IJUH

Fall 2025
Volume V
Number i

International Journal of Urologic History

- Leo Buerger and the revolutionary Brown-Buerger Cystoscope
- Urology as a specialty: birth and innovation
- *Taqaandan*: the controversary of cultural practices
- Urinary botanopharmacology by native North Americans
- The rectal neobladder at its centennary

PRAETERITUM DOCET

'The past teaches'

On the Cover

Henry II (973–1024), Holy Roman Emperor and the only German medieval saint, was known for consolidating imperial authority while maintaining profound personal piety. He and his wife, Cunigunde (c975-1040), reportedly lived in celibacy, and after his death she became a devout nun, underscoring the couple's exemplary sanctity. The Bamberger Cathedral, which Henry himself founded and is now a UNESCO World Heritage site, houses a remarkable, late Gothic sculpture by Tilman Riemenschneider (c.1460–1531) of Henry II undergoing lithotomy. Unlike many medieval depictions of the procedure, requiring a forceably strapped patient and muscular assistants, the emperor's surgeon appears to have removed the stone effortlessly, without an incision, and gives the stone the emperor. To the side, a page or assistant sleeps, a subtle, humorous touch that highlights the artist's attention to human realism even within a miraculous scene. Contemporary sources from Monte Cassino suggest Henry, who had been suffering from considerable pain, may have passed the stone naturally, framing the event as a miracle. The sculpture's placement in the cathedral highlights both the sacred and political dimensions of Henry's life: it celebrates his personal holiness, commemorates his role as founder, and blends human vulnerability with miraculous intervention, all rendered in Riemenschneider's signature realism and emotional intensity.

1.Rennie KR. The Destruction and Recovery of Monte Cassino, 529-1964. Oxford: Taylor & Francis, 2021. p 47.
2. *Tilman Riemenschneider: Werke seiner Blütezeit.* Mainfränkisches Museum Würzburg, Museum am Dom Würzburg: Schnell & Steiner, 2004.

The International Journal of Urologic History (IJUH) (ISSN 2769-2183) is published electronically twice yearly. For article submission instructions, please visit www.ijuh.org

The International Journal of Urologic History

The Physician, Gérard Dou (1613-75)

Gérard Dou was Rembrandt's oldest pupil in the Dutch 'Golden Age' and worked in and around Leiden. Known for his richly detailed portrayels of daily life, he created works that adapted to small interior spaces of 'niches' and gave the illusion of 3-D known as trompe-l'œil. Here, a physician performs the age-old art of uroscopy, a a respected ritual in its time, though of dubious medical worth (Source: Museum of Art, Vienna)

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IJUH
The International Journal of
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Foreward

The 'Voynich' manuscript is one of history's most mysterious and has been the subject of scholarly debate for centuries since its discovery in 1912. The book, a work of 240 pages of vellum, is now digitally available through the Beineke, has been carbon dated to the 1400s, and appears to be a treatise on medically important herbs, with a focus on female health.(1) Its text, however, in a neat, well organized but novel lettering system, is of a completely unknown and possibly even encrypted language. Hundreds of theories by generations of linguists, historians, and sleuths have failed to decipher the codex, has generated an academic community of veritable 'Voynichists', and was even the basis of an international conference held in Malta in 2022.(2) Professional historians have relied on computational statistics, probability mechanics, and machine learning to develop what is essentially a new lexicon, the original intent of which remains unknown, and which still precludes anyone from 'reading' the book, or, as has been said, "making any sense out of it at all".(3) One interpretation is that authors' hope was to protect the somewhat sensitive gynecologic subject matter, the role of bathing, devices, herbs, and the zodiac.(4) Our own interpretation was that at least one of the ornate 'baths' in the text may have invoked a bladder and a colon (see Figure below) in a discussion of their health.

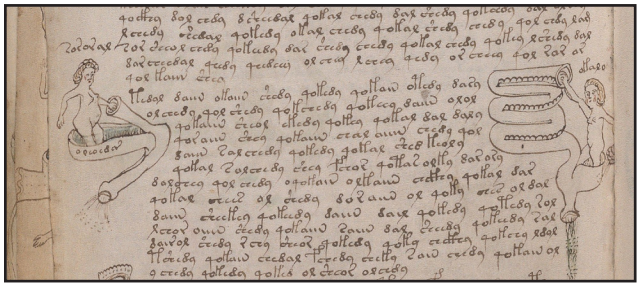

Figure 1. Selection of the 'Voynich' manuscript, Beineke Ms. 408, f77(L), depicting what are likely homages to the bladder (left) and colon (right) in a section on pelvic gynecologic health in a medieval but unknown and undecipherable language.

History is only for the brave and its puzzles may remain maddingly distant even with the most sophisticated of tools. Thus, this issue of *IJUH* presents five articles which share the unenviable task of elucidating some of the important stories that shape our modern era. Rubano et al. provide details of the botanical medications North American peoples used to treat urinary disorders, not dissimilar to what was probably intended by the 'Voynich' for a medieval European population.(5) Jungano et al. introduce the innovative surgeons who used the rectum for urinary diversion 100 years before the invention of durable urinary stoma appliances.(6) Smith et al. peel back the mysteries surrounding the first modern so-called Brown-Buerger cystoscope and Gudell et al. reveal to us that the development of urology as a separate specialty was a veritable battle of wills and wits.(7,8) Cultural mysteries, including the practice of Taqaandan described by Parmar et al., seem strange, even injurious, yet deserve the same open-minded framing required by the consummate historian.(9)

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Taqaandan through the Ages: Social Taboos, Puritanical Religions and 'Cracking' the Penis

Kalpesh Parmar[1], Antonin Prouza[2], Anshu Jha[2], Ali Reza Vosough[2], Aditya Manjunath[2], Odunayo Kalejaiye[2], Bhaskar Somani[3], Joe Philip[2,4,*]

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Introduction: *Taqaandan* (Kurdish: "to click") is a culturally rooted practice observed in Western Iran, involves the intentional cracking of an erect penis. Taqaandan stems from restrictive sociocultural norms and misconceptions about its benefits, often perpetuated by a lack of sexual education. Historically, penile fractures were first documented by 10th-century physician Albucasis. This study examines its historical, cultural, and clinical implications through five cases presented at a regional medical center

Sources and Methods: Patients with a history of penile and trauma were evaluated in the clinic following engagement in Taqaandan. Clinical examination, imaging, and patient history were used to assess the impact of this practice. MRI findings, combined with clinical symptoms, informed the management strategy. We used primary and secondary sources to research further the history of Taqaandan.

Results: A total of five patients a mean of 24.6 (18-29) years presented with penile pain, bruising, and swelling. Four (80%) reported the characteristic "pop" sound indicative of partial tunica albuginea rupture. MRI findings revealed localized edema or partial defects without evidence of complete fractures or urethral injury. Conservative management, including rest, non-steroidal anti-inflammatory drugs (NSAIDs), and follow-up, proved effective, with no long-term complications reported.

