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Trans urethral resection of prostatic obstruction

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Trans-Urethral Resection
of
Prostatic Obstruction

Arch S. McMillen

April 1, 1934.

Trans-Urethral Resection

Introduction

History

Review of Literature: (Selected Articles)

- a. Instruments
- b. Methods of Operation
- c. Variations in Procedure
- d. Types of Hypertrophy Suitable for Resection
- e. Dangers and Complications of Resection
- f. Functional Results and Mortality
- g. Advantages of Resection

Bibliography

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If one wishes an interesting chapter of reading on the progress of medicine, he needs only to review the literature of the last decade with reference particularly to the armamentarium of the urologist in his treatment of the problem of prostatic hypertrophy.

The attention of the urologists and surgeons has been called, particularly in the last ten years, to the endo-urethral method for relief of prostatic obstructions, this period being frequently termed 'the renaissance of urology', and its more enthusiastic supporters say it should be classed along with Pasteur's, Lister's, and Reed's work, as one of the classical examples of progress in medicine.

McCarthy (1) says, " Innovations, especially in surgery, are prone to experience one of two types of reception. Frequently they encounter a spirit of hostile resistance, through which, if they are intrinsically meritorious, they must infiltrate until they are finally accorded adequate recognition. Occasionally the innovation is accepted and applied with such enthusiasm and promiscuity as to militate, temporarily at least, against its full usefulness." The innovation of trans-urethral resection, in which McCarthy himself has played an important part, has met both such types of reception, and now, if we may judge from the writings of many many

authors, the procedure is finally being accorded adequate recognition.

In this paper we propose to briefly sketch the history of the development of trans-urethral resection, then review the more recent literature with reference to methods of operation, the advantages of the procedure, the types of hypertrophy suitable for this method of approach, the results obtained, the dangers and complications. We thus omit any detailed description of the anatomy involved, the physiology of the gland, the etiology of hypertrophy, the symptomatology, and confine our remarks to the trans-urethral method of resection.

HISTORY:-

It is of interest to note Sir Everhard Home's writings for he believes the symptoms of prostatic hypertrophy have been recognized from time immemorial. He surmised that the enlargement of the prostate gland is alluded to in the beautiful description of the natural decay of the body in the Bible, in the book of Ecclesiastes, the 12th chapter, the 6th verse, where it is written, 'or the pitcher be broken at the fountain, or the wheel broken at the cistern', expressive of the two principal effects of this disease, the involuntary passing of the urine, and the total stoppage. (2)

When we speak above of the 'innovation of trans-urethral resection' we are technically incorrect as we find John Hunter was the first to suggest tunneling of the obstructing body by the catheter. One Lafaye, in 1756, on attempting to catheterize his superior Astruc, was unsuccessful, and he perforated the tumor by a lancet shaped stilet. This act was repeated and Astruc lived 10 years till 1766. (3).

The scene shifts to 1834 when Guthrie employed endo-urethral instrumentation by means of an instrument having a concealed blade, and in 1841 Mercier practiced prostatic section by means of a prostatectome or concealed knife passed thru the urethra into the bladder. In 1873 Bottini modified this procedure, the galvanocautery being substituted for the purpose of cutting thru the obstructing tissue, and in the more recent literature Bottini is usually referred to as the originator. (4).

These early attempts were discarded as incomplete, being blind and fraught with danger from infection, incomplete drainage, and hemorrhage. McCarthy's explanation puts the reason for their failure aptly, "These discerning attempts were only occasionally successful, not because of mistaken clinical concept, but for the very good reason that the collateral sciences had not yet developed to the stage where they could supply the exacting optical and electrical equipment essential to this highly technical procedure." (5).

In 1909 Young presented his median bar excisor or punch for the removal of lesser obstructions, and in so doing gave by far the greatest impetus to endo-urethral surgery, and inaugurated a period which has culminated in the acceptance of this method of approach for the majority of obstructions. In 1910 Beer introduced fulguration as a method of destroying benign papillomas of the bladder, and in 1911 Bugbee attempted to destroy tissue at the vesical neck by the same method. (7). In 1913 Stephens reported the use of high frequency applications thru his cystoscope for the deep cauterization and incision of small obstructions at the bladder neck, and Heitz-Boyer reported some cases done in a similar manner and claimed excellent results. In 1914 Georges Luys presented a report on his operation consisting in the destruction of the obstructive tissue by means of fulguration. At first he applied this treatment to the small obstructions but later utilized it for the larger ones. He re-

ported 146 cases in 1926 with 132 uniformly satisfactory results, with an operative mortality of 1.9 percent. (8).

In 1920 Caulk added further impetus to the progress with his addition of the cautery to the punch, thus making possible a deeper bite of tissue and control of hemorrhage. During the year 1925 two urologists added to the general knowledge, one with an accessory for the Young punch, the other with a new instrument. Both had as their essential feature, an apparatus for cauterization. Tolston's modification consisted of a high frequency electrode introduced thru the sheath of the Young punch for the application of high frequency to the area from which the section had been excised. Kenneth Walker of London brought out a new instrument, similar in design to the Young punch, but adding an optical and irrigation attachment and the complete insulation of the instrument with bakelite except at the slot which encases the obstruction. (9).

In 1926 three new operative procedures appeared-- Maximilian Stern's resectoscope, designed to remove multiple pieces resembling spaghetti from the orifice under vision; Foley's endothermal prostatic excisor; and Collings operation with a radiotherm knife. These three make use of cystoscopic application, Stern by means of a loop, Foley employing a sliding wire charged with current, and Collings by means of a curved electrode. Then in 1928 Rose proposed a further modification of the punch type instrument, embodying the principle of resection of the obstruction with a cold knife followed by cauterization

through the same sheath. Following this innovation McCarthy presented a very ingenious instrument of the punch type, having as its attributes thorough visualization, irrigation, and a trigger handle for the manipulation of the incisor. (8).

From the date of Stern's and McCarthy's innovations the progress that has been made has been largely confined to modifications and improvements of their instruments, which we will discuss in reviewing the literature. The period of 7 years from 1926 has been one in which the endo-urethral method of operation has been on trial in various clinics over the country, having as its greatest advocates Caulk of St Louis, who has perhaps been the most persistent of those pointing out the merits of the procedure; McCarthy of New York, whose instrument is being used in the majority of places; Thompson, Bumpus, and Braasch of the Mayo Clinic, who have had remarkable results; and it is largely thru the work and publications of these men that endo-urethral work has risen in popularity to the point where it is replacing the supra-pubic and perineal approaches in the majority of cases. Only in conservative New England do we find publication of opinions adverse to the procedure.

REVIEW OF LITERATURE:-

Methods of Operation:-

Just what trans-urethral resection is is well defined by Davis and Owens (9): "Trans-urethral prostatic resection may be described as the removal bit by bit by means of an electric cutting current thru an endoscopic tube of a sufficient amount of the obstructing prostatic tissue to permit the patient to empty the bladder. Very complicated and elaborate electrical equipment is required in order to provide both a cutting current to remove tissue and a coagulating current to control hemorrhage. The mechanism of the modified endoscope employed for this purpose provides a small wire loop 7 mm. in diameter which may make an excursion of 27 mm. in length, cutting out a piece of prostatic tissue of approximately corresponding size. A large number of cuts may be made at one sitting, permitting the removal of 5 to 10 grams of tissue or more. Tissue may be removed with great exactness thru the more modern lens systems, and with the coagulating current permits the control of immediate hemorrhage in a thoroughly satisfactory manner." We purposely inject this simple statement of the principles of the procedure for a detailed description of the instruments in use only confuse the reader as to the purpose of the various parts, and with this understanding of the procedure we may proceed to the instruments on a firmer foundation.

In devising his instrument McCarthy (10) laid down the following ideal requirements:-

1. The most precise visualization of the prostatic urethra.

2. The greatest possible flexibility of manipulation under vision, of the electric cutting loop.

3. Ample electrical power to excise the obstructing prostate under water with a coincidental minimum of hemorrhage and of tissue coagulation.

4. Interchangeability and ease of manipulation of electrodes, in the closure of bleeding points.

5. The completion of the operation including the introduction of a No. 24 French whistle tip indwelling catheter with but one introduction of the instrument, the sheath being withdrawn after the catheter has been passed through it.

6. Rapid epithelialization with a minimum of cicatrization.

The McCarthy Resectoscope is at this time the most universally used instrument. It consists of a sheath, obturators, telescopes, loops, and a working element. The sheath is made of non-conducting bakelite material, has an open end, and is usually 28 F. in size, although a 24 F. is made. The straight obturator fills the open end of the sheath, and facilitates the passing of the instrument into the bladder; the Coude type obturator can be deflected from a straight line so as to allow the instrument to be passed more easily over a large middle lobe. The telescope used for visualization while operating is the same for the oblique instrument supplied with the McCarthy Pan-endoscope. A retrograde vision telescope, and a right angle vision telescope are also made so that by their use there is greater accuracy in the survey of the operative field both before and during the operation. The loops are either fine for cutting

or quite heavy for coagulation. The working element has a guide for the telescope, and one for the loop, and a rack and pinion for regulating the fore and aft movements of the loop. (11).

McCarthy describes the procedure as follows:

"The equipment consists of what is called a visualized electrotome, the cutting power being furnished by an electrical surgical unit. The former, developed thru the joint efforts of Mr. Reinhold Wappler, of New York, and myself; the latter resulted from the extensive researches of Mr. Frederick Wappler, son of Reinhold. The lens system employed in the telescope is the unique so-called amphitheater type of vision. To this telescope is adjusted a wire loop connected with a rack and pinion attachment, permitting easy forward and backward movement of the loop. Following the introduction of the sheath with its obturator, the latter is withdrawn and the telescope with its loop introduced. With a foreknowledge of the nature of the obstruction, the tissue is removed seriatim, by placing the loop behind the obstruction and drawing it slowly and steadily thru it, until the former has reentered the sheath. The arc of the current which may be compared to the radio current, cuts and coagulates the tissue. At the completion of the operation, a well defined tunnel should result, with no evidence of encroaching prostate anywhere along its trajectory which extends in gradually enlarging diameters from immediately posterior to the verumontanum to the internal sphincter. Severed pieces should be removed during or before the con-

clusion of the operation, and bleeding points coagulated by means of electrodes designed for this purpose. Following this, a catheter of large size is left indwelling for at least 48 hours after the urine has remained macroscopically clear." (12).

In another publication McCarthy (5) amplifies this description: "This new technique constitutes a departure from the methods heretofore described, in that, with amphitheatre vision, one sees the entire prostatic urethra in tubular perspective, as though one looked from an observation car into a well-illuminated tunnel. Thus one sees the number, type, and extent of prostatic boulders that encroach upon its lumen. In simplest terms, with this visual survey in mind and under the most precise observation the cutting loop which is fitted to a rack and pinion, is adjusted behind the obstruction, the cutting current started with a foot switch and the loop withdrawn by means of the pinion near the eye-piece, bringing with it a tubular cast of prostatic tissue comparable in size to the loop. The loop when charged with this new current, cuts under water smoother and cleaner than the sharpest scalpel and what is very important, coagulates superficially as it cuts. It thereby acts, when properly regulated, as an effective haemostatic agent. Incidentally its trajectory, because of the mechanical arrangement, is as straight and precise as though it travelled on rails.....The obvious interpretation is that thus equipped one may remould the prostatic urethra at will.....The rationale as I conceive it is, that here we have a tubular structure, the lumen of

which is encumbered and distorted by irregular encroachments--that we should have tubular vision for its adequate comprehension--that our objective is, or should be, restoration of that lumen to normal or a moderate exaggeration of its normal tubular character. In other words, an operation of canalization rather than excavation."

The electrical control units are of two general types; the tube rectified current, and the spark gap current. It is generally agreed that the former is a better current for cutting, while the latter is better for hemorrhage control. The tube rectified unit produces a true radio frequency current, whose oscillations are all of exactly the same amplitude, thus giving a smooth cutting effect. This does not burn the tissues apart, but the cells are exploded just before the electrode makes contact with them. This leaves a very thin layer of coagulated tissue, which results in almost no post-operative sloughing, but which is sometimes insufficient to check hemorrhage at the time of operation. For this reason, an ordinary fulguration machine is sometimes used in conjunction with the tube rectified unit. The Falconer electrosurgical unit has both these features built into one portable machine. The McCarthy unit is the most widely used tube rectified unit. (11).

