

# Mini-reviews

Harry Herr is known to all of us as a world leader in urological oncology, and we have all learned from his thoughtful approach to the subject and from his surgical excellence. What many might not know is that he is also a specialist in the history of urology, and indeed is in charge of that section of the *Journal of Urology*. He writes here about the surgical treatment of the enlarged prostate, which should form the starting point of future lectures on the management of BPH.

## The enlarged prostate: a brief history of its surgical treatment

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### INTRODUCTION

The enlarged prostate has plagued men since antiquity, or at least when they lived long enough to reach the 'prostatic' age. Ageing men urinate too often (frequency), too soon (urgency), too late (hesitancy), not enough (poor emptying), at inconvenient times (nocturia), when they do not want to (dribbling) and even sometimes cannot urinate at all (retention). Originally termed prostatism, urinary problems caused by the enlarged prostate are now euphemistically referred to as LUTS. Over the centuries, the enlarged prostate has been lanced, punctured, punched, incised, cut, crushed, scarified, sliced, enucleated, whittled, and burned. This article highlights landmark developments in the surgical treatment of this uniquely male malady, the enlarged prostate.

### THE ANCIENT ERA

Although urinary retention resulting from an enlarged prostate was treated more or less successfully for centuries using catheters, true remedial surgery is the product of the last 100 years. The prostate gland has been discovered, 'lost' or unnoticed, and 'rediscovered' several times. Although Galen gives Herophilus (circa 300 BCE) the credit for

first using the word 'prostate', there are only vague references to the gland until the mid-16th century, when Nicolo Massa of Padua (circa 1550) is said to have 'rediscovered' it. Jean Riolan the younger was apparently the first to suggest, in 1649, that the enlarged prostate could cause urinary retention.

There seems to have been little medical interest in the enlarged prostate until late in the 18th century, although there are occasional references to the use of catheters and 'tunnelling', i.e. the forcible passage of a rigid sound or catheter. Ever since catheters and sounds became available and were used to relieve urinary retention, physicians have sought means of carrying a cutting or piercing instrument into the urethra to open a way for the outflow of urine, to facilitate the dilatation of contracted parts, or even to form a new channel. Chopart, writing in 1831, says that in 1756 Lafaye passed a lance-shaped stylet through an open-end catheter to pierce the median lobe. His patient lived 10 years in fair comfort with only occasional need for catheterization. An autopsy confirmed the diagnosis of an enlarged prostate with a false passage. Chopart tried the same procedure, as did Billroth, once later in the century, both with fatal results [1].

### PUNCH, PRESSURE AND PUNCTURE PROCEDURES

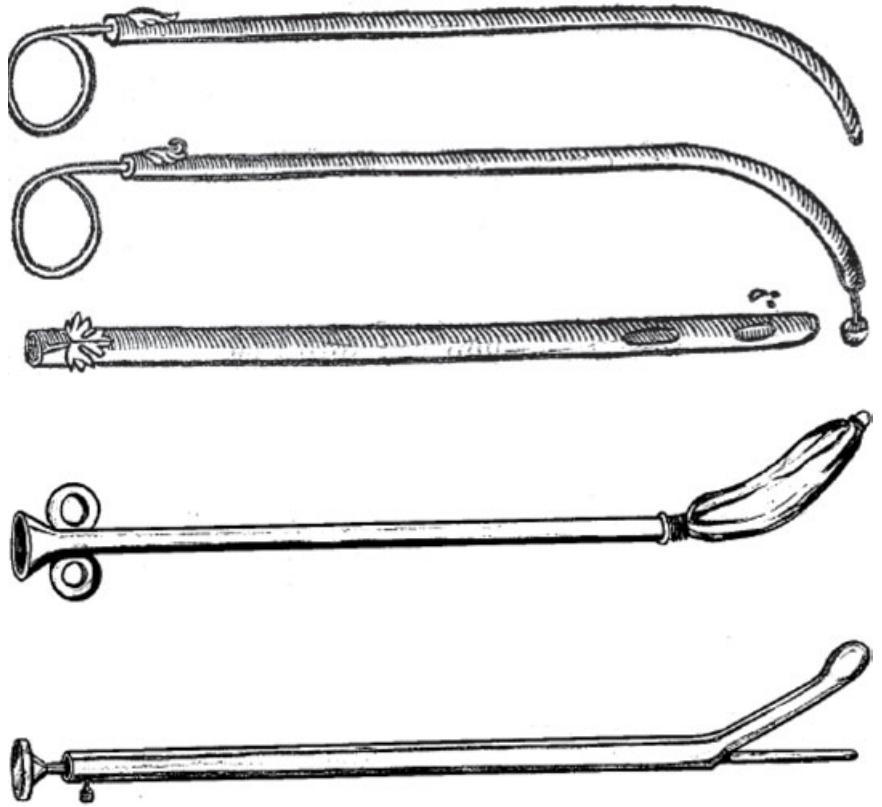
Ambrose Parè in 1575 is credited with performing the first definite operative