Conclusions: This study underscores the need for culturally sensitive health education to address myths surrounding Taqaandan, reducing its prevalence and risks. While no surgical intervention was required in these cases, the practice highlights the sociocultural stigma surrounding sexual arousal. Further research is essential to quantify its global impact and develop preventative strategies.

Key Words: Andrology; Taqaandan; History; penile fracture; penile clicking; Sexual health education

Conflict of Interest (COI) Disclosures: no disclosures were reported

Ethics Statement: This study received a waiver from the UK Medical Research Council (MRC) regulatory support centre and the UK National Health Service Health research authority (HRA)

Taqaandan (Kurdish: "to click") represents a culturally embedded yet medically significant practice where an individual deliberately "cracks" an erect penis. Unlike accidental injuries caused by external trauma or forceful intercourse, *Taqaandan* is self-induced, characterized by intentional bending or manipulation of the penile shaft until an audible popping sound is heard [1]. This peculiar phenomenon has been predominantly observed in the Kermanshah province of Iran, a region rich in cultural traditions and deeply influenced by religious values. Understanding Taqaandan requires exploring its interplay with societal taboos, cultural perceptions of sexuality, and historical narratives [2].

Historically, the condition of penile fracture has intrigued physicians and historians alike. The earliest accounts of penile injuries are attributed to Abu al-Qasim al-Zahrawi (known in the West as Albucasis), a 10th-century Islamic

physician from Cordoba, Spain. In his comprehensive medical treatise Al-Tasrif, Albucasis described penile injuries, offering innovative management techniques, such as the use of a goose's neck as a splint to stabilize fractures. These accounts demonstrate that the condition, while rare, has been recognized and treated for centuries [3].

The sociocultural context of Taqaandan, however, distinguishes it from other causes of penile trauma. In puritanical societies, where discussions about sexual health are often considered taboo, individuals may resort to unconventional or risky behaviours to manage their sexuality. The practice of Taqaandan is believed to have emerged as a response to societal pressures and restrictive attitudes toward erections outside of marriage [4,5]. In many traditional settings, arousal is stigmatized, creating a need for discreet methods of detumescence or coping mechanisms for sexual frustration.

The motivations behind Taqaandan are diverse. Some individuals perform it as a learned habit passed down from peers, while others believe it to have physiological benefits, such as increasing penile size or improving sexual performance. These misconceptions, coupled with the lack of accessible sexual education, contribute to the persistence of this practice. Despite its cultural roots, Taqaandan has significant medical implications, with a substantial proportion of penile fractures in Western Iran attributed to this behaviour [4].

This study seeks to provide a comprehensive exploration of Taqaandan, delving into its historical origins, cultural significance, and clinical impact. By examining case reports and available literature, the aim is to shed light on this underreported phenomenon and its implications for healthcare providers, particularly in regions with similar sociocultural dynamics

SOURCES AND METHODS

Study Design and Case Selection

This research adopted a retrospective design, analysing five cases of Taqaandan-related injuries presenting to a regional medical center. Patients were selected based on their history of self-induced penile trauma, corroborated by clinical findings and imaging studies. The inclusion criteria required clear documentation of Taqaandan as the precipitating event, while cases involving accidental or intercourse-related fractures were excluded.

Ethics Review

The UK Medical Research Council (MRC) regulatory support centre and the UK National Health Service Health research authority (HRA) developed research ethics committee decision tool confirms that ethics

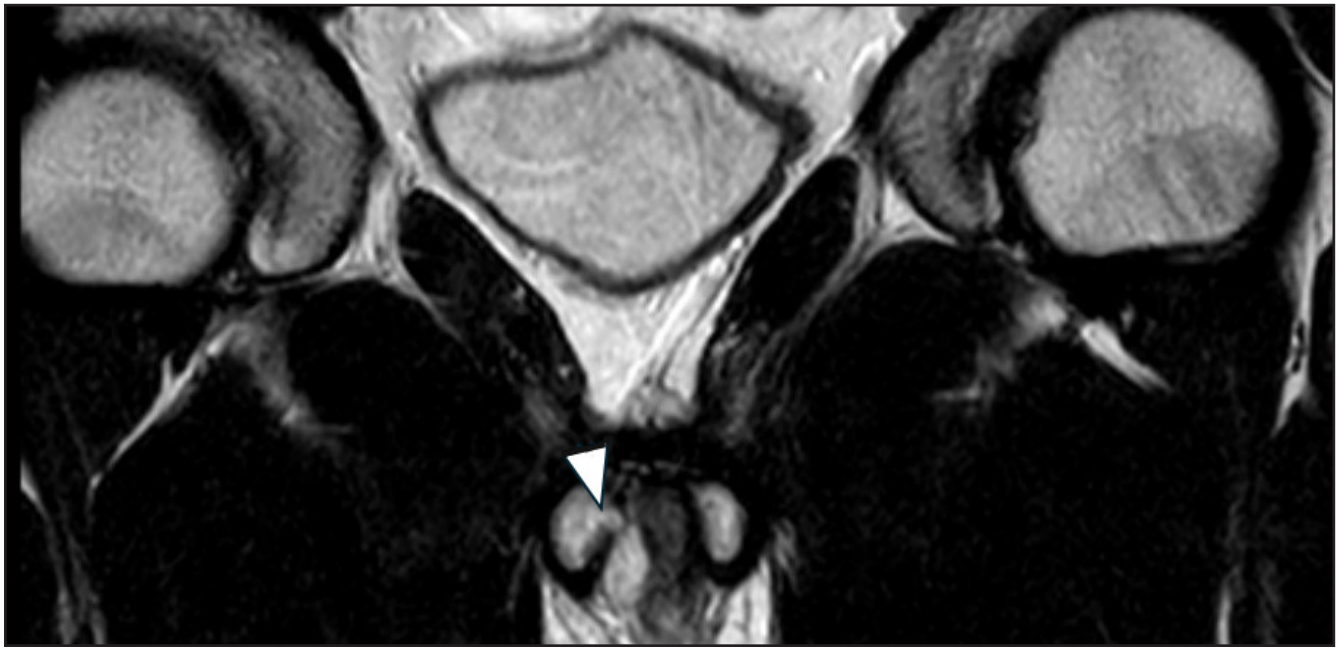

Figure 1. Coronal T2 weighted MRI image of the penis shows a small defect in the tunica albuginea of the right corpus cavernosum at 2 o'clock position near the base of the penis (white arrowhead). Please note the loss of continuity of the tunica albuginea.