Barnes gives the following detailed description of the procedure, using the McCarthy Resectoscope, The technique of transurethral prostatic resection, especially when used for the larger hypertrophies, is

probably more difficult to master than any other urological procedure. There are two reasons for this. First, hemorrhage: The field of vision becomes obscured with the flow of blood from a severed vessel, and later if this hemorrhage is not stopped, a clot forms which covers the bleeding point, making it difficult to locate for coagulation. The second difficulty is that of limiting the resection to the prostatic urethra. It is very easy without frequent reorientation, to resect above the bladder neck onto the trigone, or below the verumontanum into the external sphincter.'

'The resectoscope, being a straight instrument, is sometimes difficult to pass over a large middle lobe. When this is the case, the Coude tip obturator may be used, or when this is not available, a No. 24 catheter is passed into the bladder, then the sheath is passed over this and into the bladder, thus using the catheter as a guide.'

'After the instrument is introduced, a thorough survey of the field of operation is made. The verumontanum is located, and the sides of the urethra may be marked by a superficial cut with the loop electrode. The amount of encroachment of the lateral lobes into the prostatic urethra is observed, the prostatic border is studied, and the urethral orifices located if they are not covered by the middle lobe. If they are, the amount of projection of the middle lobe into the bladder is estimated, and a definite plan of attack is formulated. In this survey the right angle and the retrograde vision telescopes are useful.'

'The resection may be started by attacking either the middle or lateral lobes first. By leaving the middle

lobe until last, it helps to keep the working end of the telescope elevated so as to allow a more complete resection of the lateral lobes. However, there is always more bleeding from the anterior portions of the lateral lobes, and for this reason, it is sometimes better to leave them until last. In the author's opinion, it is preferable to resect the intravesical portion of the middle lobe first, if it is at all prominent, then the intravesical portions of the lateral lobes. In other words, the vesical border of the prostate is attacked first. The resectoscope is then pulled back into the deep urethra, the verumontanum relocated, and the remainder, or intraurethral portions of first the lateral, then of the middle lobes are removed. If the prostate is small, and the prostatic urethra not appreciably lengthened, the resection of the intravesical, or bladder neck portions of the middle and lateral lobes is sufficient, there being in these cases very little or not intraurethral encroachment.'

'With the McCarthy resectoscope, the cutting excursion of the loop is toward the operator, the cut being terminated by the entrance of the loop into the bakelite sheath. At the start of the resection, the loop is placed over the edge of the prostatic border, the vesical end of the scope depressed toward the prostate, the current is applied, the loop is slowly drawn through the prostatic tissue and into the sheath. This removes a cylindrical cast of tissue, leaving a groove in the prostate. The vesical end of the cystoscope is then elevated away from the prostate, and the loop pushed back into position for the next cut. The field of vision is kept clear by running

water in through the sheath. In this way, successive cylindrical casts of tissue are removed. In the author's opinion, it is preferable to make several successive cuts deep, in approximately the same groove as the first cut, coagulate the bleeding points, and then shift to an adjacent portion and repeat the procedure. In this way, the same vessel may be cut several times before it is coagulated.....The depth of the excision may be regulated by more or less pressure on the vesical end of the resectoscope. Most operators remove each section as it is cut, by taking the telescope and loop from the sheath. The author allows the pieces to fall back into the bladder, and at the end of the operation, or whenever necessary, to clear the bladder for observation, the pieces are removed with the McCarthy evacuator.' (11).

For a visual understanding of the McCarthy instrument and steps in the procedure the reader is referred to various illustrations on adjacent pages.

A similar instrument, the Stern-Davis resectoscope, is the original Stern resectoscope introduced in 1926 by Maximilian Stern, and since modified by T. M. Davis, who describes his procedure as follows (13):-"The sheaths are 26F. and 28F. with a fenestrum $\frac{7}{8}$ inch in length without reinforcement of the fenestrum's edge and three-fifths of the diameter of the tube in depth. The beak is straight and $\frac{1}{2}$ -inch in length distal to the fenestrum. A $\frac{1}{32}$ inch hole in the tip of the beak allows the escape of the irrigating fluid during sectioning; this latter prevents the fluid pressure from forcing the engaged tissue out of the fenestrum, permitting the removal of larger sections.

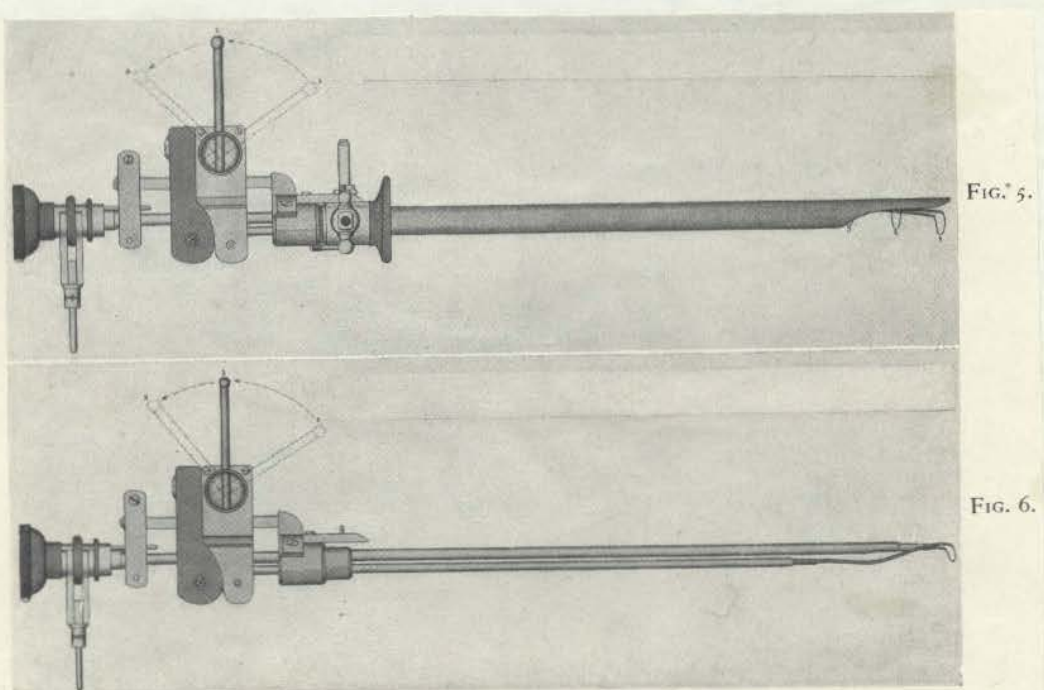
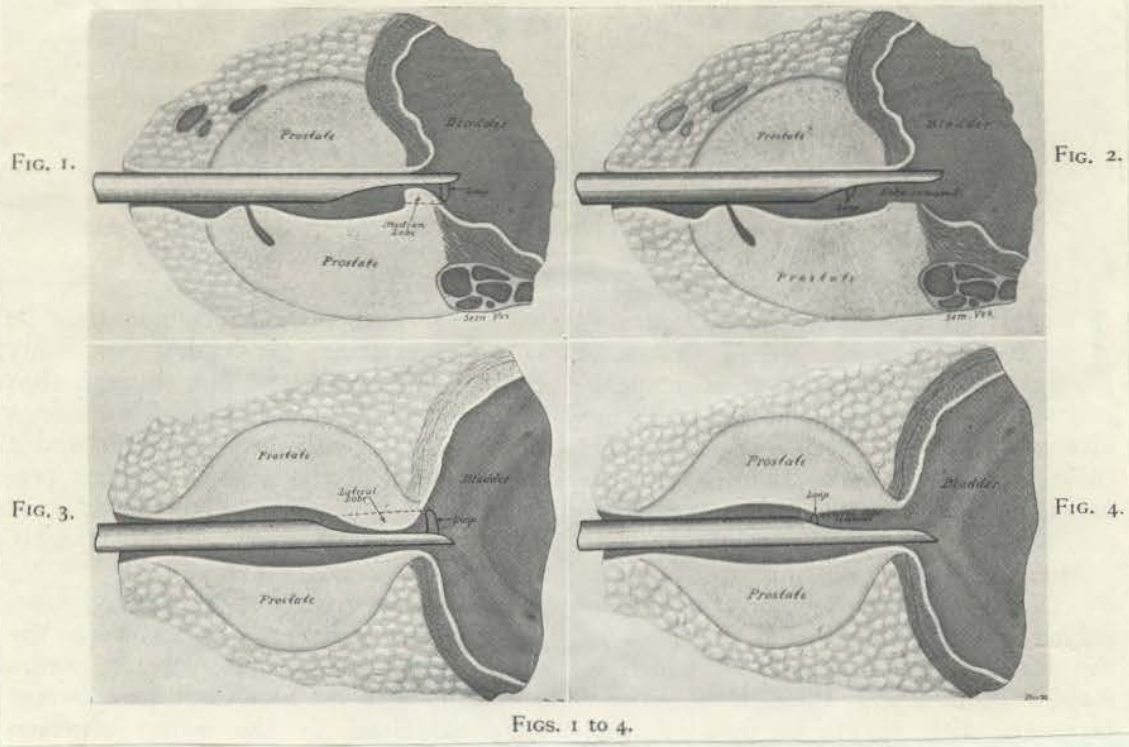
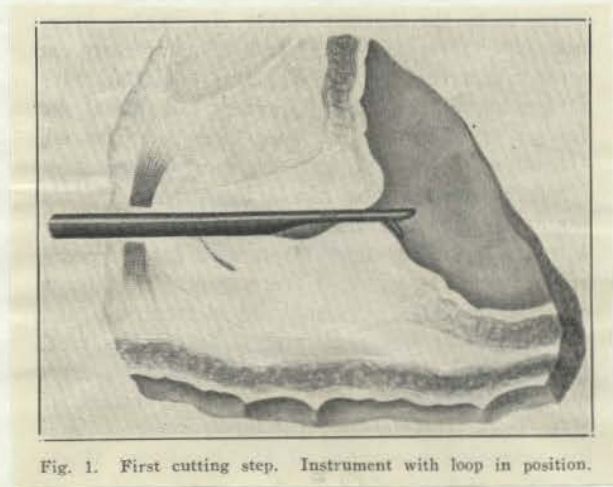
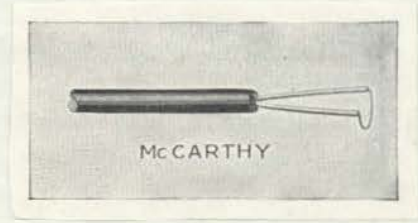
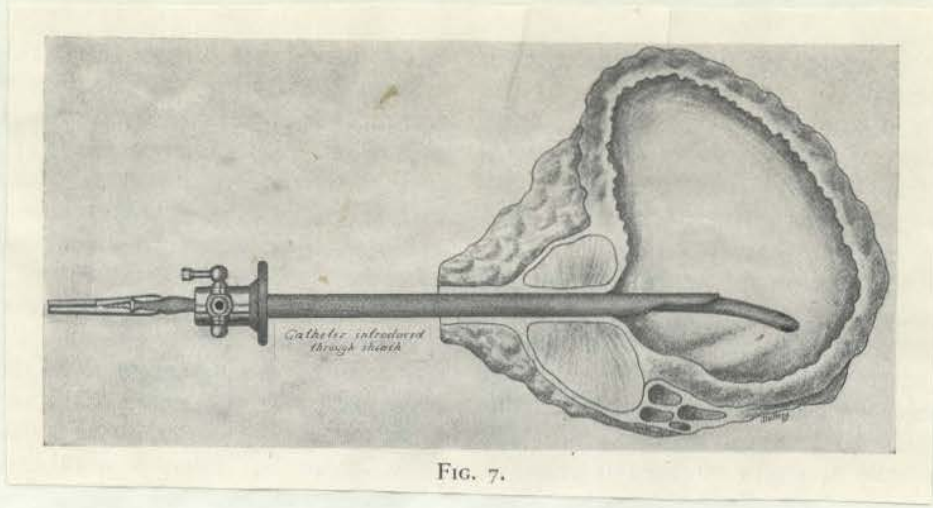


FIG. 5.—McCarthy visualized prostate electrode assembled.
 FIG. 6.—Shows cutting and optical construction.



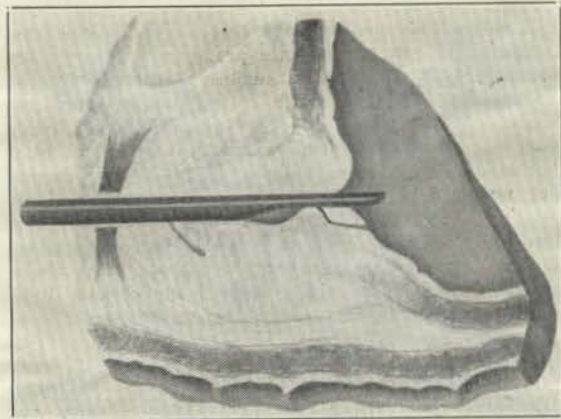


Fig. 2. Tissue partly severed.