procedure on the enlarged prostate. He devised a punch-type instrument to remove the 'carinosities', a term applied to any type of deep urethral growth. It was an ingenious tool, consisting of a hollow sound housing a sharp-edged hemispherical tip fastened to a wire that passed through the tube, so the operator could advance the tip after passage. When the tip was advanced, any surrounding tissue would fall into this space and be clipped off when the tip was pulled back against the sharp edge of the sound (Fig. 1). Parè displayed, in the 16th century, the very ideas put forth as new in the first half of the 19th century, notably punch operations [2]. Indeed, Parè's simple principle of using a cutting or other destructive implement through a hollow tube inserted into the urethra to remove, incise, or crush obstructing prostate tissue is the basis of endoscopic prostatic surgery today.

Except for Parè, the 16th and 17th centuries are mostly silent on the prostate. In the late 18th century, interest in it grew, probably because men now lived long enough to require treatment. Morgagni in 1761 described the autopsy of a 73-year-old man who died of uraemia, 'the fibres of the urinary bladder had so increased, as to resemble strong bundles of fibres in the heart. An excrescence of the prostate gland, in the form of a pear, and scarcely leaving any passage, had been affected in the lower part.'

Although the generally accepted treatment for the enlarged prostate from the end of the 18th century to the beginning of the 19th was the liberal use of a catheter, pathological studies clearly showed that simply relieving obstruction and not treating the gland itself could prove fatal. At about this time, various methods of treatment appeared: puncturing the distended bladder by suprapubic, transperineal, or transrectal approaches; also dilating the prostatic urethra or, as some thought, causing absorption of tissue by pressure. The dilatation and pressure technique originated in the early 19th century and continued intermittently for the next 75 years. Around 1815, Philip Syng, Physick of Philadelphia, often called the father of American surgery, developed his dilatation or 'pressure' treatment. He used a metal catheter with a bag covering the inserted end (Fig. 1). When the bag was inflated, it pressed on the lobes of the prostate to reduce the swelling. The pressure and the time were as much and as long as the patient would bear, usually

FIG. 1. Early treatments of the enlarged prostate from the 16th to 19th century (adapted from [1]).



≈15 min. This was repeated every 2–3 days, but the treatments did not help much, an experience that might seem familiar to urologists who advocated balloon dilatation during the 1980s [3]. Leroy D'Etiolles in 1831 tried dilating the prostate using a straight sound, and later invented an instrument with three blades that could be separated to expand the prostatic urethra in all directions. Two decades later, the French surgeon Louis Auguste Mercier used an angled metal sound equipped with a separate rod protruded to press on the prostate, primarily the median lobe (Fig. 1). Mercier's prostatic compressor probably tore the gland; it was painful and offered little help [4].

In the last quarter of the 19th century puncture operations were revived to divert the urine from the obstructed urethra. The suprapubic approach was preferred, and many types of tubes were devised to maintain patency of a controlled urinary fistula and keep the patient dry. A perineal puncture to create an external urethrostomy at the apex of the prostate was never widely used, because drainage tubes were uncomfortable, especially when the patient was seated, and

dribbling of urine was common. Forceful puncture or 'tunnelling' through the prostate was still used on occasion, but it was a bloody, and often fatal, operation.

#### OPEN ADENECTOMY

The end of the 19th century saw a start in the planned removal of part, and eventually all, of the obstructing prostate adenoma. Modern surgical procedures for removing the prostate gland developed from centuries of experience by lithotomists cutting for stone, particularly during perineal lithotomy, which explains why perineal prostatectomy preceded the suprapubic operation by several years. In the past there had been isolated instances when prostate tissue was removed by chance during perineal lithotomy. Couvillard did this in 1639, and Desault did the same thing some 150 years later. Jean F. Amussat, writing in 1832, inadvertently removed part of the prostate while performing a suprapubic lithotomy.