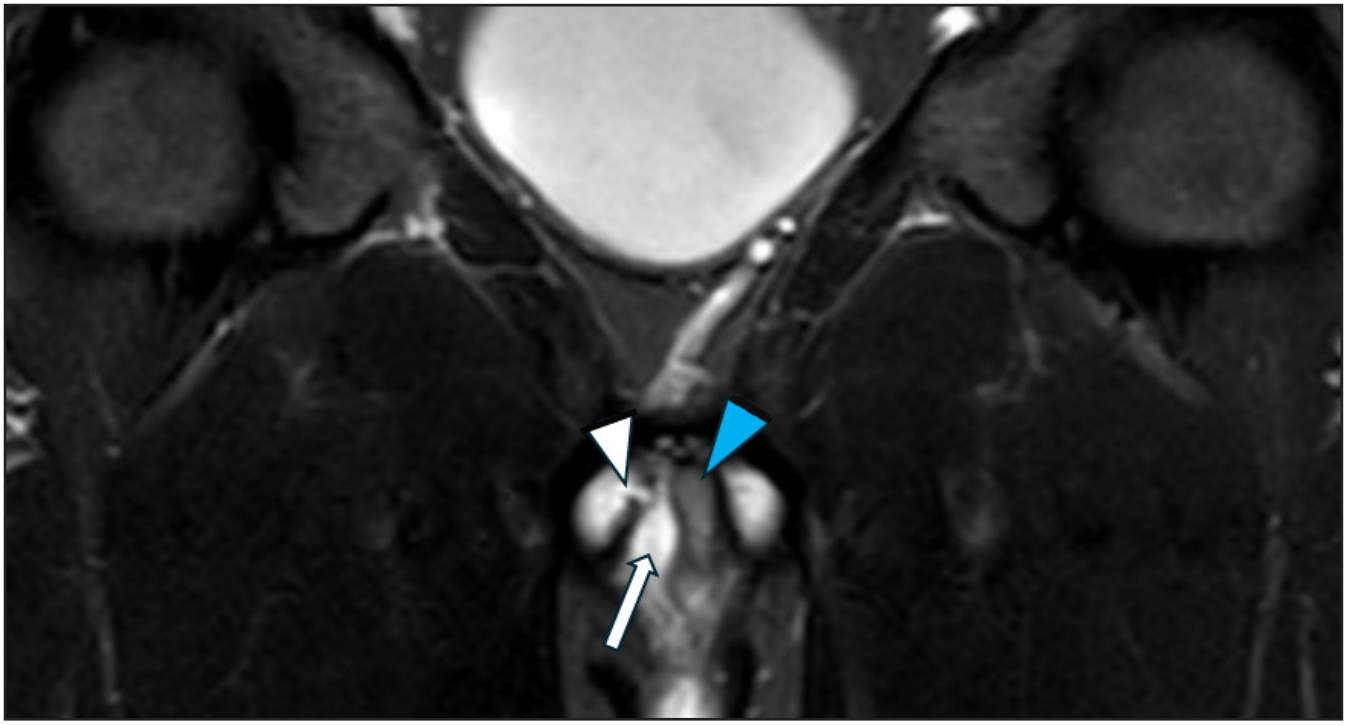

Figure 2. Coronal Short Tau Inversion Recovery (STIR) sequence MRI image of the base of the penis at the same position as on image 1, shows the small defect in tunica albuginea as an outpouching at the superomedial aspect of the right corpus cavernosum (white arrowhead). For better appreciation compare it with the normal looking left corpus cavernosum. The asymmetrical biconvex bright focus on the right (white arrow) is the associated haematoma and oedema which has mildly deviated the corpus spongiosum (blue arrowhead) to the left.

review was not needed for this work.

Literature review

To contextualize the findings, an extensive literature review was conducted using medical and non-medical databases, including PubMed, MEDLINE, EMBASE, and Scopus. Keywords such as "penile fracture," "self-induced penile trauma," and "Taqaandan" were utilized to identify relevant studies. Additionally, historical texts, including Albucasis's Al-Tasrif, were consulted to trace the documentation of penile fractures over time.

Searches were expanded to include online resources (Google, Yahoo, Bing) and non-academic databases to capture grey literature and anecdotal reports. The review included studies published in English and Persian to account for regional research. A qualitative synthesis of findings was performed, with particular attention to cultural and sociological factors influencing the practice of Taqaandan.

Data Analysis

The clinical characteristics, imaging findings, and outcomes of the five patients were analysed descriptively. Comparisons were made with existing case series to identify patterns and deviations in presentation and management. The literature review findings were integrated to provide a broader perspective on the phenomenon, highlighting gaps in research and opportunities for intervention.

RESULTS

The five male patients with a mean age of 24.6 years (range: 18-29 years), presented with varying degrees of penile bruising and discomfort after engaging in Taqaandan, a practice involving intentional cracking of the penis. This was not uniform with penile dorsal twisting action, torquing and others a compression action to effect detumescence. The symptoms reported by all patients included mild to moderate penile pain, localized swelling, and bruising. Four of the five patients described the characteristic audible "pop" at the time

of injury, suggestive of tunica albuginea rupture. Despite this, none of the patients exhibited significant penile curvature, deformity, or signs of urethral involvement upon examination.

Magnetic resonance imaging (MRI) played a crucial role in diagnosing and evaluating the extent of the injuries. MRI of the penis was performed without IV Contrast. This was done withing 24 hours of the injury and soon after presentation to the emergency department/ urology.

One patient demonstrated a focal defect in the tunica albuginea consistent with a partial rupture, while the remaining four cases showed only localized edema without evidence of complete tears [Figure 1,2]. The imaging findings aligned with the clinical presentation and indicated injuries that were more consistent with minor trauma rather than the more severe penile fractures.

Management in all cases was conservative, emphasizing rest, pain relief, and follow-up. Patients were advised to avoid any activities that could strain the healing tissues, including sexual activity or manual manipulation. NSAIDs were prescribed to reduce inflammation and alleviate pain. Regular follow-up visits ensured that healing progressed without complications and that there were no emerging concerns such as fibrosis or erectile dysfunction.

The outcomes were universally positive. All patients experienced resolution of pain and swelling within two to three weeks. None required surgical intervention, as the injuries were self-limiting with appropriate conservative care. Long-term follow-up at three and six months confirmed the absence of penile deformities, functional impairment, or other complications, highlighting the success of non-invasive management in these cases

DISCUSSION

The literature corroborates the association between Taqaandan and penile fractures, particularly in regions with restrictive sexual norms. A landmark study by Zargooshi in 2000 identified Taqaandan as the leading cause of penile fractures in Kermanshah, accounting for 75% of cases [5]. Similar patterns were observed in smaller studies and anecdotal reports from neighbouring areas [6-8]. Cultural and psychological factors emerged as significant contributors to the persistence of Taqaandan. In many cases, the practice was learned during adolescence, perpetuated by myths about penile anatomy and function. The lack of sexual education and open dialogue about sexual health further reinforced these misconceptions.