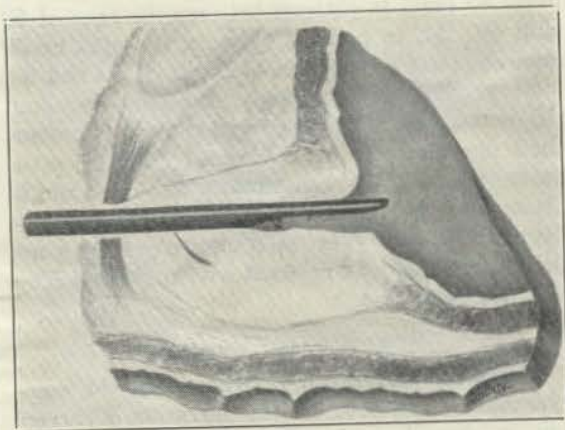


Fig. 3. First step in cutting completed.

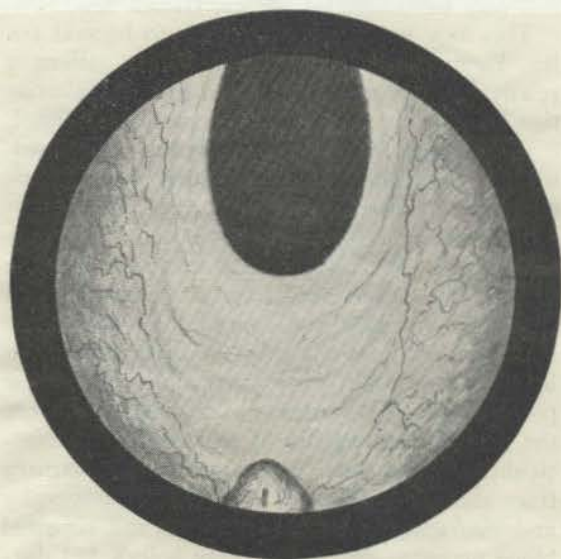


Fig. 4. Illustrating satisfactory immediate end results one year after operat.on.

This improved sheath permits the removal of the larger intravesical protrusions without the beak of the instrument traumatizing the posterior wall of the bladder.'

'The working parts have been modified by using a larger lamp which greatly increases the illumination, an advantage especially appreciated in the presence of active bleeding, and which also permits the use of a special foroblique telescope with its enlarged objective field as well as the direct vision telescope originally supplied. The rack of the loop mechanism has been elongated to permit the increased loop excursion. The hard rubber bridge of the loop mechanism has been improved to increase insulation of this part....The active loop is constructed of .017 tungsten wire about four times the diameter of the original. The angle where the loop is placed at right angles to the loop shaft is reinforced with silver tubing giving adequate support at this point. In using the original equipment it was frequently necessary to change the loop electrode several times during a single operation. With the improved loop, as many as thirty-two complete operations have been performed with a single loop. This will give some idea of the sturdiness of the improved loop electrode which permits the use of the most powerful cutting currents and, what is more important, it permits the use of a coagulating current which formerly disintegrated the original loop.'

'In the perfection of the Davis-Bovie Electro-Surgical Unit which has two separate units within one cabinet, either of these currents is interchangeable by means of an electro-magnetic control activated by a double tread foot switch. The cutting current developed

by this unit sections tissue with a minimum of hemorrhage as there is sufficient coagulation during the loop excursion to control all vessels if the movement is made sufficiently slowly. The time consumed in making each section should be about six to nine seconds. Should hemorrhage arise it is easily controlled by changing the foot to the coagulating foot switch tread and bringing the loop slowly thru the gutter formed by the sectioning. With this new generating unit many operations are completed without the necessity of controlling hemorrhage a single time, the coagulating current being used to check any oozing capillaries at the completion of operation.'

'The form of anesthesia used in resection is caudal and trans-sacral block, and the technique is so well known that a recapitulation at this time is not necessary. The patient having received the anesthetic is placed in the usual cystoscopy position with an eight by twelve inch in foil plate well lubricated with surgical jelly placed under the buttocks and connected to the inactive terminal of the generating unit. The patient is prepared and draped. The resectoscope sheath is introduced, the obturator removed, and the bladder irrigated with sterile water until the medium returns clear. The bladder is filled with 300 cc. of water, the observation telescope is inserted and a visual inspection of the vesical orifice and posterior urethra is made, the type and amount of obstructing tissue being determined.'

'The observation telescope is replaced by the working parts; the active terminal of the generator is connected to the proper receptacle of the loop mechanism;

the light-conducting cords and water conduit are connected; visual inspection of the orifice and posterior urethra is made with the direct vision telescope of McCarthy; the verumontanum should be located, this being always at the apex of the prostate gland.'

'The site of the initial section is determined and the tissue is made to engage within the fenestrum, only slight pressure being used as deep pressure induces hemorrhage from trauma. The loop will be observed resting upon the tissue protruding within the fenestrum. With continuous irrigation which keeps the sheath cool, the cutting current is turned on with the foot switch. Bubbles will be arising from around the loop and a halo formed where the loop comes in contact with the tissues; the loop is slowly advanced the entire length of the fenestrum, removing a section of tissue about one-fourth by one inch, leaving a clean gutter that is within full view of the operator. The gutter is observed for a few seconds to determine the presence or absence of hemorrhage. Should hemorrhage occur, the loop is slowly returned thru the gutter with the coagulating current imposed upon the loop by changing the foot to the proper tread of the double-foot switch. This current will instantly control the largest vessel encountered.....After each section the working parts are momentarily removed from the sheath bringing with the loop the tissue sectioned which is easily shaken off into the drain pan or removed with the fingers of the left hand. The working parts are replaced and additional sections are removed as described.'

'Upon completing the removal of tissue, the entire area is inspected and even the most minute bleeding point is arrested by coagulation. The time and place for hemostasis are on the operating table when adequate means are at hand; one should not depend upon the obsolete method of frequent irrigations to remove blood clots. The irrigating fluid should return perfectly clear before the instrument is removed. A 16 F. soft rubber catheter with multiple eyes is fastened within the urethra with adhesive tape and is to be connected to a reservoir attached to the bedside. Continuous drainage for 48 hours is maintained to give the bladder complete rest after which the catheter is removed and the patient voids a free stream.'

'The fundamental principle in this problem is the removal of the obstructing tissue, either by excision or destruction or a combination of these, sufficient to relieve the obstruction with a minimum of injury to the surrounding parts. Equally important is the restriction of complications and the absolute control of hemorrhage.'

A third instrument developed by Caulk of St. Louis is known as the cautery punch, originally presented in 1919 as a modification of the Young punch, and has been used by its inventor over a period of years with remarkable results. McCarthy (5) pays the following tribute to Caulk, "Whatever success may attend the procedure herein outlined I cheerfully ascribe to Caulk. For it was he who demonstrated that instrumental endo-urethral approach in the management of prostatic hypertrophy was a feasible procedure, and it was the inspiration of his work that, in the face of many discouragements, kept us everlastingly at

it." The essential principle back of Caulk's instrument is the employment of cautery for the excision of the obstructing tissue, rather than the high frequency cutting currents used in the instruments described previously. In 1932 Caulk modified his instrument to include cystoscopic visualization as well as the endoscopic visualization which the instrument originally included. (14,15). Too an irrigating attachment was added. The improved instrument consists essentially of the cautery punch sheath and the punch tube, with the addition of a carrier for the McCarthy foroblique lens system, an irrigating channel provided with a small water tight device uncomplicated by screws or ratchets and another small attachment which enters the irrigating channel, constructed for the purpose of carrying a fulgurating electrode which is easy to manipulate and also effective in applying a light spark to the site of bleeding so that hemorrhage can accurately be controlled.

Caulk describes his modified instrument as follows: In order to satisfy the demand for cystoscopic visualization and irrigation, a modification of the punch instrument, which embodies a cautery current and telescopic visualization has been developed. The shell of the instrument consists of an outer sheath which carries a small sealed channel down to the punch-shaped fenestra for the McCarthy foroblique telescope and light. This channel imparts a slightly oval shape to the sheath, which is also equipped with a beak similar to the former punch and which allows easier introduction into the bladder than straight instruments.'

'The working element embodies a platinum-iridium

knife in the form of three fourths of a circle connected to metal electrodes. The absence of a complete circle allows the knife to slide over the telescope and light and gives vision of the movement of the knife during the entire cut.'

'The metal electrodes, which correspond in shape to the knife, are prolonged backward out of the sheath and contain large irrigating and exhaust ducts, thru the former of which a fulgurating electrode may be inserted to control hemorrhage, should this arise.'

'The connection to the transformer is effected thru a terminal on the working element, which allows connection on either the right or the left side, as convenience demands. This connection also acts as a handle to push the working element thru the fenestra.'

'The current is supplied by a stepdown transformer, delivering a low voltage, high amperage current. This transformer is equipped with a foot switch that does away with the need of another assistant and gives the operator complete control during the operation.'

'After the instrument has been inserted and the working element has taken the place of the obturator, the operator is accorded a view that allows no mistake in his orientation of the piece of tissue that will be removed when he sends the blade home. Thus, before him is the hollow end of the sheath at the end of the fenestra, and falling into the fenestra may be seen the lobes of the prostate as the sheath is rotated. The offending lobe is selected and the sheath raised or lowered, whichever the case may be, to bring the portion of tissue to be excised

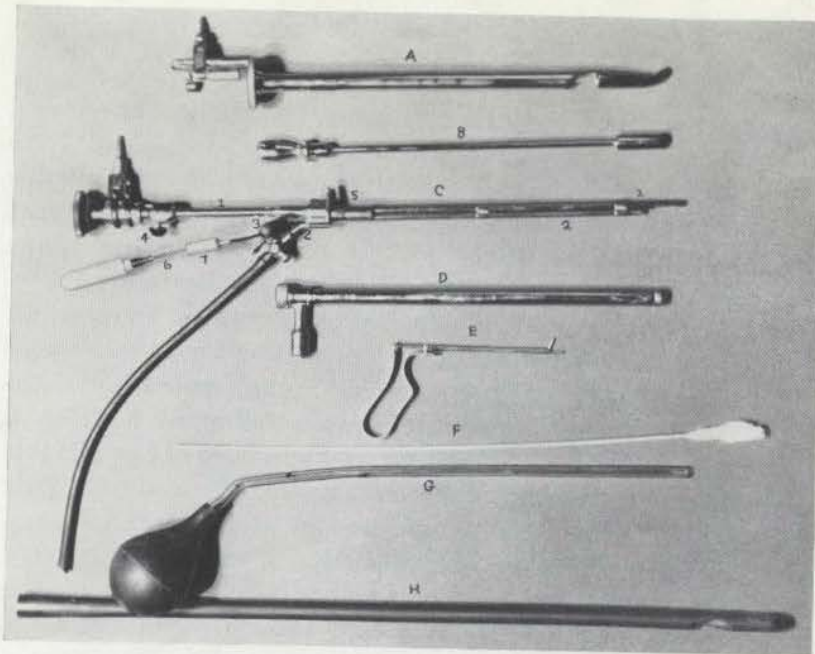


FIG. 1. A, punch sheath; B, obturator; C, cystoscopic, irrigating, fulgurating attachment—(1) cystoscopic carrier, (2) irrigating channel, (3) fulgurating channel, (4) set screw to fix cystoscope, (5) notch for attachment to post on punch tube, (6) electrode, (7) bakelite button; D, cauterity punch tube; E, forceps; F, cotton pledget; G, evacuator; H, catheter with large eye.

The Caulk Cautery Punch

more firmly into the fenestra, just as in the original punch.'

'With the water running, the operator pushes the blade up until it touches the entrapped gland. While still exerting a moderate pressure on the working element, the surgeon steps on the foot switch and immediately feels the knife being to travel thru the tissue, and in approximately two seconds he recognizes the click as the blade enters the distal end of the fenestra, signalling that the cut is complete and to release the foot switch.'

'The ability to cut under water with the cautery current has been a gratifying feature of this instrument. It cuts as quickly and as cleanly as any of the electric currents, and visualization is not disturbed by bubbles. In many instances the blade can be observed thru out the incision, and the inspection with this instrument has been more complete than with any other that we have employed.'

We have presented these rather lengthy descriptions of the various procedures, all of which are essentially quite similar, to point out the three types of instruments, and to give the details of the immediate operation, as practiced by the inventors of the various types of instruments. Regardless of the type of instrument employed all the writers are agreed that the procedure depends largely on the individual skill of the operator, and the success which various surgeons have had is a measure more of the ability of the man rather than the merits of the particular instrument which he uses.

