A History Of Urologic Endoscopy

By Pat Hanson, R.N.

With the continuing advancement in endoscopy and other urological procedures, there has also been an increasing interest in how it began. It is intriguing to look back at the ingenious efforts of man to look inside his body in order to ascertain the cause of his ailment. Many of the early methods seem quite crude when compared to modern-day instrumentation and we expect that our armamentarium will appear so to future generations.

The known history of urology begins in Egypt. Records have been found dated as early as 3000 B.C. describing symptoms and diagnosis. Pictures from tombs of 1600 B.C. showed a surgeon performing a circumcision—the oldest known surgical procedure. During this time it is known that a leather or bark codpiece was worn over the penis to prevent parasites from entering the urethra and bladder. Dysuria, incontinence, retention, enuresis, vesical calculi, and stones were described. Bamboo reeds, bronze and tin catheters were used to drain the urine, and sounds were employed to relieve obstructions. However, it often has been difficult for archeologists to decide whether tools unearthed were instruments belonging to the medical profession or to the trade of the carpenter.

Each area of the world developed similar instruments. The Chinese used catheters made from hollow leaves; and the Hindus in 1000 B.C. used gold, iron, and wood smeared with gee or lac for dilating the urethra.

The study of the anatomy of kidneys and bladder was first undertaken by Aristotle, but treatment was conservative: diuretics, diet, sitz baths, poultices, and massage. The exceptions were catheterization and “cutting into the lower parts” for removing bladder stones. The latter procedure was accomplished by first manipulating the stone into the orifice of the urethra, and then making an incision large enough to push the stone out.

During the first and second centuries A.D., Alexandrian medicine describes more surgical treatments for fistulae, hypospadias, phimosis, urethral strictures, and tumors of the prepuce. The last great physician of the period was Galen. For treatment of urinary retention, he prescribed the use of an S-shaped catheter, such as have been found in Pompeii.

Uroscopy, visual examination of the urine for color, clarity, consistency, and sediment was widely used during the time of Hellenistic medicine as an attempt to divine what was occurring inside the body, but from the time of Galen until modern times there is little to report in the field of urology. In fact, until the middle ages, urinary disorders were considered to be beneath the dignity of physicians and were left to the care of quacks. It was not until the early 19th century that any major medical advancement was made in this area.

In 1805, Phillip Bozini of Frankfurt, designed and built the first endoscope — the lichtleiter. (Figure 1) This instrument first used wax candles enclosed in a vase-shaped tube made of tin, covered with cardboard and leather. The round opening was divided

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vertically, one side for viewing and the other, for the light source. A mirror was attached to a reflecting conductor to direct the light. Needless to say, this instrument was quite cumbersome and sometimes dangerous due to the candle heat. The light was inadequate, but it was a beginning.

Joseph Gunfeld made a wooden, direct viewing cystoscope which he later developed further by putting a glass window at the end. I imagine that it was quite wet for the physician before this addition. In 1826, Pierre Segalas introduced his urethrocytique speculum which was used to examine the urethra and bladder. Figure 2) He also used candlelight with a tube of highly polished silver for good reflection. The illumination was projected along the shaft by two conical mirrors, between which, two candles were placed. The light was somewhat improved, and the operator wore an eye shield for protection. Singed eyebrows was one of the hazards which confronted the 19th century urologist.

The following year, Dr. John Fisher of Boston invented the Fisher cystoscope. Figure 3) Light was projected through the tube onto a mirror, which directed it into the bladder. The cavity was viewed through a window in the mirror. This instrument also had a system of lenses to sharpen the image, but the light was poor. Drs. Fisher and Segalas had a disagreement regarding who had invented the system first. They were not at all similar in construction, but did use the same principles.

During this period Dr. Antonin Desormeaux earned the title of "the father of cystoscopy". He introduced an indirect method of lighting in 1853 by using a planoconvex lens between the burning alcohol light source and the mirror; thus concentrating the rays of light at the parts of the distal speculum. This mirror also had a central hole for viewing. With this instrument he was able to perform diagnostic procedures and treatment of diseases of the ureters. (Figure 4)

Francis Cruise of Dublin demonstrated his modification which had a more intense light employing a mixture of petrol and camphor. (Figure 5) The light source was placed on the side, whereas Dr. Desormeaux was underneath the scope. Cruise admitted that there were a couple of problems. The instrument became very hot and the light was difficult to adjust because the beam was so narrow. He overcame the heat problem by using mahogany.

About this same time, Julius Brusch, a dentist, got into the picture by trying a different approach to achieve adequate illumination. He used a water-cooled platinum wire brought to white heat electrically. This was then placed in the rectum and the bladder transilluminated. A speculum was inserted transurethrally for viewing the bladder.

Nearly 50 years later, Max Nitze built the forerunner of the modern...
The first double catheterizing scope was designed by Boisseau du Rocher. The sheath and telescope were separate, and an obturator was used to fill in the fenestra when introducing the scope. It was a rather large 27 Charrière.