The practice of Taqaandan cannot be understood in isolation from its cultural and historical backdrop. In traditional societies where sexual expression is tightly regulated, behaviours like Taqaandan serve as coping mechanisms for managing sexual arousal or frustration. The origins of this practice likely stem from societal pressures to suppress erections, viewed as sinful or shameful outside the marital context [9].

The influence of Zoroastrianism and later Islam on Persian culture underscores the role of religion in shaping attitudes toward sexuality. Zoroastrian teachings emphasized purity and self-discipline, while Islamic jurisprudence further codified sexual morality, prohibiting premarital or extramarital sexual activity. These doctrines, while promoting chastity, inadvertently contributed to the stigmatization of natural sexual urges, fostering behaviours like Taqaandan [10].

The medical consequences of Taqaandan, though often mild, can be severe in cases of complete tunica albuginea rupture. Penile fractures typically present with pain, hematoma, and deformity, requiring prompt diagnosis and intervention. Delayed treatment can result in complications such as erectile dysfunction, penile curvature, and psychological distress [11].

In the present case series, conservative management was successful, reflecting the partial nature of the injuries. However, the reliance on self-reported history and the absence of urethral injury or severe curvature may have contributed to this favourable outcome. This highlights the importance of imaging, particularly MRI, in diagnosing subtle or atypical cases.

Taqaandan is perpetuated by a combination of cultural, psychological, and educational factors. The practice is often learned during adolescence, a critical period for developing sexual habits and beliefs. In the absence of accurate information, myths about the benefits of Taqaandan, such as enhancing penile length or relieving discomfort, become entrenched [12].

The psychological dimension of Taqaandan is also significant. In conservative societies, guilt and shame associated with sexual arousal can lead to maladaptive coping mechanisms. Taqaandan, by providing a temporary sense of control or relief, may serve as a psychological crutch. This underscores the need for culturally sensitive interventions that address the underlying emotional and educational gaps.

While Taqaandan is predominantly reported in Iran, similar behaviours have been documented in other cultures. For example, self-inflicted penile fractures have been reported in South Asian and Middle Eastern countries, often linked to misconceptions about penile

anatomy or function. A case series by Ansari et al identified cultural and geographic factors as key determinants of self-induced injuries, highlighting the universal impact of sexual taboos [13].

Penile fractures in Kermanshah are notably more prevalent compared to other regions in Iran, with incidence rates ranging from 3.1 to 39 cases per year, and approximately 75% of these cases attributed to the practice of Taqaandan. This disparity can largely be explained by widespread misinformation regarding the structural properties of penile tissue, as many individuals mistakenly believe the penis to be cartilaginous. Over the last three decades, the increasing migration patterns and the proliferation of social media content showcasing this practice have contributed to its continued occurrence, despite awareness campaigns [14].
Clinicians should maintain a high index of suspicion for Taqaandan-related fractures in cases presenting with abnormal penile injuries and an associated clinical history. Prompt diagnosis is essential, as early management with conservative measures can prevent complications. In addition to treatment, patient counselling is critical, emphasizing the futility of the technique and addressing myths surrounding penile anatomy and sexual health. Educational initiatives can help correct misunderstandings about the risks associated with Taqaandan and foster healthier attitudes toward sexual norms, thereby reducing the prevalence of this harmful practice [15].

The global prevalence of Taqaandan-like practices remains unknown, reflecting the challenges of studying sensitive topics. However, the underlying sociocultural dynamics are not unique to Iran, suggesting that lessons learned from addressing Taqaandan could be applied to other contexts.

The high prevalence of Taqaandan-related injuries in certain regions calls for targeted public health initiatives. Sexual education programs tailored to local cultural and religious norms could play a pivotal role in dispelling myths and promoting healthier behaviours. Healthcare providers should be trained to recognize and manage Taqaandan-related injuries, using a non-judgmental approach to build trust and encourage open dialogue.

In clinical practice, a thorough history and physical examination are essential for diagnosing Taqaandan-related injuries. Imaging, particularly MRI, should be considered in cases of diagnostic uncertainty. In penile MRI for patients especially with suspected injury, the STIR (Short-TI Inversion Recovery) sequence would be useful. The primary benefit with this sequence is to suppress fat signals, which improves the detection of pathologies like tumours, hematomas (bruises), or oedema (swelling) by making them stand out against the darker background of fat as bright (i.e. white) entities in the image

CONCLUSION

Taqaandan exemplifies the complex interplay between culture, religion, and medicine. Rooted in centuries-old societal norms, this practice persists as a response to restrictive attitudes toward sexuality. While often dismissed as a benign habit, Taqaandan carries significant medical and psychological implications, necessitating a multifaceted approach to prevention and management. Western hemisphere clinicians should be aware of these practices which mimic penile fractures and not always necessitating surgical intervention.

By addressing the cultural discussion around this phenomenon is vital for reducing the associated medical risks and breaking down the social taboos that contribute to its persistence. Further research is needed to quantify its prevalence, understand its psychological underpinnings, and develop culturally sensitive educational interventions. Ultimately, the story of Taqaandan underscores the importance of addressing the intersection of culture, health, and sexuality, ensuring that individuals have access to accurate information and safe practices.

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DISCLOSURES

The authors received no funding for the preparation or submission of this manuscript.

DECLARATION OF COMPETING INTEREST

The authors declare that there are no competing interests. All contributions were made in good faith and without external influence beyond those acknowledged in the manuscript.

STATEMENT ON USE OF GENERATIVE ARTIFICIAL INTELLIGENCE

The authors affirm that no generative artificial intelligence (AI) tools (e.g., large-language models) were used in the writing, analysis, or figure preparation for this manuscript.

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Rediscovering Leo Buerger: The Unwritten Legacy Behind the Brown-Buerger Cystoscope

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Introduction: Few instruments are as strongly associated with the urologist than the cystoscope. Its development over 400 years to the modern instrument reflects many innovators but the contribution of Leo Buerger, the early 20th century American urologist, cannot be understated. The Brown-Buerger cystoscope was the first American-made cystoscope, was widely adopted throughout the US by 1910, and established itself as the standard instrument in urologic practice, to the extent that Hugh Hampton Young remarked that there was little need for further refinement. Little is known, however, of Leo Buerger himself, from his rise to prominence, to his untimely death in a Manhattan hotel room. Our objective was to fully describe Leo Buerger and how his contributions revolutionized urology.

Sources and Methods: We used historical materials derived from PubMed and Google Scholar; the archives of the William P. Didusch Center for Urologic History, and the archives of the City College of New York, municipal archives, and historical newspapers.