In comparing the results of the high frequency instrument as compared with the cautery punch Caulk noted in 4,885 cases a mortality of 4.7%, whereas in the cautery operations in 6,008 cases a mortality of .9%, and the complications following operation showed the same favorable outlook for the cautery current. This striking difference led him to investigate the effects of the two types of currents on surrounding tissue. (17, 18.) He presents the two following comparative tables:

Temperatures produced in a human prostate by applying cutting currents:

Temp. Before Application	Temp. Imm. After	Duration of App.	Current App.	Notes
37.40 C.	46.02 C	2 Sec.	700	Water Running
38.00	45.26	2	700	
38.72	47.25	2	700	Thermocouple
38.96	49.20	3	700	2 cm. from point of current applic.
38.96	46.56	3	600	Interval between applic.
39.20	45.74	4	500	between applic.
38.28	45.90	3	600	applications about
38.36	47.55	4	500	2 minutes.
38.54	49.66	6	500	

Temperatures in human prostate produced in Transurethral operation employing cautery punch.

Temp. before Cut.	Temp. After Cut.	Time Employed	Notes
37.50 C	37.50 C	3 Sec.	Two Min. Between Cuts
37.59	37.59	3	Four Other Cuts made
37.83	37.83	2.5	But no data obtained.
37.62	37.62	3	
37.62	38.22	3	
37.87	37.87	4.5	
39.06	39.06	4	

Caulk explains that the slight heat elevations in the cautery operations are due entirely to conduction, that is, they extend from the point of application down into the tissue, by the high frequency currents are entirely

differet, the heat in tissue is produced as the heat waves come from one pole to the other. It was demonstrated that the low coagulating currents which apparently cause more visible surface necrosis, generate far less heat in the tissue. In most instances following the application of high frequency current, temperature elevations have been recorded even at a distance of a centimeter away which are entirely incompatible with the life of cells; the thermal death point of tissue being from 45 to 47 C.

Histological studies following high frequency current application show three definite zones:

1. Coagulation necrosis.
2. A zone of fragmentation where the cells have lost their staining qualities and are broken up in many instances. The nuclei are picnotic and the cytoplasm shows vacuolization and fragmentation. This zone shows copious hemorrhage throughout the tissue.
3. A more or less normal zone, but the cells show desquamation and evidence of shrinkage.

From this work Caulk concludes that high frequency currents produce heat in tissues away from the site of actual burning, oftentimes beyond the thermal death point of the tissue; that cautery heat does not penetrate to such depths, its only heat resulting from conduction and is superficial; that the heat generated by high frequency currents is accumulative, hence a proper cooling time should always be given between current applications. He says, "It is this deep heat effect which is evidently

responsible for many of the late sloughs and the erosion of vessels which creates the tendency to secondary hemorrhage and sepsis. These deep effects are never observed following cauterization." (17,18).

The same objection to high frequency currents is made at the Mayo Clinics, where, in order to eliminate post-operative necrosis and sloughs, Braasch developed an instrument different from all the others, in that he used a cold tubular knife instead of the wire loop electrode in making the excision, and coagulation is used only for control of the bleeding. Bumpus makes the following statement, "Dr. Braasch developed an instrument with a tubular knife instead of the wire loop electrode. Removal by excision results in much less coagulation than when excised by high frequency current, and so less coagulated tissue is left to act as a secondary source of infection or to produce late bleeding by the late breaking away of the scar." (19,20).

Another outstanding work by Caulk (8) was his observation of the striking tendency of the prostate to diminish in size and undergo retrogression when being drained or following partial removal, and it was really this finding that opened the way for trans-urethral surgery. Writing on the subject Caulk says, "A second factor...is the variability in the magnitude of the prostate following drainage and partial removal of tissue. To my mind this is the most significant single phase of the entire subject. I have for ten years carefully studied the transformation and transition both by careful rectal and cystoscopic study of a large number of prostates

under drainage and partial removal, and with but few exceptions observed that the gland presented a most striking tendency to diminish in size and undergo retrogression under these conditions. This particular feature of the subject, the importance of which I have been stressing for many years is the basis of my belief in the rational of the application of minor surgery for large prostatic obstructions. This evidence of uniform shrinkage following drainage and particularly after partial excision of tissue offers highly suggestive evidence that these growths are fundamentally inflammatory because no other would show this tendency to retrogression. In order to fortify this contention, I have followed a large series of cases, well over a hundred, some extending over a period of twenty years with decided evidence of prostatic overgrowth and obstructive symptoms, some on catheter life, whose prostates with local treatment alone have returned to normal size with restoration of normal urinary function and remained so. It seems definite to me, after carefully observing several hundred cases of prostatic enlargements which have been partially resected, that the majority of the growths are the result of chronic indolent inflammation, and that the shrinkage following partial removal is not entirely due to the reduction of edema and congestion, but occurs thru absorption of chronic inflammatory hyperplastic tissue made possible by effective drainage and splinting as consistently occurs in other portions of the body under similar conditions"

Caulk is not alone in this observation. Says

Bumpus (23), "It has long been observed that with urinary retention there is associated marked congestion and engorgement of the prostate gland which increases in size, and some believe stimulates adenofibromatous hypertrophy. In any event, when the residual urine is relieved by suprapubic drainage the diminution in the size of the prostate gland in a few weeks time is often little short of astounding. Naturally, the same shrinkage occurs whether the residual urine is relieved by suprapubic drainage or by the removal of the obstruction to its natural outflow, so that frequently large glands decrease in size after the removal of comparatively small amount of obstructing tissue."

Kenneth Walker of London concurs in the finding, (21), and McCarthy (1) says, "It is a matter of common knowledge that deviation of the urinary stream by cystotomy is, at least, in benign hypertrophies, invariably followed by shrinkage of the prostate.....The enlarged prostate is a hydrated rather than an essentially hyperplastic organ, and following the disappearance of obstructive symptoms recession of the gland is to be expected."

Maximilian Stern concurs in the opinion that the organ is hydrated, and goes further to suggest, "Many observers have noted a marked shrinkage of the intrusions following deep coagulation and dessiccation. By repeated applications of a mild coagulating current limited precisely as to its penetration and the area intended for removal, a happy outcome may confidently be expected. A current strength just sufficient to blanch the mucosa after a few seconds contact, is sufficient. The urethral

injection of 20 cc. of 2 per cent novocaine 10 minutes before passing the instrument is advised. Examination after two weeks will show in many instances a marked reduction in the size of the prostatic and sphincteric intrusions. There is also a distinct diminution in the redness of these areas. With the relief of obstruction due to the edema of the mucosa rapid shrinkage follows. In some cases it will be found that no further treatment is indicated. In others, though symptomatic improvement occurs, there persists sufficient encroaching tissue to warrant resection." (22).

T. M. Davis (13) also substantiates the finding in the following statement, "All operators are familiar with the marked shrinkage that regularly occurs in the enlarged prostate gland following the preliminary cystotomy drainage prior to enucleation in the two-stage prostatectomy. The prostate diminishes in size with the removal of the residual urine through a cystotomy incision, and the same shrinkage has been described by Caulk and confirmed by the author following the adequate drainage instituted thru removal of the tissue that is impinging upon the vesical orifice and posterior urethra. When this can be accomplished thru trans-urethral methods the indications for more radical surgery vanish, for few patients will submit to a prostatectomy when a minor procedure will permit them to completely empty their bladder."

The reader is referred to Caulk's diagrammatic sketch representing the comparison in size of the prostate before and after trans-urethral operation, which is on an adjacent page. (14).

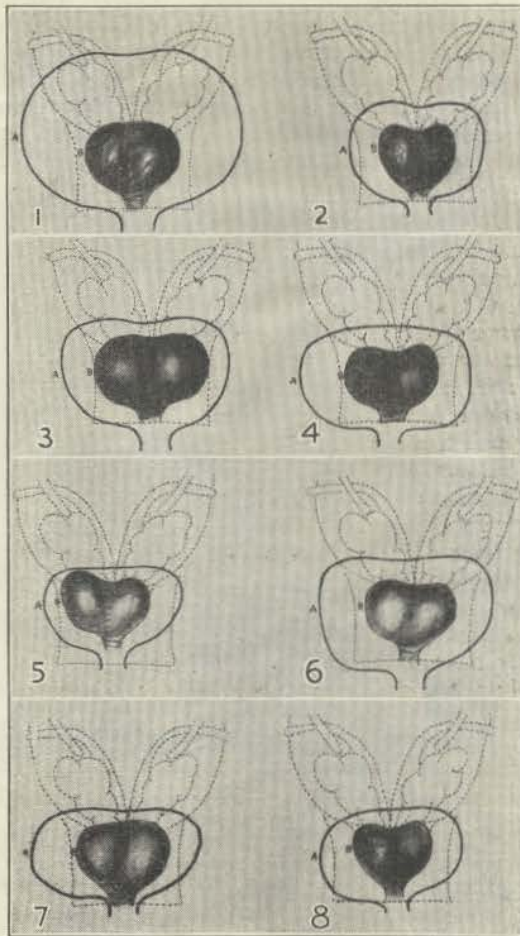


Fig. 2.—Comparative size of prostates in eight patients before and after operation, as determined through rectal examination: *A*, before operation; *B*, after operation; 1, five operations, twenty-five sections removed; 2, two operations, twelve sections removed; 3, two operations, twenty-two sections removed; 4, five operations, forty sections removed; 5, one operation, six sections removed; 6, four operations, thirty sections removed; 7, two operations, twenty-seven sections removed; 8, two operations, fourteen sections removed.

Caulk

Anesthesia of choice in the majority of clinics is the caudal and transcaudal block. Davis (24) injects 20 cc. of 1 per cent procaine hydrochloride into the caudal canal; then 3 cc. in each sacral foramen, and after that goes back and injects 15 cc. in the caudal canal. He has found that about 70 cc. can be used. Alcock (25), McCarthy (10), Bumpus (19), Stern (22), and Bugbee (7), all mention the use of caudal and transcaudal anesthesia. Caulk (8) believes that twilight sleep and local urethral and infiltrative anesthesia of the bladder neck seem preferable to sacral, spinal, or general. Walther (26) finds that sacral, caudal, or local anesthesia relaxes the sphincter too much and distorts the field, and has found N₂O and oxygen satisfactory. Sargent points out that spinal anesthesia is his choice because of the danger of explosion of general anesthetics in the presence of the intricate electrical equipment. (27).

That careful preoperative treatment is essential, the same as in prostatectomy, is the conclusion of the majority of writers. Early in the evolution of this procedure writers referred to it as minor surgery in comparison to prostatectomy, the result being that meager attention was paid to careful preparation of the patient. The disastrous results have caused the pendulum to swing to the other extreme now and writers are suggesting the same care for resection patients as those who are to undergo prostatectomy. Shivers (28) recommends the same treatment pre-operatively as those who are to undergo prostatectomy, and warns that it is too serious a procedure to make it an office operation. Day (29) makes the statement that resectionists are quite agreed that the same careful prep-

aration and pre-operative drainage is as necessary before resections as before prostatectomy. Davis (13) says, "Regardless of the type of obstruction or the operation to be performed, it is of paramount importance to properly prepare these patients by thorough decompression with a retention catheter. A careful watch should be maintained over the nitrogenous constituents of the blood, the renal function should be stabilized and the correction of constitutional abnormalities should received appropriate consideration. It is only by adhering to these well-known surgical principles that maximum results and a minimum mortality and morbidity rate may be obtained."

Walker of London (21) uses the same pre-operative treatment in resection work as for a supr-pubic prostatectomy. If a large amount of residual urine is present preliminary drainage thru an indwelling catheter is required. His statement: "The fact that urethral prostatic resection is a trivial operation in comparison with enucleation does not relieve the surgeon of the responsibility of estimating renal function and of doing everything in his power to safeguard the kidneys. Any operative procedure, however trifling, is likely to be followed by a rise in the blood urea, and preliminary treatment of the kidneys is as important where urethral methods are employed as it is in the case of a suprapubic prostatectomy."

Both Caulk (8, 17,) and McCarthy (12) recommend as careful preparation of the resection patients as those to be submitted to open operation.

Bumpus however has a different slant on the pre-operative drainage. He believes that in the absence of urinary or prostatic infection such a period of drainage, carried out by means of an indwelling catheter, is bound to result in infection, and what was before a mild inflammation of the prostate, causing no reaction, is activated to a point of virulence, so that the patient becomes a poorer instead of a better surgical risk. He reports 276 resections in 1932, 45 per cent of which were done without any preliminary drainage and he couldn't detect that their post-operative course was essentially different from that of patients who had had the most painstaking preoperative preparation. He had no deaths in the series and believes it is due to the care taken relative to sepsis. (20).

