to ten days and frequently less, so that a repetition of the procedure seems preferable to complete enucleation if it does not have to be repeated too frequently.

Some observers have claimed that transurethral resection can be carried out without mortality. I seriously doubt it, for in any surgical procedure in such cases deaths are likely to occur. Six of the patients in this series of 250 died while they were under observation at the Mayo Clinic. A review of the cases is enlightening and shows, I think, that, aside from the usual hazards of operative procedures, infection rather than hæmorrhage is likely to be the causative agent. Two of the deaths occurred more than a month after the resection, one of the patients was aged seventy-eight years, and transurethral resection had been performed not because it was considered a suitable operation but because risk of prostatectomy was too great, obviously not a proper indication for resection. Death was due to generalised sepsis. The other death occurred two and a half months following resection, and was also from septicæmia resulting from urinary infection. In both of these cases residual urine persisted, and with it urinary infection because of failure to remove enough tissue. As previously stated, although the amount of residual urine present is not one of the criteria for or against adopting transurethral resection, it is the best method for measuring the success following operation. Frequently on removal of the catheter from 30 to 100 c.c. of retained urine may be noted for a few days, until the œdema incident to the operation has subsided. If more than this is present the operator has probably failed to remove sufficient tissue. In such cases it is fortunate if a stormy convalescence and subsequent resection are escaped. It is the complete relief of obstruction and disappearance of residual urine that makes this procedure so well tolerated and so rarely followed by such unfortunate results.

The third patient who died was aged seventy-three years. He had carcinoma of the prostate gland. Post-mortem examination disclosed that death was the result of embolic pneumonia. In the fourth case a rising temperature, with leucocytes numbering 39,000, and death on the

seventh day, also indicated severe sepsis. Necropsy was not performed and the cause of death can only be surmised, but I believe it was due to peritonitis, the result of urethral perforation with secondary extravesical extension. One of the remaining two deaths was the result of vesical perforation with the cautery due to faulty vision ; the other occurred on the third day after operation from cardiac failure.

Sepsis seems to have been the main factor in these six deaths. The posterior urethra is a situation from which hematogenous infections most easily arise, and when it is made the scene of resection of tissue as well as cauterisation in some form to prevent bleeding, I fail to see how fatal infections can always be prevented. The destroyed tissue must be absorbed and in a few cases this must act as a fatal focus if resisting and recuperative powers are lowered by long periods of previous urinary obstruction. It is noteworthy that in none of these cases was hæmorrhage either a direct or contributing cause of death.

Operation in Multiple Stages

Whenever possible the operation should be completed at one stage to avoid the complications previously noted. If the amount of obstructive hypertrophic tissue is too great to permit all of it being removed at one time, it is almost always preferable to perform prostatectomy. Multiple transurethral resections will confine the patient to the hospital as long as prostatectomy, whereas the average stay following transurethral resection is usually about seven days.

Because transurethral resection carries less risk, it is sometimes advisable to perform multiple transurethral resection. This applies to patients handicapped by a severe cardiac lesion or other disease contra-indicating a general surgical procedure. In such cases, the residual urine must be scrupulously removed by indwelling catheter or intermittent catheterisation. If patients are extremely debilitated, especially if renal function is poor, I prefer to precede transurethral resection by suprapubic drainage.

This was done in forty-six (18·4 per cent.) of these cases. It furnishes a combined method of treatment by which many debilitated patients can be relieved of urinary obstruction when the most optimistic surgeon would not consider them suitable risks for prostatectomy. The patient in this type of case is certainly the one that will derive the greatest benefit from these newer methods of treatment.

Types of Obstruction

For transurethral resection, as well as for prostatectomy, the most satisfactory enlargement is that due to benign adenomatous hypertrophy

of the gland. Healing is usually rapid even in cases in which considerable tissue is removed. The amount of tissue removed to relieve the obstruction will, of course, be greatest in this group.

The next most satisfactory cases are the adenocarcinomas. After removal of obstructing tissue recurrence is not as rapid as one might expect. I have a specimen of a bladder removed at necropsy several years after resection in which the urethra was still free of obstruction, although the patient died with extensive metastasis to the viscera as well as to the skeleton. The mucous membrane was intact over the excised area in the specimen. The patient remained free of residual urine to the time of his death and was saved many years of catheter life by the procedure. Of course, the majority of patients die as a result of the disease before there is time for recurrence of the obstruction, but I have repeated the resection in one case five years after the initial operation with relief of symptoms. The pathologist reported that the tissue from both operations was highly malignant.

When the obstruction is due to prostatitis and only inflammatory tissue is excised at the time of resection, the results are prone to be disappointing. Needless to say, such patients should not be subjected to resection until every effort has been exhausted to correct the prostatitis by other methods. When such methods have failed and residual urine persists, then resection of the obstructing portion of the gland is justified. If the precaution of previous treatment by massage and irrigation is not followed, a stormy reaction may occur following operation, as to resect prostatic tissue in the presence of active infection is needlessly to court disaster. In such cases I insist on local treatment until the prostatic infection appears as quiescent as can be hoped for. I also place the patient on a ketogenic diet, which renders the urine highly bactericidal in the majority of cases. If these precautions are taken, resection can be performed and may frequently break up the vicious cycle of prostatitis producing residual urine and the residual urine acting as an irritant to the prostatitis.

The Economic Factor

The economic factor in this form of treatment of prostatic obstruction is very important. If forty-six patients on whom cystostomy had been performed previously are excluded (such patients must necessarily remain longer under treatment so the suprapubic sinus may heal) it will be found that 68 per cent. of the patients remained in the hospital less than ten days (Table III).

When it is recalled that six weeks is considered an average stay in the hospital following prostatectomy, the saving to the patient is apparent,

TABLE III

DAYS SPENT BY PATIENTS IN HOSPITAL AFTER TRANSURETHRAL RESECTION (FORTY-SIX PATIENTS WITH CYSTOSTOMY EXCLUDED).

Days.	Cases.	Per cent.
Less than 7	98	48·03
Less than 10	39	19·11
Less than 14	21	10·29
Less than 21	23	11·27
Less than 30	10	4·90
More than 30	13	6·37
Total	204	81·60

and still more important is the saving to all charity hospitals who care for this type of case. I am informed that the cost of dressings for patients following prostatectomy is greater than for any type of surgical case with the exception of those in which colostomy has been performed. This cost is, of course, entirely eliminated by transurethral resection. In fact, many patients whose funds would be exhausted by hospitalisation now find themselves with something left besides gratitude with which to reward their surgeons.