Results: Designed by Leo Buerger and manufactured by Wappler Electric Company, the Buerger cystoscope integrated many prior innovations into what would be recognized by today's urologist as a modern equivalent and included a catheterizing channel, mirrored lenses, and an irrigating system. Buerger himself, growing up as a European émigré in late 20th century New York, rose to educational prominence in city schools where he was a classmate and friend of Upton Sinclair Jr, trained at Mt Sinai in New York and in Breslau, Germany, and then practiced in the medical wards of Manhattan which served the indigent poor and wealthy alike. His observations of obliterating vascular disease in smokers became known as Buerger's Disease. His personality was abrasive and a urologic career in California and a real estate enterprise in Manhattan proved unsuccessful. He died in his apartments at the Sherry-Netherland Hotel at the age of 64 in 1943.

Conclusions: Leo Buerger's revolutionary innovations in instrumentation produced the Brown-Buerger cystoscope which has been the field's 'work horse' for a century. His personal life was less successful, was sued for divorce, struggled with antisemitism, and grappled with financial failure, and loss. The Brown-Buerger cystoscope, however, remains a coveted prize for the winner of the annual history essay competition of the American Urological Association.

Key Words: Leo Buerger, Frederick Tilden Brown, cystoscopy,

Leo Buerger, the New York urologist, wrote of the cystoscope in 1933 that "in no other domain is the progress of the art and science of medicine so intimately linked and dependent upon the use of a diagnostic optical instrument, as in the field of urology. The accurate visualization of the bladder interior and the precise execution of maneuvers therein are fundamental achievements; indeed, they are a *sine qua non* for both diagnosis and therapy."(1)

The cystoscope set urology apart from other surgical specialties and is often regarded as the field's foundational instrument. Its development—shaped by urologists, engineers, and entrepreneurs—illustrates a rich history of innovation, collaboration, and competition. Among its most influential iterations was the Brown-Buerger cystoscope, developed by Frederic Tilden Brown (1853–1910) and Leo Buerger (1879–1943), which became central to diagnosis, treatment, and surgical education for decades. While Brown was celebrated in his time, Buerger's contributions have

https://doi.org/10.53101/IJUH.5.1.003
Vol. V (i), pp 8-18, Fall 2025
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received far less recognition. Our aim was to identify unpublished and primary source materials that would better trace the evolution of the cystoscope with a particular focus on Buerger's career, his contributions, and legacy.

SOURCES AND METHODS

We used systematic searches of medical and scientific literature using PubMed, Google Scholar, and the archives of the William P. Didusch Center for Urologic History (Linthicum Heights, MD), the New York Public Library (digitalcollections.nypl.org), Museum of the City of New York (collections.mcny.org), the Lillian and Clarence de la Chapelle Medical Archives at New York University (archives.med.nyu.edu), and the Archives and Special Collections of the City College of New York (library.ccny.cuny.edu). These platforms facilitated access to primary and secondary sources, including peer-reviewed publications, historical manuscripts, and institutional archives. Additional materials were gathered through the U.S. Patent and Trademark Office, digital newspaper archives, relevant monographs, and the Vital Records of the city of New York (www.nyc.gov/site/doh/services/birth-death-records.page), the state of Maine (https://www.maine.gov/dhhs/mecdc/vital-records), and Bayview Cemetary, Jersey City, NJ.

RESULTS

Early Cystoscopic Timeline

The Hippocratic Oath forbade lithotomy—derived from *lithos* (*Gk*: "stone") and *tomos* (*Gk*: "to cut")—a restriction often seen as an acknowledgment of medicine's limitations.(2) By the 1st century C.E., Aulus Cornelius Celsus described lithotomy as frequently fatal, citing complications like high fever, urinary fistulas, and severe inflammation. At the time, surgery was left to "practicing men," a separate class not bound by the Oath. Over time, these specialists evolved into the first urologists. Seeking safer access to genitourinary structures, early urologists turned to endoscopy to avoid complications like fistula, hemorrhage, and death. The cystoscope revolutionized the field by enabling internal examination and treatment through natural orifices. At the first meeting of the Urology Section of the San Francisco County Medical Society, Martin Krotoszyner (1861-1918) declared, "The history of urology is best divided into two parts: the pre-cystoscopic and the cystoscopic era."(3) The cystoscope lineage reflects decades of scientific debate, technological innovation, and professional rivalry.

The development of cystoscopy is well known and has been traced back to Philipp Bozzini (1773-1809) of Frankfurt's *lichtleiter* (*Ger:* "light conductor") in 1806, representing the first use of reflected light as an illumination source.(4) Comprised of a sharkskin-covered metal chimney housing a candle and mirror for reflection, its initial intended use was to find bullets lodged in his patients.(5) Antoine Desormeaux (1815-1882) of Paris was the first to perform a true endoscopic procedure in 1853, using a long metal channel with a mirror reflecting a petroleum-fueled lamp.(4) He was first to recognize the benefit of lenses to condense light allowing for more sophisticated visualization. (6) However, both instruments were afflicted with the same drawback—they became intolerably hot during use. Maximilian Carl-Friedrich Nitze (1848-1906) of Berlin pioneered the first modern endoscope in 1878 allowing for the systematic treatment of bladder tumors and calculi.(5) Nitze collaborated with an optician, an instrument maker, and a dentist to create a 7 mm prismed telescopic lens with two large horns near the eyepiece to facilitate inflow and outflow of water to cool the tungsten wire.(7) The electrician Charles Preston and urologist Henry Koch (1851-1915) of Rochester, NY developed a low-amperage, but short-lived 'mignon' light bulb small enough to fit into the tip of the cystoscope between 1896-1899, allowing for true illumination of the bladder. The instrument maker Reinhold H. Wappler (1870-1933) emigrated from Germany to New York and in 1890 set about creating the Wappler Electric Company to manufacture an 'American' cystoscope, later becoming the American Cystoscope Makers Incorporated (ACMI). He once lamented about the state of current cystoscopic technology. "In a most deplorable state were the Genito-urinary specialists; they depended for diagnosis on instruments brought over from Germany and Austria. Those instruments were very delicate and of many mechanical defects—they were mostly on the way for repairs."(8) Seeking his own advancements to the frenzied developmental cycle of creation and improvement, New York urologist Frederic Tilden Brown (1853-1910) partnered with Wappler to create the "Composite Sheath" cystoscope (1901). It built upon Boisseau du Rocher's 27 French "Megaloscope" of 1895, the first double-catheterizing cystoscope.(9) Brown's elegant set of instruments boasted several telescopes for visualization including a direct and right-angle view. Obturators were used for instrument placement and later exchanged for a lens system during use.(10) It also earned the ire of du Rocher himself, who claimed infringement. The next major contribution to the Brown cystoscope, and from

which emerged the instrument that revolutionized the field, was from New Yorker Leo Buerger.