Sir William Fergusson, in the 1830s, was apparently the first to recognize the

possibility of treating the enlarged prostate by removing obstructing prostatic tissue. While doing a perineal lithotomy on an elderly man, some tissue caught in the forceps between the bladder and the stone and was removed with it. The patient could void more easily afterwards, and this so pleased Fergusson that he repeated the procedure whenever it was indicated, with satisfactory results. He did not suggest that this operation be done primarily for the enlarged prostate, but only as an adjunct to a lithotomy [5].

Forty years later, John W.S. Gouley described a median incision in the perineum carried deep to the apex of the prostate. He passed a grooved director through the urethra to the bladder, incised the prostate laterally, and, if a median lobe was present, he excised it with a wire snare called an 'ecraseur'. He did not do a complete adenectomy, as he claimed to have done in 1880. George E. Goodfellow of Tombstone, Arizona, later performed the first planned and complete removal of the adenoma when he enucleated both lateral and median lobes of an enlarged prostate in 1891, but did not report his feat until 1902.

With the advent of anaesthesia and antiseptic surgery, the perineal operation for stone was gradually supplanted by the suprapubic approach. This encouraged surgeons of the 1880s to attempt removal of the enlarged prostate by the same route. Von Dittel of Vienna in 1885, Belfield of Chicago in 1886, and McGill of Leeds in 1887, all removed portions of the prostate by this method. They removed only part of the median lobe protruding into the bladder, not the complete adenoma, explaining why many suprapubic operations failed because obstructing prostate tissue was left behind.

In the mid-1890s, several combined operations were introduced to facilitate removal of both intravesical and intraurethral lobes of the prostate. The bladder was opened to gain access to the median lobe, then, using downward transvesical pressure to push and a catheter balloon to pull, the prostate was brought down so the lateral lobes could be shelled out through a perineal incision. None of these manoeuvres succeeded in drawing the prostate into the perineal wound, as it is held fast by the strong puboprostatic ligaments; they did serve to steady and hold the gland. The Syms balloon proved to be the most satisfactory method until Proust and Young introduced their prostatic tractors.

The end of the 18th century marked the beginning of efforts to refine suprapubic prostatectomy, which became the most commonly used operation for the next 50 years. Eugene Fuller of New York in 1895 published an account of six cases of 'prostatectomy' he had done by the suprapubic route and drained through the perineum [6]. Recognizing that unsuccessful results of other surgeons who aimed only to chisel out a channel were due to incomplete removal of the enlarged gland, Fuller first incised the bladder neck with scissors to find the plane between the adenoma and capsule, then used his finger to enucleate both lateral and median lobes. His illustrations indicate that the complete adenoma was shelled out from its fibrous capsule. At first, he applied pressure on the perineum with his fist to steady the gland. He later used a finger in the rectum, suggested by Ramon Guiteras of New York. Peter Freyer of London popularized the procedure, claiming priority in 1912.

For the next 30 years, urologists debated the best approach to the prostate, above or below the pubis. Perineal operations before 1900 had been more or less blind procedures, and not until Proust presented his method had the procedure been done with visual control. In 1903, Hugh Hampton Young of Baltimore, influenced by Parker Syms and Fergusson, described his operation, a combination and modification of various features of the different perineal operations at that time. He improved the operation by devising an ingenious prostatic tractor to bring the prostate gland into the perineal wound and hold it steady while he incised the capsule and enucleated both the lateral and median lobes of the prostate under direct vision. The bladder was drained through the open urethra by a catheter and the prostatic fossa packed with gauze. Primary closure of the prostate capsule would come later. Young's operation was not universally adopted, largely because of its difficulty and unfortunate sequelae of rectal injury, recto-urethral fistula and incontinence. In his hands, perineal prostatectomy produced excellent results with little incontinence, and had a low mortality rate [7]. In addition, the perineal approach prepared Young to proceed with the first landmark radical prostatectomy for prostate cancer in April 1904.

J. Bentley Squier of New York in 1911 presented a radical departure from the methods previously used by Fuller, Freyer and

others performing suprapubic prostatectomy. He inserted a finger through the bladder neck into the prostatic urethra, and, pressing upwards against the pubis, broke through the mucosa, thus engaging access to the cleavage plane between the adenoma and capsule just beneath the anterior commissure, without the use of scissors or a knife, and enucleated the gland by working the finger upward [8]. This became a common method, still used today to remove the adenoma.