Routine vasectomies preceding resection to prevent the complication of post-operative epididymitis is the practice of Kretschner (30), Walther (26), Caulk (8), who report complete absence of the complication following this procedure, or at least a marked decrease in the incidence. Thompson (31) reports a series of 205 cases in which epididymitis developed in 8% of the total number when vasectomy was not performed.

Walther (26) routinely gives his patients 2 .1 gm. tablets of pyridium t.i.d. to control fever, beginning this procedure 4 to 5 days prior to resection. He also makes it a practice to give 250 cc. of whole blood immediately following operation to combat the shock in men over 65.

Alcock (25) takes air cystograms as a routine, and

urethrograms with jelly made of iodized oil, before and after resection, and finds this procedure invaluable. Alcock also recommends that more of the operations be done in two sittings rather than one. He finds the advantages very definite, in that many cases in which it had been definitely planned to do the operation in two sittings, obtained a functional result following the first resections so satisfactory that a second resection was not necessary. Indications for the second resection are based largely on the functional result and post-operative cysto-urethrograms. He also stresses the point that the second resection is always easier to do than the first, and that the tissue can be removed in larger quantities and more rapidly than in the first.

Ballenger, Elder, McDonald, in reporting a series of 144 cases resected, advise a two-way resection of the large prostates, combining a trans-vesical approach via supra-pubic incision to remove with loppers the intra-vesical mass, with a trans-urethral approach which they do a week following the first procedure, to remove the urethral obstruction. In order to remove sufficient tissue these writers suggest a routine introduction of the finger into the rectum to press up on palpable masses so as to push them into the field for resection. (32).

Graves (33), who is the most enthusiastic resectionist among the conservative New Englanders, finds that it lessens trauma and initial bleeding to carefully pass sounds gradually increased in size to 30 F. before introducing the resectoscope. He also recommends that before the patient

comes to the operating room the bladder and urethra be irrigated with a bland antiseptic solution. Following operation he keeps a constant catheter drainage for the first 12 hours with frequent irrigations, using boric acid solution and ephedrin.

The statements of the various writers as to the amount of tissue that should be removed is interesting and vital to the success or failure of the procedure. McCarthy (5) believes in restoring the lumen to normal or a moderate exaggeration of the normal tubular character regardless of the amount of tissue removed. Barnes (11) determines the amount of tissue resected on the shape of the prostatic urethra, and considers his objective reached when all the encroachment is removed. He makes the statement that it is usually safe to remove from the prostatic urethra all that can be reached with the loop. Bumpus (19, 23, 34) points out that the operation of transurethral removal of obstructing tissue rests on logical ground; for it endeavors to correct obstruction by removal of the obstruction only, and not to remove tissue that does not obstruct. When this obstruction is slight and in a channel, the diameter of which is less than 1 cm., the amount of tissue capable of causing obstruction can be insignificant, and cases are seen in which urinary retention is completely relieved by the removal of less than 1 gm. of tissue. He reports that the largest amount of tissue removed from a single patient was 63 gm. His experience has shown usually that 20 gm. of tissue may be safely removed if associated residual



FIG. 2. SPECIMENS REMOVED FROM THREE INDIVIDUALS AT ONE SITTING

Caulk

urine is completely relieved. In a three year period 535 prostatectomies were performed at the Mayo Clinic, the obstructing tissue removed in 244 cases, or 42 percent of the cases, weighed 30 gm. or less. He argues that if the obstructing portion of an hypertrophied gland may be taken arbitrarily as representing two-fifths of its weight, for considerable portions of the hypertrophy extend into the rectum and cause no urinary obstruction, then the removal of up to 20 gm. of tissue thru the urethra will mean that all glands of weights up to 50 gm. can be safely operated on by trans-urethral procedure. In only 32 per-cent of the 575 cases did the removed tissue weight more than 50 gm. Day (29) makes the statement that 5 gms. to 25 gms. or more, of tissue are removed, according to the needs of the individual case as interpreted by the judgment of the operator. Davis (13) reports the amount of tissue which has been removed varies from one and a half grams in constrictures and small bars to 45 gms. in the larger types of hypertrophy. It is evident from the foregoing statements that most of the men agree with McCarthy that the operation is one of canalization rather than excavation, Bumpus being the only writer who places a more or less definite limitation as to the amount of tissue that can be taken safely. However it is interesting to note that the latter reported the resection of the greatest amount of tissue we were able to find in the literature.

Types Fitted for Trans-Urethral Resection:-

The variance in opinion as to the applicability of the trans-urethral procedure is best presented by a symposium of statements of the writers. Generally speaking it may be said that since Young's introduction of the median bar incisor in 1909 the use of the urethral instruments has extended to include the majority of prostatic obstructions.

Stern (22), "In the examination of a patient to determine whether his prostate is to be resected or enucleated, the surgeon should, first, appraise the patient as to his general competence; second, learn the size and location of the intrusions, and third, estimate the degree of inflammation and edema present. In all cases of prostatic enlargement except those frankly falling into the class of bars and contractures, there are present inflammation and edema, which, when more than moderate in degree act as distinct contra-indications to immediate resection. Among these there is a certain number in whom resection can be performed under the most ideal conditions, following several weeks of drainage and shrinkage of the prostate gland."

Loughnane (50): "Per-urethral treatment of the prostate is indicated in the following types of cases: (1) fibrous prostate; (2) median lobe enlargement; (3) unilateral lobe enlargement; (4) early general enlargement; (5) general vesical enlargement only or mainly; (6) prostatic enlargement with cardiac or general debility. It is not indicated in the following: (1) very large general enlargement; (2) marked rectal enlargement;

(3) malignant disease of tumour, except as a palliative measure; (4) if infection is present or severe; (5) if calculi are present in the bladder; (6) if enlargement is due to tubercle or abscess; (7) if prostatic calculi are present; (8) if kidney function is very bad, and there is marked debility; (9) if there is no good reaction to sepsis; (10) marked intra-vesical enlargement; (11) if enlargement is inflammatory.

Cabot (49): "It is undoubtedly too early to express an opinion as to the place which it will finally occupy. On the evidence at present available it appears to me well suited to the treatment of the small, chiefly fibrous obstructions at the neck of the bladder. It has yielded excellent results in the cases of moderate fibro-adenomatous hypertrophy whether of later or median lobes. Although its advocates put it forward as applicable to the much enlarged prostate glands, their case is, I think, yet to be proved. In this group regrowths from the considerable remaining portions of the adenomatous hypertrophy are likely to occur, and the evidence is as yet lacking to show that for those cases reasonably permanent results can be obtained."

Walker (21): "The key to success in periurethral work on the obstructing prostate lies in the careful selection of cases...Let it be realized once and for all that the periurethral approach is not a general substitute for prostatectomy; it should be considered rather as a method that is applicable to special types of cases in which it is indicated or in special circumstances. The special type of case in which it is indicated is that in

which the amount of enlargement is small, altho the obstruction may be great. More particularly is it applicable where the intravesical portion of the prostate is affected and the total volume as felt by bimanual examination but little increased. The special circumstances in which it may be used are those in which for some reason or other the total removal of the prostate is contra-indicated, either because the general condition of the patient is too poor or because some serious complication exists, such as grave renal impairment or a serious cardiac or pulmonary lesion."

Munger (35) in February, 1933 wrote, "Dr. Davis has put before this audience a new hazard which should be thought about. That hazard is trans-urethral resection. I am declaring myself as an ultra-conservative in this procedure until we know more about it." The same writer wrote in March, 1934 (36) "In all types of prostatic obstruction except the enormous intrusion or the very vascular type, transurethral resection is the method of choice."

Alcock (25): "Which cases can be done by resection and which must be left to surgical prostatectomy? It is largely a personal matter, and ninety percent of the result of resection depends on the man doing it. The size of the gland does not determine resection or prostatectomy. If the instrument cannot be passed into the bladder resection cannot be done, but I have had only 4 such cases in 400."

Engel and Lower (45) present the following outline of those suitable and not suitable for resection:

Types Suitable for Trans-urethral Resection:

1. Solitary commissural hypertrophy
2. Solitary sub-cervical hypertrophy
3. Posterior commissural and bilateral lobe hypertrophy with predominance of the former: that is, without marked intra-urethral encroachment of lateral lobes and marked lengthening of prostatic urethra.

4. Subcervical and bilateral lobe hypertrophy with same restrictions as above.

5. Anterior lobe hypertrophy.

6. Sclerotic median bars.

7. Patients having had previous prostatectomy.

Types Not Suitable for Trans-urethral Resection:

1. Simple bilateral lobe hypertrophy.
2. Ponderous subcervical or posterior commissural hypertrophies.
3. Any case presenting marked extra vesical lateral lobe enlargement.

Graves (33): "Valuable as it is, it has in my opinion limited and clear cut indications for its use.

These may be classified broadly in three groups:

1. Relatively small circumscribed obstructions at the bladder neck, which we recognize usually as fibrous or glandular median bars. The true rounded middle lobe hypertrophy before it has progressed to extreme enlargement with marked elevation of the urethral floor.

2. Those obstructed cases of carcinoma too advanced

for complete perineal extirpation in which it is desired to restore normal bladder function without more extensive surgery.

3. Those cases of benign hypertrophy with marked or complete retention in which the general degenerative changes, particularly in circulation and kidneys, are such as to render the patient unfit for safe prostatectomy by any other method.

Thompson (31): "By careful study and cooperation at the Mayo Clinic, application of the operation has gradually been extended until at the present time I am firmly convinced that the tissue causing urinary obstruction can be adequately removed in any case in which it is possible to pass an operating instrument. Not only do I believe it feasible--but desirable."

In February, 1933, Davis and Owens (9) wrote, "In cases of carcinoma of the prostate the value of trans-urethral resection is not open to question." We are not able to report to what extent they have extended this opinion.

Caulk (14): "Thirteen years ago, this operation was apparently limited in usefulness to the bars and constrictures of the vesical neck, but during the process of development it has been gradually applied to the larger obstructions with equal effectiveness, until at present I find that, at least in my hands, it is effective in almost 100 per cent of all obstructions, regardless of size; indeed, during the past year I have been compelled to perform but one prostatectomy."

Day (29): "After having resected some quite large adenomatous prostates, and also after much personal correspondence with several of the outstanding resectionists of the nation, the author is convinced that it is technically feasible to perform the operation in an overwhelming percentage of cases of prostatic obstruction--probable in 90 per cent or more. He believes it can be stated definitely and with assurance that it is advantageous, and the operation of choice, in a considerable proportion of cases--say 25 or 30 per cent. This includes contractures, bars, median lobes that are not too large, lateral lobe enlargement of the mixed fibro-adenomatous type, that is to say, if the lobes are not too vascular; also in the nodular type, frequently carcinomatous, encroaching irregularly on the margin of the bladder neck. Again, in certain types of carcinoma unassociated with adenoma, and where there is definite associated contracture or bar formation."

Davis (13): "With the present equipment, it is possible to relieve more than 90 per cent of the cases with an operation that is simple, wherein the risk is negligible, and the final results are equal, if not superior, to those obtained by prostatectomy."

McCarthy (12): "Though we have carried out this operation with gratifying results in practically all forms and types of prostatic hypertrophies save the rare enormous enlargements, and have done but a few prostatectomies during the past year and a half, it is the present consensus of opinion in our department at the Post-Graduate

Hospital, that this procedure should be limited to the correction of prostatic fibrosis, so-called collar condition, small and moderate middle lobes, and moderate sized combined middle and lateral lobes." In another publication (5) McCarthy writes, "In other words 90 per cent of prostatic encroachments, malignant or otherwise, and however dense, may be regarded as so much plastic material to be removed seriatim...The obvious interpretation is that thus equipped one may remould the prostatic urethra at will. This is borne out by the experience of my associates and myself in a large series of cases of all types, from the simplest fibrosis to advanced malignancies, and all degrees of urinary retention. Further, lest there be the slightest misapprehension, the assertion is here made that this procedure is more precise and more surgical than is that of open prosta-tectomy."

In discussing the types of urinary obstruction McCarthy (1) brings out the following types. The first is gradual in onset and is constantly cumulative. It occasionally reaches the stage in which complete retention occurs. The underlying causative factor is pathologic intrusion at the floor of the sphincter. Under this heading may be mentioned fibrosis of the vesical neck, so-called collar prostate, or enlargement of the middle lobe. The second type of retention is the spasmodic or intermi-tent form, characterized by rapidity of onset and is frequently complete, though

usually temporary. This is the well known type, in which the patient reports satisfactory antecedent function of the bladder, and at intervals experiences periods of well-being, with only nominal residual urine between attacks. The dysfunction of the bladder in this type usually occurs after prolonged exposure to cold, such as during attendance at a football game, or any sustained excess. It is also the type that impresses the superficial observer as having been cured by the passage of sounds, deep roentgen irradiation, and other measures. This is the pure lateral lobe type of enlargement which, contrary to some previously held beliefs, plays only an occasional role in urinary retention. The third type is a combination of the first two, and it is to be inferred that in this form also the lateral lobes play only an incidental part.