After Edison invented the electric lamp in 1880, it was first used in a cystoscope system by David Newman of Glasgow in 1883. The glass window at the end was protected by a conical tip which was moved aside by a lever after the instrument had been introduced. The electric lamp was introduced separately alongside the instrument, as were ureteral catheters. Dr. Newman actually performed ureteral catheterization with this device. (Figure 7)

Dr. Howard Kelly used a head lamp with reflected light, patient position, and air to perform successful cystoscopies and ureteral catheterizations. The female patient was placed in a lithotomy position with her thighs drawn up on her chest. The male was placed in the knee chest position thus aiding vision by straightening the urethra.

The development of instrumentation to aid ureteral catheterization continued. Early in the 1890's, Nitze devised a cystoscope in which the beak was moveable, and carried the light. The curved stationary section had a channel through which the catheter was passed. Caspers modification had two prisms, and the catheter passed through a slot in the shaft. In 1897, Joachim Albarran added to the Nitze cystoscope, a deflecting lever which was used to direct the ureteral catheter. At first, this was separate from the scope and clamped on, but in a short time, it was fused to the shaft. The lid was elevated by wires attached to wheels on the viewing end. Luys perfected a direct air vision cystoscope for females in 1904, and for males, in 1905. It had a distal optical system and an internal lamp, but Nitze's cystoscope remained the preferred one.

Cystoscopy equipment, including lithotomy tables, had to be transported to the patient. Porters were hired by physicians to perform this task.

During these same years, bladder separators were being used to collect ureteral specimens. These instruments would partition the bladder to separate the drainage from the right and left ureters. The first effort was produced by Lambotte. It was a double channel catheter with a small rubber balloon. By pulling on a steel rod which was attached to the two catheters, the latter bulged out with the balloon, and created a partition in the bladder. The Luys separator was introduced with a dam in the shaft; by pulling on a chain, the rubber was made taut in the midline between two bladder catheters. (Figure 8) A third type was created by Harris in Chicago. His method was to pass a metal rod into the vagina or rectum, and elevate the rod thus creating a tissue diaphragm to separate the right and left ureters. A suction bulb was then employed to collect urine. These methods were quite successful, but ureteral catheterization was becoming popular.
and as a consequence, bladder separators had a short life.

Bladder stones which were mentioned in ancient history, and had been removed by lithotomy, were now being successfully approached transurethrally. As early as 1625, Sancturoius used a forcep with a stylet. Once in the bladder, the stylet was removed and the arms pressed open in hope of catching the stone and extracting it in the closed three-prong device. Civiale introduced the Trilabe in 1818. (Figure 9) It had three blades to grasp the stone, after which, a rotating burr was advanced. Another style from this era had a screw type drill with a particularly fierce two-bladed model developed for the female. Civiale also developed the lithontripteur which was operated by a bow. Charrier devised a rack and pinion type of lithotrite, and during this period, a sound was used to help to diagnose calculi in the bladder.

There was a great deal of interest in dissolving stones in the bladder. One of the approaches consisted of a pouch in which the stone was enclosed. Then acid was introduced through the hollow handle of the instrument. As an improved alternative, Dr. Henry Bigelow, professor of surgery at Harvard in the late 1880's, constructed a strong lithotrite. He named the operation in which it was used, litholopaxy. This involved the crushing of the stone and the evacuation of the pieces. A mallet was used to shock the stone to fragments once the calculus was firmly grasped in the lithotrite's jaws. The evacuator had a powerful rubber bulb with a glass trap to receive the debris.

All of these early methods often failed to produce a calming effect on the patient. Dr. Benjamin Franklin elected to solve his own problem. When his bladder stones caused obstruction, he floated the stones to the dome of his bladder by standing on his head to urinate.

It was during the late 1880's that Drs. Valentine, Brown, Otis, Cabot, and Alexander went to Reinhold Wappler and induced him to repair their German-made instruments. It was from this need that A.C.M.I. developed, and American-made instruments became available. Dr. Tilden Brown worked closely with Mr. Wappler in the development of his cystoscope and catheterizing mechanism. Modifications were suggested by Dr. Buerger and the Brown-Buerger urethroscope was devised.

Another unusual design was that of the Dourmaskin dilator and cystoscope which had a dilator attached to the sheath that could be elevated at the proximal end of the instrument. (Figure 10)

Hugh Young, one of the great names in urology, contributed much to the development of endoscopic instruments. Mr. Wappler said that "Dr. Hugh Young of the Brady Institute in Baltimore gave specifications which tended to make American products superior to the German make." One of the systems that was used for many years was the Hugh Young Pediatric cystoscope.

Along with the development of transurethral endoscopy, an interest in transurethral surgery appeared. Prior to surgical intervention to relieve enlarged prostates, patients were encouraged to do self-catheterization. As a result, many practical devices were designed for carrying one's catheters and lubricant. In a walking stick and umbrella, the catheters were stored in the shafts and removed via the distal end. (Figure 11) The handles held the lubricant. Antiseptic and aseptic techniques came along much later.
The first transurethral resections of the prostate were done without a lens system, employing a knife punch. This procedure developed slowly and was resisted by many urologists until recent years. The first person to treat vesicle neck obstruction was George J. Guthrie, a British Army Surgeon. In the 1830's he used a small knife projecting beyond the end of a metal catheter. As early as the 16th century, Ambroise Pare had tried to perfect an instrument for this purpose. It consisted of a catheter with a sharp edged dome which could be moved in and out of the catheter. (Figure 12) D'Etoilles used a snare to remove prostatic tissue, and Civiale designed a cutting instrument, the kiotome.