In the first two decades of the 20th century, suprapubic prostatectomy, despite its improvements, lagged behind the perineal operation. Descriptions by pioneers of the procedure, from the 'nibbling' operations of the late 1880s and 1890s, were of operations conducted blindly and under guidance of the finger. Suprapubic operations often failed because they left obstructing tags of tissue, causing persistence of residual urine in many cases. Others tried a retropubic approach to the prostate, but abandoned it because of unsuccessful results. Von Stockum in 1909 did not open the bladder but simply incised the capsule of the prostate to shell out the adenoma. He packed the cavity with gauze and drained the bladder with a suprapubic tube. It remained for Terence Millin from Ireland, working in London in 1945, to perfect and popularize the retropubic operation, suturing the capsule and draining the bladder by a urethral catheter [9].

## TRANSURETHRAL PROCEDURES

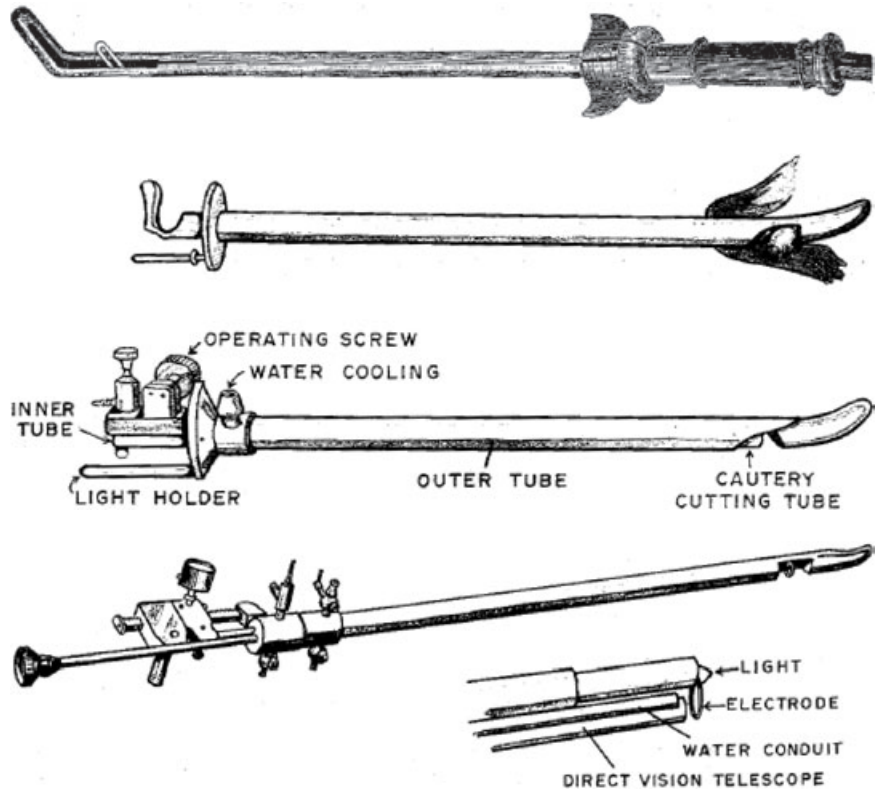
While open surgery of the prostate was developing, the transurethral method was not neglected. Shortly after the introduction of lithotripsy in the 1820s, methods were devised to remove parts of the gland. They were all based on the idea of increasing the lumen of the prostatic urethra by destroying or damaging the prostatic tissue so that it would contract. In 1830, George James Guthrie, a young British army surgeon, was the first to incise the bladder neck with a concealed knife passed through the urethra. Also in 1830, Leroy D'Etiolles scarified the prostate using a lancet. Shortly thereafter, Jean Civiale introduced his 'kiotome', another concealed knife that could be protruded to incise the median lobe. Mercier designed several instruments between 1839 and 1844 for transurethral removal of bladder neck obstruction by 'valves', probably referring to a median bar. Resembling a lithotrite, Mercier's

'prostatome' combined both incisor and excisor blades, and was the first instrument devised for actually excising abnormal prostate tissue [10]. Mercier used this about 300 times and thought well of it, but it caused considerable haemorrhage, and most patients were left with urinary incontinence. All of these instruments and methods were conducted blind, caused troublesome bleeding and could not have been particularly successful. However, they were the first of a long series of punches that in the early 1900s had quite a vogue.