McCarthy (48) also points out that in the palliative treatment of prostatic malignancies trans-urethral resection is a veritable godsend. Until recently, it has been accepted practice in the case of advanced carcinoma of the prostate, manifesting obstructive symptoms, to advocate permanent cystostomy and such additional steps perhaps, as irradiation, narcotics, and dynes, etc. Today, with resection, supplemented with x-ray therapy, we can continue the patient's economic usefulness, restore his bladder function, and in considerable measure, control the inevitable pain up to the terminal stage of the disease.

Reports of successful use of the resection instruments in relieving urethral strictures in male and female, and urethral caruncles, are also available.

Dangers and Complications of Transurethral Resection:-

Early attempts at trans-urethral removal of prostatic obstructions were fraught with dangers and complications, but as the knowledge and experience with the procedure have broadened the possibility of complication has narrowed, as is the case with any new method. We present the following symposium of writings of various authors, necessarily including much repetition, which should be of value in reminding us that though the operation may sound utopian in the writings of some, it is not without it's dangers.

Alcock (25) gives the most complete discussion of complications. In the early resections hemorrhage was the bugaboo, but the writer makes the statement that any uncontrollable hemorrhage at the time of operation is the fault of the operator and not the method. The amount of blood lost during operation should be and is insignificant. In none of his cases did hemorrhage having any thing to do with death. However he finds late hemorrhage frequently occurs. Seventy per cent of the patients report some terminal hematuria during the 3rd, 4th, and 5th weeks. In only 8 of 400 cases was the bleeding of any magnitude. The cause of bleeding is attributed to the sloughing of the tissue.

"Infection," quoting Alcock, "is the most serious, most troublesome, and probably the most common complication following resection, and is at present our biggest problem. Explanation is to be found in the necrosis that follows

in the wake of resection. It is true that the film of coagulated tissue is very thin, but the depth of necrosis extends far beyond the zone of coagulation. This necrosis in part is probably due to the heat produced in the tissue as shown by Caulk, but I am quite sure that thrombosis also plays an important role."

Further complications mentioned by Alcock are frequency of urination, which in practically all cases is fairly well marked immediately after the indwelling catheter is removed. As experience with the procedure grew this has become negligible however. Practically all cases show varying amounts of residual urine immediately following removal of the catheter. As a rule this usually decreases in amount as days go by, and if it does not it is indication for a second resection. To relieve the complication of epididymitis routine vasectomy may be done.

Kretschner (30) agrees with Alcock that it is not the bleeding, but the infection which is the major complication.

Sargent (27) mentions particularly the following dangers: (1) Fluctuations in blood pressure. It is difficult to avoid fluctuations in blood pressure with spinal anesthesia. A lowered pressure during resection may give a bloodless field, which however may give rise to fatal hemorrhage on rise of the blood pressure. The administration of ephedrine to counterbalance the decrease harms the heart in the old men. He mentions a case in which during operation the pressure was down around 80, and the operative field was bloodless. With recovery of blood pressure

several hours later severe bleeding developed, and before arrangements could be made to properly control it, he had bled more than his age and physical condition could withstand. Conversely a violently stimulated heart due to an overbalance of ephedrine can be serious to these old men. One of his best surgical risks died on the 4th post-operative day from his first attack of coronary disease. An overbalance of ephedrine ran his normally low pressure up to 190 and whipped his heart into a frenzy for 8 hours following resection. (2) Severe Delayed Hemorrhage.

(3) Sepsis. More attention must be paid to pre- and post-operative care. Pyelonephritis is common. While hemorrhage and cardiovascular accidents of surgery account for some deaths, sepsis in one form or another is the outstanding danger in trans-urethral resection. (4) Epididymitis. Section of the vas is employed to relieve this complication.

Herman and Greene (53) tabulate their complications observed in 75 cases:

Local Complications

Rupture of Bladder	1	Retention	2
Cystitis	3	Repeat Operat.	2
Epididymitis	5	Hemorrhage	3
Indolent Sinus	2		

General Complications

Pyelonephritis	5	Pneumonia	1.
Pyoarthritis	1	Temp. Rise	8
Empyema of Gall Bl.	1	Chills & Fever	2
Angina Pectoris	1	Herpes Zoster	1
Delirium Tremens	1	Carbuncle	1
Cardiac Disease	3	Activated T.B.	1
Uremia	2		

Readmissions (6)

1. Volvulus: 1 month after resection. Died

after operation. Autopsy disclosed large epithelial lined tunnel thru prostate.

2. Reoperation for complete retention: 35 pcs. tissue removed. Perfect Recovery.

3. Reoperation for frequency, urgency, and 200 cc. retention. 7 pcs. tissue removed. Perfect Recovery.

4. Hemorrhage: 16 days after revision. Controlled by catheter.

5. Hemorrhage from trigone: biopsy specimen showed inflammatory ulcer.

6. Pernicious Anemia and hemiplegia 8 months after operation. Died.

Davis (37) explains secondary hemorrhage largely on the basis of clots or tissue left in the bladder which set up a reflex spasm of the bladder. These clots or bits of tissue are easily evacuated from the bladder with his cystoscope curette, and coagulation of the bleeding vessel is so readily accomplished that secondary hemorrhage if it should arise, is of minor importance in his experience. He believes postoperative infection is of negligible frequency because the lymph channels and blood vessels are sealed by the dehydration incident to heostasis. He mentions however that 15 per cent of the cases have an elevation of fever, varying from normal to 104 F., which usually does not persist more than one week. He believes the temperature elevation has been lower as a rule in those patients that have been on preliminary drainage with a retention catheter and have developed an immunity. Eight cases are reported of epididymitis, all subsiding without interference.

Colby (38) sums up the complications as being hemorrhage, pyelonephritis, cardiac decompensation, septicemia, urinary extravasation, incontinence, multiple abscesses of the kidney, urethrorectal fistula, general peritonitis, perineal abscess, ischio-rectal abscess, and failure to relieve obstruction.

Loughnane, (50), mentions that diathermic treatment has been complicated by haemorrhage, retention, sepsis, and extravasation of urine. Hemorrhage is seldom of serious import, and is generally dependent upon the intensity of the treatment. All that is necessary to do if the bleeding is free and external is to irrigate the bladder and tie in a large catheter. This is sufficient in the case of reactionary hemorrhage unless the bleeding has been chiefly internal and the bladder become filled with blood-clot. In this case it may be necessary to remove the clots with an evacuator, before tying in a catheter. Similar treatment is usually effective also in hemorrhage occurring at the time of the separation of the sloughs, but as now sepsis is liable to be present it will be useful to irrigate the prostatic urethra and bladder with silver nitrate, 1 per cent solution, which is both a good antiseptic and styptic. Retention of urine may be common following diathermy and is due to reactionary edema, hence the use of the in-dwelling catheter.

Walker (21) : "Apart from sepsis and uraemia few complications are to be feared during convalescence. Hemorrhage, either postoperative or secondary, is in the vast majority of cases trifling, and the author cannot recall one instance in which he has been compelled to open the bladder for clot retention."

Barney (42) from the conservative New England district reports the occurrence of the following complication in 56 resections--pyelitis, scrotal abscess, epididymitis, peri-urethral abscess, paraphimosis, pneumonia,

collapse of lung, anemia, phlebitis, pulmonary embolism, and three severe post-operative hemorrhages.

Thompson (31), whose report of 205 cases at the Mayo Clinic shows remarkable results, says that severe hemorrhage immediately post-operative rarely occurs, and does occur only in cases with marked sustained drop in blood pressure. In only one case in 205 was it necessary to control early post-operative bleeding by further electro-coagulation, and in no case have any of the hemostatic bags been employed, such as recommended by McCarthy in cases of hemorrhage. Thompson mentions that as a rule there is less than a degree rise in temperature, and only patients with associated marked prostatitis have rise of 2 to 3 degrees. After removal of the catheter very little pain on voiding is experienced until the 7 to 8th day when the sloughs pass and nerve endings are exposed. Severe post-operative hemorrhage occurred in 5 per cent of his 205 cases after the 10th day. Incontinence has not developed in any case in the series. Epididymitis developed in 8 per cent of the cases. The period required for complete healing varies, the extensive resections requiring a little less than 3 weeks. Notable in Thompson's series is the absence of sepsis as a complication, which he believes is due to the care they take in preventing it. A special technique for nurses in handling the indwelling catheter is employed to eliminate possible contamination.

Bugbee (4): "The following complications have come under my observation following resection by some of the

most ardent advocates of the method: deaths from hemorrhage and perforation of the bladder, periurethral abscess, poor urinary control, severe infection, and recurrence of obstruction. These are mentioned as showing a few possibilities from what has often been emphasized as a minor procedure."

Collings (51); "Eleven per cent of transurethral patients had severe urethral chills and fever. All these patients had had the lopp and knife excision of the obstructing portion of the prostate. It was rare that a knife excision patient had over a degree or two of fever. Sixty per cent of the private patients had no bleeding following operation; in 32 per cent the urine was pink for one or two days; in 7 per cent the urine was pink with small clots for three or four days. One patient had secondary bleeding fourteen days after operation; another clots off and on for nine days, both controlled by an indwelling catheter. One patient continued to bleed so much following operation that I had to do an immediate suprapubic cystotomy. A tear was found in the bladder neck (thought to have been caused by forcibly passing the 28 F. sheath thru the tight bladder neck). In a Bellevue patient incontinence developed after operation. Because of a weak rotary convertor I was using a coagulating instead of a cutting current. Twelve days after operation the patient had a secondary hemorrhage and the posterior layer of the triangular ligament sloughed away." He continues, "Patients with nocturia of from one to eight times before operation gave the follow-

ing reports after operation: sixty-one did not get up all at night; 23 per cent got up sometimes once, and 16 per cent got up once or twice." So in this series one would hardly list frequency as a complication.

Were we to attempt a summarization of these statements of the various operators, outside of the occasional remote complication, the two greatest worries of the resectionist are sepsis and hemorrhage, both of which in the hands of various men have been very successfully controlled. When we later consider the average age at which patients are resected the great wonder is that more serious complications are not encountered.

Functional Results and Mortality In Trans-Urethral Resection:

When two different procedures may be offered to a patient seeking relief from prostatic obstruction, the important thing to him and to his surgeon is the result which may be expected, both from a functional and mortality standpoint. As pointed out previously, trans-urethral resection went thru a period where it's originators were claiming amazing results and referring to it as 'minor surgery' in comparison to prostatectomy, whereupon it was taken up by numerous instrumenteurs unschooled in the procedure, and the immediate reaction was unfavorable because of high mortality and poor results. Now, however, results are being reported which show the procedure in its true light.

Alcock (25) presents two very interesting charts in comparison of 400 prostatectomies with 400 resections.

	Prostatectomies		Resections	
	Number	%	No.	%
Hypertrophies	375	96%	324	81%
Carcinomas	25	4%	76	19%
Age				
90-100	0	0	1	.5%
80-90	15	3.7%	25	6.2%
70-80	136	34.0%	235	58.8%
60-70	204	51.0%	127	31.7%
50-60	41	10.2%	12	3.0%
40-50	4	1.0%	0	0.0%
Over 70	151	37.7%	261	65.2%
Under 70	249	62.3%	139	34.8%
Average Age		66.3		72.1

It is interesting to note here where the majority of cases are operated upon, 58.8% of the resection patients being between 70 and 80, whereas prostatectomy patients show

51% between 60 and 70. We need not point out the difference in age and its effect on the risk of any procedure.