Leo Buerger: service and innovation

Leo Buerger (1879–1943) received little positive recognition during his lifetime and remains absent from major medical biographies.(11) Born to a Jewish family in Vienna, he immigrated to New York as an infant and grew up on the lower East Side. He attended the City College of New York (CCNY) at 23rd Street and Lexington Avenue. He was an outstanding mandolin player, becoming the leader of the school orchestra. He was in the Chess Club, the "Sound Money League", and with his classmate, future writer Upton B. Sinclair Jr (1878-1968), participated in the debate and writing club, the Clionian Society Literary (Figure 1). They both graduated in 1897. Buerger then attended medical school at Columbia University, interned at Lenox Hill Hospital (1901–1904), and became an assistant pathologist at Mount Sinai Hospital in 1904 (Figure 2, left). Aspiring to a surgical career, he volunteered at the Breslau Surgical Clinic in Germany (1905–1906) and then then returned to Mount Sinai as an associate in general pathology. (12) He did not receive a surgical appointment until 1914. Mount Sinai—originally founded as the "Jews' Hospital", included the (Har) Mount Moriah facility in the lower East Side where Buerger held a post—played a pivotal role in caring for immigrant communities yet was often regarded as second-tier by the broader medical establishment.(13,14)

F. Tilden Brown: A "Bold and Enterprising Nature"

In contrast to Buerger's recent immigrant background, fellow New York urologist Frederic Tilden Brown (1853–1910), descended from a Mayflower settlers, and was a member of the Sons of the Revolution and Society of Colonial War. He was a graduate of the 1880 College of Physicians and Surgeons a few years before Buerger, was a member of the American Medical Association and the Greater New York Medical Association, and he enjoyed

Figure 1. The Clionian Literary Socieyt of the City College of New York (CCNY), 1897, where both Buerger, front row, left, and future 'Muckraker', the author Upton Sinclair Jr., (second row, second from left) were friends and members. (Courtesy CCNY Special Collections and Archives)

Figure 2. (Left) Leo Buerger at the time of his medical school studies at New York Univeristy (courtesy Lillian and Clarence de la Chapelle Medical Archives at New York University). (Right) F Tilden Brown (front row, right(with the surgical staff of Presbyterian Hospital, c 1903, a few years prior to the development of the Buerger-Brown cysoscope.(Courtesy of the New York Academy of Medicine Library) Brown, a staple of the NY Academy of Medicine and Manhattan's medical elite, portrayed a different projectory than Buerger's as a 1st generation Austrian immigrant practicing in the lower East Side. Neither had propitious ends. In 1910, Brown suddenly left New York for Bethel Maine, where he died of suicide.(15) Buerger died in a hotel room in 1943 and is buried in an unmarked grave in New Jersey.(12)

the privileges of the Rockaway Hunt, Riding, and Garden City Golf Clubs.(15) Like his father, he was inducted into the NY Academy of Medicine and was described as having "a bold and enterprising nature."(16) Counted among the inner circle of the urologic elite like FC Valentine, EL Keyes, and FN Otis, Brown was a regular at the Academy on 5th Avenue, where his frequent addresses earned acclaim. His prominent surgical appointments at Presbyterian, Nassau, and Bellevue Hospitals, where he also taught genitourinary diseases, reinforced his stature (Figure 2 right). Kelly's Dictionary of American Medical Biography called him "one of the conspicuous landmarks in his specialty".(17) Among the nouveau riche of Manhattan's Gilded Age, the New York Times' made sure to print the details of his grandson's wedding.(18)

The Brown-Buerger Correspondences

Buerger began developing his version of the cystoscope in 1906 and, on October 8, 1908, he wrote to Brown seeking feedback on his forthcoming paper, "A New Indirect Irrigating Observation and Double Catheterization Cystoscope."(19) At times terse if not dismissive, Brown's reply would have seemed an unlikely basis for a partnership.

"Please do not think that I mean to retract my enthusiastic congratulations over your unmistakable achievement in so assembling and proportioning the features and details of the Composite Cystoscope and the Otis-Brown Cystoscope, in the slightest degree; but only to urge a perfectly just maintenance and balance of the history of Cystoscopy by calling your attention to the fact any one reading, or learning your paper, as at present expressed, would be apt to get the erroneous impression that your intended presentation possessed a certain number of intrinsic and original features while in reality it consists of an assemblage of already existing parts and details in the instruments above alluded to. I do not, for a moment, knowing you as I do, mean to infer that you could intend or wish to either keep in the background the existence of features utilized in your adaptation, or to make unduly prominent the valuable new proportioning and assemblage of these features. But I can perfectly appreciate your enthusiasm, and sympathize with your gratification in having so re-adjusted certain parts as to make it decidedly easier for the examiner and less uncomfortable for