There were no more advances in transurethral surgery until 1873, when Enrico Bottini of Italy introduced galvanocautery [11]. Before then, the morbidly enlarged prostate was incised with a cold knife. Bottini used a wire-loop cautery through a straight insulated tube to burn several incisions, or gashes, in the lateral and median lobes of the prostate (Fig. 2). When they healed, these cuts would leave V-shaped slots and give a larger channel for urine to flow through. In the next 20 years, the Bottini operation using thermogalvanic destruction and incision of the enlarged prostate was popular, but was still a blind procedure, and many surgeons feared using it. The technique eventually failed because of incontinence (from lack of visual control), delayed bleeding, and recurrence of obstruction. By 1897, A. Freudenberg of Berlin had modified Bottini's galvanocautery by combining it with the irrigating cystoscope, which had now come into wide use, to permit for the first time destruction of the prostate under visual control [12]. The method worked, and was used with various modifications until 1909, when Young brought out his 'cold' punch.

After using and modifying Freudenberg's instrument, Hugh H. Young created a 'cold' punch. This was a metal tube with a curved beak, and behind it, a large fenestra illuminated by a small electric bulb at the external end of the tube. Cutting was by an inner tube that sheared off tissue protruding through the fenestra (Fig. 2). Each piece of prostate was retrieved separately using forceps. In 1913, he reported using the punch operation in more than 100 cases of obstruction by median bar and other small enlargements of the lateral or anterior portions of the prostate, without fatality, and with excellent results. Two years later he replaced the cutting tube with an electrically heated cautery tube and made the outer tube

FIG. 2. Major developments in endoscopic treatment of the enlarged prostate during the 19th and 20th century (adapted from [1]).



double-walled so that water could circulate to cool it. Young's basic design was the forerunner of a great variety of subsequent punch operations [13].

Until this time, all electrical endoscopic instruments were electrically heated cauteries. In 1908, Edwin Beer of New York experimented with high-frequency unipolar current (Oudin) to treat bladder tumours. Beer's remarkable discovery was that he found a way to cauterize tissue through the cystoscope under water [14]. A.R. Sevens and H.G. Bugbee, also of New York, working independently, used the same current, and later the D'Arsonval (bipolar) current to destroy median bars and small median lobes. These high-frequency currents did not penetrate and damage surrounding tissue as much as cautery heat, so they produced less necrotic tissue and were less likely to cause secondary haemorrhage.

Between the two World Wars, many punches and other endoscopic instruments were developed to remove portions of the enlarged prostate. During this time, the development of transurethral surgery proceeded in America

and was not overly popular in Europe or England. In 1918, W.F. Braasch of the Mayo Clinic had a punch like Young's but with a light on the bladder end. Bumpus, also of the Mayo Clinic, added a needle electrode in 1927 and made further improvements 5 years later, all to aid in controlling bleeding. J.R. Caulk of St. Louis in 1921 introduced his punch, which had a sheath resembling Young's. The cutting was by an insulated, plate-like knife, which also acted as a low-energy cautery so that coagulation and removal of tissue could be done at the same time. In all of these instruments, vision was poor, the methods were crude, and they quickly gave way to cutting-loop resectoscopes.

In 1925, Kenneth Walker of London constructed an insulated sheath out of 'Bakelite'; previous sheaths and tubes been made of metal. Cutting was done under vision with the 'cold' knife, and a metal rim at the fenestra permitted using a diathermy current to coagulate bleeders. It had a moderate use in England.

Cutting with high-frequency current was first used by C.W. Collings of New York in 1926. He

had a tube machine, which he called a 'radiotherm.' His procedure was similar to that of Bugbee, but instead of burning away tissue he cut it. When he replaced the tube with a high-frequency spark gap, he found that the cutting power was not diminished but there was very little coagulation. In the same year, Maximilian Stern of New York invented a remarkable new instrument that he named the 'resectoscope' [15]. Outfitted with a tungsten-wire loop that could be moved to and fro with a handle on the outside by a rack and pinion arrangement, obstructing prostatic tissue could be whittled away under direct vision by moving the loop (Fig. 2). Stern's resectoscope was an excellent cutting tool but, like Collings', was deficient in coagulation, and it would have been discarded had it not been for the persistence and electrical expertise of T.M. Davis of Greenville, South Carolina. Davis developed a switch whereby two currents could be used, one undamped for cutting and one damped to stop haemorrhage by coagulation. He also increased the size of the loop and window to permit removal of larger pieces of tissue. The excellent results reported by Davis in 1931 revived TURP.