In comparing the mortality in the same series of patients, Alcock presents the following chart:

	Prostatectomies		Resection	
	Number	%	No.	%
Total Deaths	97	24.2%	26	6.5%
Benign Hypertrophy	82	21.9%	18	5.5%
Carcinoma	15	60.0%	8	10.5%
Cystostomy	67		9	-
Prostatectomy	30	9.0%	-	-
80-90 Years	6	40.0%	3	12.0%
70-80 "	46	34.0%	17	7.2%
60-70 "	38	18.6%	6	4.8%
50-60 "	7	17.0%	-0	0.0%
1st 50	13	26.0%	11	22.0%
2nd 50	6	12.0%	4	8.0%
3rd 50	12	24.0%	3	6.0%
4th 50	10	20.0%	1	2.0%
5th 50	12	24%	6	12.0%
6th 50	16	32.0%	0	0.0%
7th 50	13	26.0%	1	2.0%
8th 50	15	30.0%	0	0.0%
Last 300	78	26.0%	11	3.6%
Last 200	56	28.0%	7	3.5%
Last 100	28	28.0%	1	1.0%

We note here that the mortality rate in resection has decreased markedly while in prostatectomy it remains constant. Alcock's words are interesting, "As experience has accumulated the troubles and tribulations have become very much less; the time of resection has very much diminished; the amount of tissue removed has increased; the course of the patients has become much more smooth; and the results have been more certain and much more satisfactory."

Thompson (31) presents an interesting series of 205 cases at the Mayo Clinic. He classifies the type of risk in this series as follows:

35-40 years	Cases 2	0.97%
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40-45 Years	Cases	4	1.95%
45-50 "	"	6	2.92%
50-55 "	"	14	6.82%
55-60 "	"	38	18.53%
60-65 "	"	56	27.31%
65-70 "	"	46	22.43%
70-75 "	"	29	14.14%
75-80 "	"	7	3.41%
80-85 "	"	3	1.46%

Age more than 70	19%
Diabetes	7%
Systolic Bl. Press. more than 160	28%
Severe Coronary Sclerosis	11%
Heart Block	3%
Cardiac Lesion other than above	4%
Parkinson's disease, Pituitary Tumor, Hep. Cirrhosis, Asthma	0.5%

In this series of 266 cases Thompson had no deaths. In 89.5% of the cases relief was afforded by one resection, and in the other 10.5% 2 and 3 resections were done. He further reports that they have not had a death since 1931, with a total of 236 cases operated upon. In this number they have had 5 recurrences.

Munger (36) reports a series of 100 resections with 3 deaths, one from a peri-urethral abscess, one from hemorrhage, and one from poor physical condition the patient being 84 years old. He reports the final results equal if not superior to those obtained by prostatectomy.

Bumpus (20), corroborating Thompson's report of the Mayo Clinic series of 236 cases, reports no deaths and makes the additional statement that the absence of mortality is due to the care they take relative to sepsis.

Kretschmer, (30), reports a series of 250 resections with a mortality of 3.9%.

Herman and Greene (53) report 75 cases with a 3.7% mortality.

Engel and Lower (45) divide their cases into the good and bad risks according to condition of the patient

and present the following chart of their results:

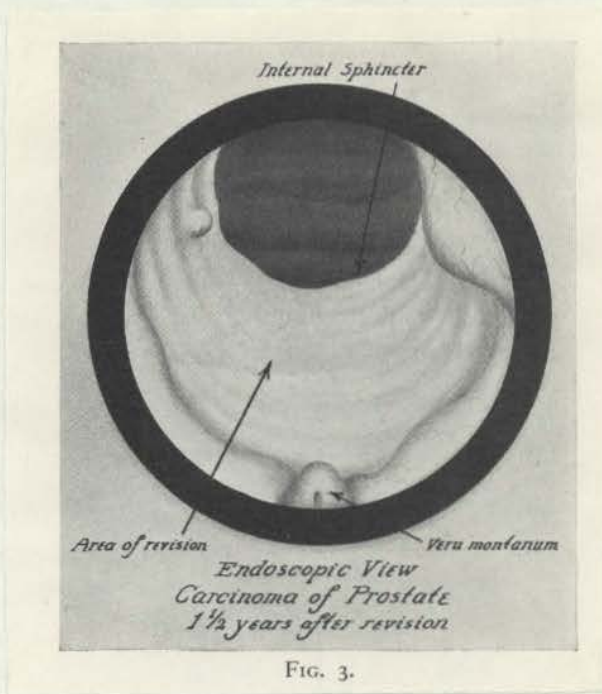
	<u>Cases</u>	<u>Deaths</u>	<u>%</u>
Carcinoma	34	1	3.0%
Bad Risk	28	2	8.0%
Good Risk	132	0	0.0%
Total	<u>194</u>	<u>3</u>	1.5%

Davis (37) in 1932 reported 194 cases and says there has not been a death immediately following resection. Forty of the patients have had carcinoma; of these 4 died of carcinomatosis without recurrence of the obstruction. As to urinary retention the author says the vast majority empty their bladder following removal of the retention catheter. He has not had a case with over 2 ounces residual urine at time of primary dismissal, and upon a return for examination this residual urine was reduced to less than one ounce in every case.

Walker (21) reports a series of 100 consecutive cases, some due to prostatic enlargement and some to bladder neck obstruction, in which he had five deaths--one due to broncho-pneumonia, one to uraemia, and three to a combination of uraemia and sepsis. Analysing these deaths he states that three of the patients who died with renal complications gave very poor renal function tests prior to operation, and that two of them were also suffering from severe sepsis, so that only the one remaining patient could alone be considered a good operative risk, for whose death the operation must be held responsible.

Young (54) reports 517 cases with 5 deaths, a mortality rate of less than 1 per cent.

McCarthy (12) in 1932 reported 125 cases in which there were two deaths, 1 a repeat case which at necropsy



McCarthy

revealed a cystitis and a previously undisclosed bilateral calculous pyelonephritis, which failed to cast a shadow on roentgen-ray exposure. The other committed suicide due to a delusion that he had contracted some serious venereal disease.

Foley (43) presents the following charts in study of 108 cases:

Age by decades:

3rd	1
4th	3
5th	20
6th	49
7th	32
8th	3
	<u>108</u>

Urinary Retention Before Operation:

Less than 50 cc.	13	
50 cc. or more	12	
100 cc. or more	18	
200 cc. or more	6	
300 cc. or more	21	
Complete Retention	38	108

Urinary Retention After Operation:

None	69	
Less than 50 cc.	17	
Less than 100 cc.	5	
Not Recorded	10	
Died (Post-Operative)	7	108

Results on basis of Emptying time, force of stream, relief of symptoms:

Well	62	
Improved	32	
Not Improved	3	
Incomplete Treatment	4	
Dead	7	108

Ballenger, Elder, McDonald (32) report 144 resections with 3 deaths.

All is not roses tho with resection--Barney (42) reported 56 resections with a total mortality of 17.8%,

the age incidence being 51 to 86 years. Twenty-four of these cases were private cases, showing 4.16% mortality, and 32 cases were charity showing 28.1% mortality. This perhaps accounts for the conservative attitude of this New Englander as far as trans-urethral work is concerned. Graves (33), another New Englander, however reports a series, the number of which is not mentioned, in which he has had no deaths to date.

Caulk and Patton (18) present a series of interesting charts in connection with their comparison of the cautery punch instrument with the high frequency instrument. They have collected 7,415 cases done by the punch operation, 159 operators, with 81 deaths, and 8,073 resections, 196 operators, with 302 deaths. This makes a total of 15,488 endo-urethral operations with 383 deaths, or a mortality of 2.4% in the total number. This is quite the most extensive collection of data presented in the literature and we are including Caulk's charts:

TABLE 5.—Total Number of Punches (7,415)

159 operators		
Total hemorrhage	588,	7.9%
Primary, mild	301	
Primary, severe	112,	1.5%
Cystotomy necessary	40	
Secondary, mild	126	
Secondary, severe	49,	0.6%
Cystotomy necessary	15	
Total cystotomies required in 0.7% of all cases		
Severe hemorrhages, primary and secondary, 2.1% of all cases, and 27.3% of all hemorrhages		
Recto-urethral fistulas	0	
Temporary incontinence	34	
Permanent incontinence	1	
Urinary sepsis mentioned by 22% of the operators, and as a cause of death in 20 cases, one fourth as many as the resections		
Extravasation	1	
Stricture of urethra	2	
Perivesical abscess	2	
Phlebitis	1	
Rupture of bladder	1	
Peritonitis	2	
Mortality	81 deaths	1.09%

TABLE 6.—Total Number of Resections (8,073)

196 operators; only 7,673 cases had definite data concerning hemorrhage	
Total hemorrhage	817, 10.1%
Primary, mild	272
Primary, severe	161, 2.1% of total
Cystotomy necessary	83, 19.2% of hemorrhage
Secondary, mild	278
Secondary, severe	106, 1.3% of total
Cystotomy necessary	36, 9.4% of hemorrhage
Total cystotomies required in 1.7% of all cases	
Severe hemorrhages, primary and secondary, 3.4% of all cases and 32% of all hemorrhages	
Recto-urethral fistulas.....	5
Temporary incontinence	113
Permanent incontinence	33
Urinary sepsis mentioned by 55% of the operators, and as a cause of death in 91 cases, four times as many as the punches	
Extravasation	7
Stricture of urethra	4
Perivesical abscess	4
Phlebitis	2
Rupture of bladder.....	3
Peritonitis	3
Gangrene of bladder.....	4
Perforation of bladder.....	2
Rupture of diverticulum.....	1
Ischio-rectal abscess	1
Perineal abscess	1
Trigonal injury	3
Pelvic abscess	1
Torn bladder neck.....	1
Peri-urethral abscess	1
Electrocutation	1
Mortality (deaths, 302).....	3.74%

TABLE 7.—Serious Complications Which Caused Death Aside from Ones Already Mentioned *

Punch		Resection	
Total punch deaths.....	81	Total resection deaths.....	302
Sepsis.....	20	Sepsis.....	91
Embolus.....	1	Embolus.....	13
Apoplexy.....	2	Apoplexy.....	7
Cardiac.....	6	Cardiac.....	24
Shock.....	2	Shock.....	19
Septicemia.....	2	Septicemia.....	8
Pneumonia.....	13	Pneumonia.....	30
Uremia.....	3	Uremia.....	21

* In comparing these two series it is noteworthy that embolus occurred almost ten times as frequently following electrical resection. Uremia resulted over five times as commonly following resection as it did with the punch operation, which unquestionably testifies to the laxity of proper preparation in many of the cases in which operation has been performed by the resection method and urgently signals the strict necessity for following in the precepts of urology in the way of preliminary preparation.

TABLE 9.—A Comparison of the Results Secured with the Punch and Resection by 141 Operators Using Both Methods

Punch		Resection	
Number of cases.....	6,008	Number of cases.....	4,885
Primary hemorrhage....	335, 5.5%	Primary hemorrhage	292, 6.0%
Primary, mild.....	251, 75.0%	Primary, mild.....	147, 50.0%
Primary, severe.....	84, 25.0%	Primary, severe.....	145, 50.0%
Primary cystotomy.....	33 or, 0.5% of total cases, 10.0% of primary hemorrhages	Primary cystotomy.....	65, or 1.3% of total cases, 22.0% of primary hemorrhages
Secondary hemorrhages. 154, 2.56%		Secondary hemorrhages. 322, 6.5%	
Secondary, mild.....	117, 76.0%	Secondary, mild.....	237, 74.0%
Secondary, severe.....	37, 24.0%	Secondary, severe.....	85, 26.0%
Secondary cystotomy....	13, or 0.2% of total cases, 8.4% of secondary hemorrhages	Secondary cystotomy....	33, or 0.7% of total cases, 10.2% of secondary hemorrhages
Of the total number of cases, 0.6% had severe secondary hemorrhage		Of the total number of cases, 1.8% had severe secondary hemorrhage	
Mortality (deaths 58), 0.9%		Mortality (deaths 231), 4.7%	

TABLE 10.—*Postoperative Complications of the Cautey Punch*

Cautey punch cases.....	2,774
Total hemorrhage	189, 6.8%
Primary, mild	121
Primary, severe	36, 1.3%
Cystotomy necessary	10
Secondary, mild	24
Secondary, severe	8, 0.28%
Cystotomy necessary	2
In other words, only 1.6% had troublesome hemorrhage	
Total cystotomies required in only 0.4% of these cases	
Temporary incontinence	11
Permanent incontinence	1
Urinary sepsis	42, 1.5%
Stricture of urethra.....	1
Mortality	0.9%
In this series, postoperative complications of any consequence amounted to only 3.6%	

It is interesting to note all thru the reports of results the relative infrequent recurrence following resection. The fear of recurrence was one of the original objections to this procedure. McCarthy (47) makes the following statement in this connection, "We have yet to notice endoscopically any evidence of regrowth along the trajectory of excision. The rational inference therefore is that relative permanency is reasonably to be expected from complete canalization of the prostatic urethra." In all of McCarthy's writings he believes that any failure of the operation to relieve symptoms is due to the operator and not the procedure; the failure to completely canalize the urethra or to remove sufficient tissue.