In the middle of the 19th century, several median bar excisors were devised. One by Guthrie and Mercier resembled the lithotrite in design. In 1874, Bottini improved Mercier's median bar excisor, and developed the galvanocautery which looked much like the lithotrite and was powered by galvanic current. It was used to cook the prostatic tissue or anything else caught in it, for this procedure was done blindly. The three modifications of this instrument were made by Fruedenberg, Chetwood, and Wishard. (Figure 13) Fruedenberg tried to insulate the instrument in a better fashion. Then, for fifteen years, Chetwood's modification was used through a perineal incision.

Hugh Hampton Young, the pioneer of modern transurethral technique, appeared on the scene at the beginning of the 20th century. He introduced the knife punch, which could be operated under direct vision. In the earlier instruments, vision was poor since there was no method for keeping the bladder distended, or for flushing the blood from the field. The punch sheath was introduced with an obturator in place. When the obturator was removed, the sheath was manipulated so that prostatic tissue bulged into the fenestra. The excising tube was then inserted, cutting away the protruding tissue. Dr. Young introduced the use of the electrocautery, in conjunction with his punch, by heating the end of the tubular knife. The outer sheath was then water-cooled. Howard Tolson used a diathermy to heat his solid nickel-silver electrode, and thus control bleeding. This was inserted through the Young punch.

Several men modified Young's punch. One of these was William Braash. His adaptation was to use his direct cystoscope, and employ an inner tube for the excision of tissue. He could determine the size of the bite by his choice of three different sized tubes. Irrigation was used, so visualization was possible during the procedure. Bleeding was still uncontrolled. In 1920, John Cauk modified the Young punch, installing an iridio-platinum cutting edge on the knife which could be heated to cauterize the median bar. In 1933, he added the foroblique telescope to the instrument. While Cauk was introducing the use of heat, Herman Bumpus, at the Mayo Clinic, was advancing his use of the cold punch. It differed from the Braash, in that he cut a fenestra in the Braash cystoscope sheath rather than to use a second sheath. This instrument was called the Braash-Bumpus punch. He also employed the Bugbee electrode to control bleeding.

In 1931, Robert Day introduced the first instrument that cut toward the surgeon. It was able to resect larger amounts of tissue. This system had a lensed telescope, but vision was poor, and the control of bleeding inaccurate. Gershom Thompson improved upon...
these instruments, and incorporated the coagulating electrode and cutting blade into one unit in which irrigation was channeled through the knife. It is hooked to a large suction bottle in which fluid and tissue chips are collected. The Thompson punch is still popular today in some areas. (Figure 14)

In 1928, F.E. Foley introduced his endothermal cystoscopic prostatic incisor. It was shaped like a sound, and had a piano wire electrode mounted on the tip where it could be pulled taut like a bowstring. When the apparatus was rotated, it would make conical excisions. The pieces then had to be cut into smaller fragments so that they could be evacuated. After McCarthy added his foroblique telescope to the Hugh Young punch, Foley developed a punch which he further modified by including a pneumatic piston and cylinder of carbon dioxide. The tank of carbon dioxide connected through a pressure tube and activated the resector. Power was being used to move the punch blade. The cut tissue was ejected into the bladder. The button on the trigger controlled the movement of the punch which started slowly and gained force as it progressed. Theoretically, the speed could be controlled by manipulating the trigger, but, in fact, this was not always so. After the resection was complete, an electrode loop was attached to the rack and pinion to coagulate bleeders.

Dr. Kirwin introduced a vesicle neck resector which was designed for resection of the middle lobe, strictures of the bladder neck, and other obstructions. (Figure 15) It was also used for removing excess tissue after a prostatetomy, and had coagulation, irrigation, and visualization. He continued to improve his instrument by developing the Kirwin rotary resector, in which the loop was rotated by hand. It was mounted on the side, and the loop was eccentric to the mounting. Even though the sheath was a #28 Fr., the working size was approximately #32 Fr. It had a system of small bevel gears for the rotating motion of the electrode. Neither instrument was fated for much popularity amongst urologists because, during this same period, between 1926 and 1932 Maximilian Stern invented the resectoscope. His median bar excisor was illuminated with an incandescent telescope; and a tungsten wire loop was moved through the tissue via a pinion and ratchet traveling block. Due to electrical current defects, this mechanism fell short of Stern's hopes. T.M. Davis modified this device to include a larger sheath and a more efficient loop. From this instrument, the Stern-McCarthy working element was developed. It was from this point that we have progressed to presently used resectoscopes.

The history of endoscopy includes many colorful stories, and among its pioneers are numbered many dynamic men.

REFERENCES

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