Inspired by Davis, Joseph F. McCarthy of New York made significant improvements in the resectoscope. In 1932, McCarthy fashioned a lens system that widened the visual field, used a nonconducting Bakelite sheath and separate currents for coagulation and cutting (developed in 1928 by W.T. Bovie). Most importantly, he moved the wire loop and cutting window to the tip of the instrument. The Stern-McCarthy resectoscope, as it became known, was the first practical cutting-loop resectoscope, and TURP emerged as the dominant method used to treat the enlarged prostate for the next 70 years [16].

Transurethral prostatectomy, as we know it today, could not have developed without four landmark inventions: the cystoscope (Nitze, 1877), the first practical incandescent light bulb (Edison, 1878), the fenestrated tube (Young, 1900), and the application of high-frequency electrical current under water (Beer, 1910). In the latter half of the 20th century, more advances, i.e. the Iglesias resectoscope, Hopkins' fibre-optics, video-cameras, laser energy, and others, facilitated many of the methods now used to treat the enlarged prostate.

## DISCARDED SURGICAL METHODS

Besides direct attacks on the gland itself, indirect surgical methods were tried; but were all complete failures. The most intriguing was castration, an idea presented in 1893 by J. William White, Professor of Surgery at the University of Pennsylvania. Because of an apparent similarity between prostatic adenoma and uterine myoma, and that a myoma decreased in size after oophorectomy, he thought that the enlarged prostate might do the same after castration. Many surgeons tried castration, and felt that there was a decrease in the size of the prostate, but besides being drastic, few patients seemed to be relieved. Alfred C. Wood, who had worked with White, also tried vasectomy, and in 1900 reported on 159 collected cases of castration and 193 of vasectomy. He claimed that most patients in both groups benefited, although more by castration than by vasectomy. He also reported a case in which the left vas only was tied, with resulting atrophy of the left lobe of the prostate. That is specific therapy indeed! Samuel Cabot of Boston reported on 99 cases, of which 84% improved after castration. Although surgical castration helped some men, many more were not helped, and after 1904, the operation had disappeared from the literature. These surgeons did not yet realise that the pathophysiology of BPH does not depend on prostate size.

August Bier of Kiel and Willy Meyer of New York in the last decade of the 19th century tried ligating the internal iliac arteries to shrink the gland. H.C. Wyman of Detroit in 1885 reported tenotomy of the puboprostatic ligaments as of some help. C. Heine of Innsbruck tried injections of iodine into the prostate in 1879. Casper tried an electric current in the 1880s with the negative pole inserted in the prostate and the positive pole on the abdomen. R.S. Ferguson used X-rays in 1936. None of these efforts was at all successful.

## THE PRESENT ERA

The transition from the 20th to the 21st century has been accompanied by a revolution in the management of the enlarged prostate. Open operations, and even the time-honoured TURP developed over the past 100 years to relieve urinary obstruction caused by the enlarged prostate gland, have been replaced by newer medical therapies and

innovative, less invasive procedures using laser, heat, and other forms of energy. Urologists and patients can now choose their acronym: TUNA (transurethral needle ablation), TUMT ((transurethral microwave thermotherapy), TULIP (transurethral ultrasound-guided laser-induced prostatectomy), TUIP (transurethral incision of the prostate), TUVP (transurethral electrovaporization of the prostate), TUEP (transurethral evaporation of the prostate), HoLEP (holmium laser enucleation of the prostate), CALRP (computer-assisted transurethral laser resection of the prostate), VLAP (visual laser ablation of the prostate), all attempts to shrink, destroy, modify or somehow modulate the troublesome obstructing prostate and relieve LUTS. But that is another story for another time. Suffice it to say, none of it would have happened without the many discoveries made by many urologists who ingeniously devised new ways and used every means at their disposal to relieve the suffering of countless men over time who were willing to risk all to keep their urine flowing freely.

## CONFLICT OF INTEREST

None declared.

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