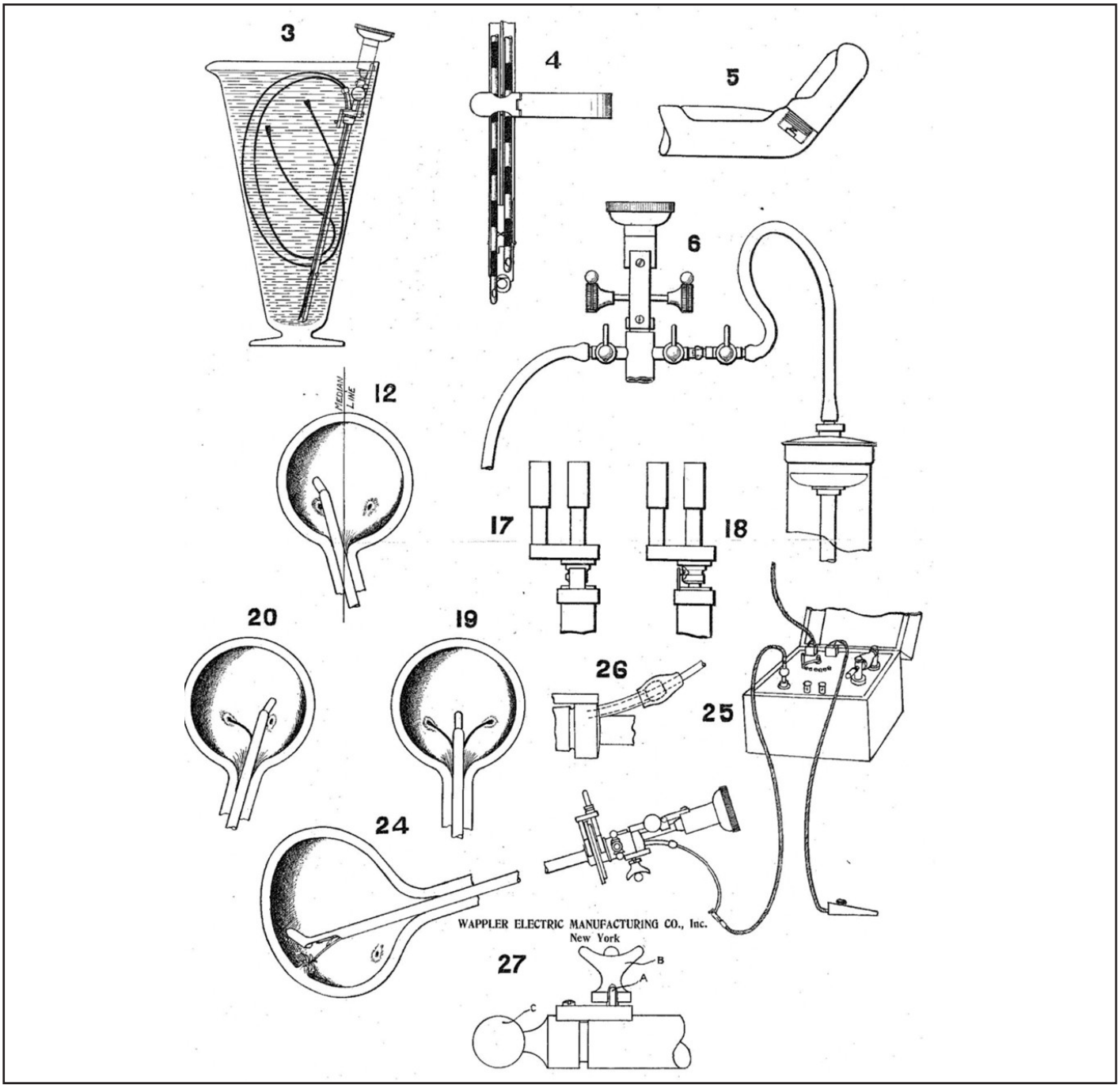

Figure 3. The Brown-Buerger Cystoscope instruction manual by the Wappler Electric Instrument Company accompanied each cystoscope kit in a 6 cm x 33 cm x 14 cm wooden box containing an indirect examining and catheterizing cystoscope. Many components in the 1909 design were novel and innovative and easily recognized by urologists a century later, including petite mignon bulbs (#5), ureteral catheterization ports (#19,20), an Albarran bridge (#24), and a power source (#25).

the examined, to carry out synchronous Ureter Catheterization, and while I wish to take this opportunity to congratulate you again over the accomplishment, I would ask you to try and take a calmly impartial view of the proper balance of proprietorship in the sum total results."(20)

Brown's tone may have extended to the broader medical community, where Buerger's improved cystoscope was initially met with skepticism or silence. Schoenberg noted that "much controversy surrounded use of the new device," further complicated by Buerger's own difficult personality that was marked by egotism.(21) Buerger recalled the "cynical attitude" of colleagues at Mount Sinai and the "disdainful

and contemptuous silence" that met his early efforts.(22) Similarly, his identification of thrombo-angiitis obliterans (TAO), a vascular condition he observed predominantly in Jewish patients, was met with skepticism during his lifetime, with many casting doubt on the validity of the disease.(23,24) Ultimately, both the cystoscope and TAO gained acceptance through subsequent studies validating Buerger's original observations.(25)

The Brown-Buerger Cystoscope: The urologists workhorse

In 1909, the Brown-Buerger Combination Cystoscope became the first widely adopted American-made cystoscope, eliminating the need for overseas repairs. Ultimately manufactured by the Wappler Electric Company, the Brown-Buerger integrated prior innovations—Brenner's catheter channel, Albarrán's deflector, Tilden Brown's sheath, Otis's telescope, and Goldschmidt's irrigating system (Figure 3). Notable for its ease of use, it allowed double ureteral catheterization, provided both direct and indirect visualization, and accommodated various instruments through a single sheath. Features included a short lamp with external power, an irrigating obturator, and a deflecting telescope that could guide two 7F catheters while enabling continuous irrigation.(19,26,27)

The Brown-Buerger cystoscope revolutionized American urology by improving visual diagnostic accuracy and simplifying ureteral catheterization, becoming the standard instrument for nearly six decades. (5,9) Hugh Hampton Young, considered the "Father of American Urology," praised it, writing, "The double catheterizing, irrigation and evacuation cystoscope, as made by American Cystoscope Makers, Inc., and generally known as the Brown-Buerger model, is so efficient that it might seem almost perfect and unnecessary to attempt to improve it."(28) Paul M. Pilcher, a contemporary cystoscopist, also acknowledged Buerger's advances as foundational to broader clinical adoption, predicting they would encourage more surgeons to embrace cystoscopy for diagnosing kidney and bladder disease. (29) The instrument's success lay in the complementary innovations of both inventors: Brown introduced a dual-lens system with interchangeable optics, while Buerger refined the design for greater maneuverability and clinical versatility. Their combined contributions made the cystoscope both technically superior and practically indispensable. Reflecting its historical significance, the American Urological Association annually presents a refurbished Brown-Buerger cystoscope as part of the

Figure 4. Brown-Buerger cystoscope, circa 1945, by American Cystoscope Makers incorporated (ACMI). These universally used instruments are now highly valued collector's items and a reburbished 'Brown-Buerger' is the main prize given to the winning history of urology essay at the annual meeting of the American Urological Assocation (AUA). (Courtesy, Didusch Museum, Linthicim)

Earl Nation Retrospectroscope Award—an emblematic gesture recognizing the enduring impact of this collaborative innovation (Figure 4).(27) Rainer Engel (1933-2018), former AUA Didusch Museum curator wrote "looking back at urology's past is just as important as looking ahead to its future. Clearly, the number of Brown-Buerger cystoscopes donated to our collection is a testament to the instrument's staying power—and its place in urology's history."(30)

DISCUSSION

Leo Buerger advanced in a medical backdrop shaped by exclusionary norms, relying on the support of influential figures like Hugh Hampton Young, who appointed Buerger to the journal's executive editorial committee, helping to elevate his professional standing.(31) In 1917, a high point in his career, Buerger joined the editorial board and accepted a professorship at the Urology Outpatient Clinic of the New York Polyclinic Medical School, a groundbreaking postgraduate training institution.(13,32) That same year, he famously performed a cystoscopy and pyelolithotomy on actress Sarah Bernhardt, who was so impressed with the outcome that she asked Buerger to name his daughter Yvonne Sarah Bernhardt (1917-1942) after her.(33)

Over the course of his career, Buerger wrote extensively about cystoscopy and urethroscopy, describing findings we take for granted today. For example, he published works correlating cystoscopic findings with stained pathologic specimens showing a clear correlation to anatomy and histology. He published over 125 articles and authored chapters in Hugh Cabot's 1918 Modern Urology.(34)