Caulk (46) in February, 1934 made an additional report of 900 cases in which he says the functional results were satisfactory, the post-operative complications, rare, and the operative mortality about 1%. He mentioned especially a series of 100 of the larger prostatic obstructions in which 70% were completely relieved for 3 to 10 years, and 22% sufficiently relieved to refuse further operative procedure.

From these varying reports it is seen that a patient may be offered a procedure in which the mortality rate is low, very low in comparison to most series of prostatectomies; the post-operative complications are negligible; and the functional results are satisfactory and in the opinion of some writers superior to those obtained with prostatectomy. In view of the types of risks which have been operated upon by resection with success, here is a procedure which may be offered to those cases in which prostatectomy could not be done; and in cases of carcinoma the results have been good.

Advantages of Trans-Urethral Resection:-

The striking thing in reading the literature on trans-urethral resection, particularly in the last year, is the preponderance of material stressing the good results and advantages of the procedure, and the almost complete absence of derogatory remarks. Perhaps this may be due to the enthusiasm of resectionists, but we are wont to think rather that it is due to the inherent quality of the procedure itself.

Lower and Engel (52) list the advantages as follows: (1) Minimal risk--this procedure is attended with almost no operative reaction or shock. First post-operative day finds these patients quite comfortable and rarely is morphia required for relief of pain. Mortality is minimized. (2) Economic advantage of shortened hospital stay and shortened convalescence. One day's preparation in patients with normal blood chemistry is safe. Post-operatively the patient normally is dismissed between the 5th and 8th day. Patients may return to their occupations in two to three weeks. (3) Relief to bad risk patients. Many may be relieved by this method who would probably never have stood a prostatectomy. (4) Freedom from sequelae. Freedom from urinary fistulae and incontinence of urine is due to fact that the bladder is not artificially opened nor is the external sphincter concerned in the procedure. (5) Preservation of sexual function and libido. May be of minor importance to some, yet to many this is an important consideration. (6) Conservative management of cancer. The canalization so that the patient may void followed by x-ray treatment has shown gratifying results.

Herman and Greene (53) in discussing the advantage of resection make a point of the decreased hospitalization. The average total hospitalization for their 42 non-complicated cases was 11.7 days, and the average post-operative hospitalization for the same 42 cases was 5.8 days. The average total hospitalization for 33 complicated cases was 36.3 days. The economic factor for the patient is clearly shown.

McCarthy (47) in comparing prostatectomy and resection gives the following figures. The average hospitalization for a one stage prostatectomy was 41.1 days, for a two stage 49 days, with a subsequent disability following from several weeks upward, and a mortality of 5 to 20%. His operative mortality in resection is 0.8%, and the average post-operative hospitalization is 7 days. From a functional standpoint the resection patients miss the long period of disability as McCarthy says, "Immediately following operation the patients have an increased frequency and turbid urine which clears up without local treatment, and which does not, as a rule, interfere with the performance of their customary duties."

Hess (55) brings out a point in stating that preliminary suprapubic drainage, in the types of cases he has most often seen, carried with it a higher mortality risk than prostatectomy itself, and resection is indicated for this fact alone. He also finds the convalescent period and its complications are greatly

lessened if not completely eliminated.

Collings (51) lists his reasons for doing trans-urethral surgery instead of prostatectomy: twenty-two patients were physicians or the father of a physician, and trans-urethral surgery was requested; twenty-three patients refused to have a prostatectomy (often because of some friend's experience); fourteen patients had a medical complication, such as a cardiac condition, renal insufficiency or advanced age, precluding prostatectomy; for eleven patients the referring physician requested trans-urethral surgery; two patients, aged 5 and 25 years, with congenital bar, were best relieved by trans-urethral excision.

Many writers bring out the point that, as mentioned above, patients will submit to resection, considering it not so extensive a procedure, whereas they would not submit to prostatectomy. If such is the reaction of patients, perhaps resection will offer a way to get patients into the surgeon's office for treatment long before they reach the stage of urine retention with damage to the kidneys, cardiac involvement. This argument comes very close to home for my Father, dreading prostatectomy due to his Father's experience, delayed seeing a surgeon until his general condition was such that prostatectomy was too much of a procedure. In the comparison of ages in which patients were operated upon by resection and prostatectomy, it is interesting to note that prostatectomy was performed much earlier than resection, probable due to the fact that the older patients either would

not or could not stand prostatectomy, whereas the older patients could stand and would submit to resection.

Most writers speak of the economic advantage of resection over prostatectomy, thinking only of the patients standpoint, whereas it should be pointed out the great saving in nursing care, supply expense, and keep applies to institutions too, such as charity hospitals.

Davis (24) presents his argument: "It is a pertinent fact that the majority of men past 50 years of age have some form of obstruction...In those who are aware of the fact, there is a morbid fear that prostatectomy is to be their only source of relief; therefore, they delay consulting a physician in the vain hope that they may escape the evil hour in which their prostate must be removed. With the proper education of the medical profession in eliciting the symptoms, in detecting earlier the presence of obstruction and in offering to their patients relief by an operation in the earlier stages, wherein the risk is negligible, the convalescence is materially shortened and the end-results are equal, if not superior, to those of prostatectomy."

Another field where resection is a distinct advantage is in the handling of cancer patients. Previously doomed to a life of permanent drainage, now the patients can be resected, constructing a normal canal for outlet of the urine. McCarthy (48) makes the statement, "It is in palliation of cancer of the prostate that the most notable progress has been made. Until recently, it has been

accepted practice, manifesting obstructive symptoms, to advocate permanent cystostomy and such additional steps perhaps, as irradiation, narcotics, anyodynes, etc. Today, with the new methods but recently introduced, supplemented with x-ray therapy, we can continue the patient's economic usefulness, restore his bladder function, and in considerable measure, control the inevitable pain up to the terminal stage of the disease."

Bibliography;

1. McCarthy, J.F., Prevention of prostatism, J.A.M.A. 99:1926-1928, Dec.3, '32.
2. Deaver, J.B., Enlargement of prostate, 1905.
3. Ibid.
4. Bugbee, H.G., Operative relief of prostatic obstruction, J.A.M.A. 99:1832-1836, Nov. 26, '32.
5. McCarthy, J.F., Endo-urethral treatment of enlarged prostate, Lancet 222:1245, June, '32.
6. Young, H.H., Young's practice of urology, Vol.2, pp.487.
7. Bugbee, H.G., Operative relief of prostatic obstruction, J.A.M.A. 99:1832-1836, Nov. 26, '32.
8. Caulk, J.R., Instrumental treatment of prostatism, Journ. of Urology, 26:49-66, July, '31.
9. Davis, E., Owens, C.A., Prostatectomy and transurethral resection compared, Nebr. State Med. Journ. 18: 122-25, Feb.'33.
10. McCarthy, J.F., The prostate at the crossroad, Am. Journ. of Surgery 15:435-440, March, '32.
11. Barnes, R.W., Instruments and technique for trans-urethral prostatic resection, Urologic and Cutan. Rev. 37:637, Sept, '33.
12. McCarthy, J.F., Progress in prostatic surgery, The Penn. Med.Journ., 36:815-821, Aug.'33.
13. Davis, T.M., Davis method of prostatic resection, Urologic and Cutan. Rev., 36:141 Mar. '32.
14. Caulk, J.R., Effects of use of cautery punch operation on necessity for prostatectomy, J.A.M.A. 99:1828-1832, Nov. 26, '32.
15. Caulk, J.R., Presentation of a cystoscopic, irrigating, fulgurating attachment for author's cautery punch, Journ. of Urology, 29:117-120, Oct.'32.
16. Caulk, J.R., Influence of type of current on post-operative complications in trans-urethral surgery, J.A.M.A. 102:117-123, Jan.13, '34.
17. Caulk, J.R., Influence of type of current upon the post-operative complications in trans-urethral surgery, Journ. of Urology 30:537-558, Nov.'33.

18. Same as 16.
19. Bumpus, H.C., Trans-urethral resection, Proceedings of Staff Meetings of Mayo Clinic, 8:204-206, April 5, '33.
20. Bumpus, H.C., Abstract of Discussion, J.A.M.A. 101: 1363-1364, Oct.28, '33.
21. Walker, K., Per-urethral operations on the prostate, Brit. Med. Journ. 3765:355, Mar. 4, '33.
22. Stern, M., The Stern method of prostatic resection, Urologic and Cutan. Rev., 37:7, Jan.'33.
23. Bumpus, H.C., Trans-urethral resection of prostate, Proceedings of the Staff Meetings of Mayo Clinic, 7:249, April 27, '32.
24. Davis, T.M., The present status of prostatic resection, J.A.M.A. 99:1928-1932, Dec.3, '32.
25. Alcock, N.G., Prostatic resection and surgical prostatectomy, J.A.M.A. 101:1355-1358, Oct.28, '33.
26. Walther, H.W.E., Abstract of Discussion, J.A.M.A. 101:1364, Oct.28, '33.
27. Sargent, J.C., Some dangers and difficulties of trans-urethral resection, Journ. of Urology, 30:559-565, Nov.'33.
28. Shivers, D.T., Abstract of Discussion, J.A.M.A. 102: 124-125, Jan.'34.
29. Day, R., To what extent can trans-urethral so-called bloodless surgery supplant the operation of prostatectomy, Urol. and Cutan. Review, 36:163, Mar.'32.
30. Kretschner, H.L., Abstract of Discussion, J.A.M.A. 101:1363-1364, Oct.28, '33.
31. Thompson, G.J., Prostatic Resection, Am. Journ. of Surgery, 21:421-427, Sept.'33.
32. Ballenger, E.G., Elder, O.F., McDonald, H.P., Two-way resection of very large prostates, Journ. of Urology, 30:531-536, Nov.'33.
33. Graves, R.C., Trans-urethral resection of prostate, New England Journ. of Med., 210:351-354, Feb.15, '34.
34. Bumpus, H.C., Results of Prostatic Resection over a Period of 7 years, J.A.M.A. 99:1836-1840, Nov.26, '32.

35. Munger, A.D., Abstract of Discussion, Nebr. State Med. Journ., 18:46, Feb.'33.
36. Munger, A.D., Prostatic Resection, Nebr. State Med. Journ., 19:81-85, March '34.
37. Davis, T.M., Trans-urethral correction of prostatic obstruction, Journ. of Surgery, 16:408, June '32.
38. Colby, F.H., Medical progress, New England Journ. of Med., 208:37-38, May '33.
39. Lewis, B., Carroll, G., Prostatic resection--without the moonlight and roses, Urol. and Cutan. Rev., 37:14, Jan.'33.
40. Caulk, J.R., Present status of trans-urethral surgery for removal of obstructing prostate, Urol. and Cutan. Rev., 37:14-17, Jan.'33.
41. Pomeroy, E.S., Comments on enlarged prostate and endo-urethral prostatic surgery, Journ. of Urology, 30:139-141, Nov.'33.
42. Barney, J.D., Prostatic Resection, New England Journ. of Med., 210:349-351, Feb. '34.
43. Foley, F., Cystoscopic prostatectomy, Journ. of Urology, 30:501-523, Nov.'33.
44. Michel, L.L., Trans-urethral removal of prostatic stones with simultaneous removal of Prostate, Journ. of Urology, 30:253-256, Aug.'33.
45. Engel, W.J., Lower, W.E., Individualizing the prostatic patient in selection of treatment, J.A.M.A. 101:1361-1363, Oct. 28, '33.
46. Caulk, J.R., Trans-urethral surgery, Surg. Gyn. and Ob. 58:341-355, Feb.15, '34.
47. McCarthy, J.F., Prostate gland--it's place in general medicine, Surg.Gyn. and Ob. 58:355-359, Feb.15, '34.
48. McCarthy, J.F., Malignant Prostate and associated obstructive manifestations, Journ. of Surgery, 19:209-214, Feb.'33.
49. Cabot, H., The selection of the appropriate operation for benign prostatic obstruction, Proceedings of the Staff Meetings of the Mayo Clinic, 6:552-553, Sept.16, '31.
50. Loughnane, F.M., Per-urethral treatment of enlarged prostate, Practitioner, 131:71, July '33.

51. Collings, C.W., The relief of prostatic obstructions,
J.A.M.A. 102:122-125, Jan,13,'34.
52. Lower, W.E., Engel, W.J., Trans-urethral resection of
the prostate, Ohio State Med. Journ.,
29:357, June '33.
53. Herman, L., Greene, L.B., Trans-urethral prostatic
resection, J.A.M.A. 101:1358-1361,
Oct. '33.
54. Young, H.H., Abstract of Discussion, J.A.M.A. 99:1932,
Oct. 28,'33.
55. Hess, E., Abstract of Discussion, The Penn. Med. Journ.
36:821, Aug.'33.