A distinctly curious mind, he also contributed to fields outside of urology. He made bacteriologic contributions in the differentiation of streptococci and pneumococci, completed studies of the role of the celiac and mesenteric plexuses in shock, described osteogenic sarcoma, and elucidated the successful treatment of a case of tetanus with tetanus antitoxin.(22) Remarkably, Buerger's identification of the vascular disorder thromboangiitis obliterans (TAO), a condition eponymously known as Buerger's disease, underscores the rare distinction of a urologist lending his name to a non-urologic medical entity. He published his seminal 1908 paper on TAO in the American Journal of the Medical Sciences, describing vascular lesions leading to spontaneous gangrene.(24) He observed TAO disproportionately among Polish and Russian Jews—a pattern made visible through ethnic segregation of

Figure 5. (Left) Leo Buerger, early 1920s, was lauded at a well publicized dinner in February of that year for "his services to humanity". He had married the French concert pianist, Germain Schnitzer (1888-1982) (right) in 1913. It was said she gave up her performing career to raise their two children but eventually sued for divorce in 1927 citing infidelity. Partially paralyzed after being struck by a taxi in 1934, she still outlived Buerger by 45 years and is buried along her daiughter Yvonne Jones (1920-1942) in Ridgefield, Connecticut.

Jewish hospitals, where Buerger worked and shared cultural ties with his patients.(35) Initially met with skepticism, his discovery was ultimately accepted into the medical canon as society attitudes changed.(23)

Buerger's promising career, with offices at 1000 Park Avenue, was followed by a sharp decline. He had married the famed French pianist Germaine Alice Schnizter in 1913, and they had two children, Gerald (1915-2002) and Yvonne Sarah Bernhardt (1917-1942) (Figure 5). Germaine stopped performing to focus on her children but the marriage proved unhappy and in 1927 she sued Buerger for divorce, claiming infidelity with a "stocky, good looking" blond.(36) Buerger spearheaded a business venture known as Hudson Towers, an ambitious 1929 plan to combine hospital, home, and hotel amenities at 263 West End Avenue in New York but the project failed due to massive cost overruns.(37) The pre-War structured was abandoned for decades. Buerger relocated to California in 1929 in hopes of a fresh start, where he was appointed professor of urology at the College of Medical Evangelists. (21) The effort proved unsuccessful. Upon returning to New York, he was not accepted back at Mount Sinai or the Polyclinic. Instead, he worked in smaller private clinics, including Beth David Hospital, Bronx Hospital, and Wyckoff Heights Hospital. He died in relative obscurity at age 64 at October 6, 1943, from a myocardial infarct, at the Hotel Sherry-Netherland, and was interred in an unmarked grave at the Bayview Cemetery in Jersey City, New Jersey overlooking the Statue of Liberty (Figure 6).(12)

Buerger's later professional isolation is often attributed to his reportedly abrasive personality—commonly described as arrogant, condescending, or dismissive—which was said to overshadow his medical achievements. His brash demeanor was on full display at a dinner meeting of local urologists held at the Alexandria Hotel in Los Angeles, where he declared that he had come "to teach the local urologists how to do urology"—a remark that was met with considerable disapproval.(22) Kaplan characterized him as "a center of controversy," admired for his innovations but burdened by his personal critiques.(22) Buerger himself believed such assessments reflected professional jealousy rather than genuine flaws. It is plausible that his defensiveness and alleged bombastic nature were, at least in part, shaped by the broader climate of exclusion and marginalization characteristic of the early 20th century. Descriptors such as "difficult" or "flamboyant" may have operated as coded language, reflecting implicit bias in an era when overt antisemitism was widespread, even if explicit documentation is limited.(13,38)

Understanding the context of Buerger's career requires acknowledging the pervasive antisemitism in early 20th-century American society. As large waves of Jewish immigrants arrived—many from Eastern Europe—they were met with hostility from the native-born elite, who viewed them as culturally alien and economically threatening. These sentiments were codified in the Johnson-Reed Act of 1924, which, under the guise of preserving "U.S. homogeneity," imposed strict quotas on immigrants from southern and Eastern Europe—effectively targeting the Jewish diaspora and barring many from fleeing persecution abroad.(39, 40) Stereotypes depicting Jews as greedy, dishonest, and conspiratorial took root, often framing them paradoxically as both capitalist manipulators and communist agitators.(41) Influential figures like Henry Ford amplified these myths. Ford's newspaper, The Dearborn Independent, published the notorious "The International Jew", blaming Jews for everything from labor strikes to economic downturns. (42,43) With a circulation of nearly a million and translations into 16 languages, the publication reflected and reinforced widespread cultural prejudice that likely shaped the professional landscape Buerger navigated.

While definitive conclusions about Buerger's character and career remain out of reach, it is reasonable to consider that both personal disposition and the broader cultural and institutional climate shaped his professional reception. The era's prevailing attitudes—including the undercurrents of antisemitism—may have influenced how Buerger was perceived and how his contributions were received. At the same time, accounts of his assertive and, at times, polarizing demeanor suggest that interpersonal dynamics also played a meaningful role. His legacy, like many, was likely the product of multiple intersecting forces rather than any single determinant.

F. Tilden Brown did not escape personal challenges either and was consumed by tragic circumstances. Shortly after the development and promulgation of the Brown-Buerger instrument in 1909, he appears to have developed a serious "nervous disorder" and suddenly left his family and residence at 14 East 58th Street, Manhattan for the rural village of Bethel, Maine. There, on the banks of the Alder River, he took his own life via revolver on May 7th, 1910.(15)

An Unwritten Legacy

Despite his prolific output—including numerous publications, patents, and innovations—Leo Buerger is largely absent from historical accounts. No full biographies exist, and only two short primary publications focus on his work: George Kaplan's "Leo Buerger (1879–1943)" and Schoenberg's "Eponym: Leo Buerger: Instrument, Disease, and Ego," together totaling just three pages.(21,22) Friedrich C. Luft , in "Leo Buerger (1879–1943) Revisited," noted that his editorial relied heavily on these limited sources due to a lack of broader documentation.(11) Our paper is the first to identify the unmarked location of Buerger's interment and to provide the tragic details of the death of his co-inventor Tilden Brown. Still, Buerger left a generally positive impression upon those who knew him. Upton B Sinclair, Jr. the great American muckraker and writer of the Jungle, was friends and college classmates with Buerger, a relationship of which Sinclair was proud. He recalled fondly in his autobiography 60 years later that

> "I number many doctors among my friends, and the better they know me, the more freely they admit the unsatisfactory state of their work. Leo Buerger, a college mate who became a leading specialist in New York, summed the situation up when I mentioned the osteopaths, and remarked that they sometimes made cures. Said my eminent friend: 'They cure without diagnosing, and we diagnose without curing' ".(44)

Figure 6. Leo Buerger grave site, plot 60-A-1, Bayside Cemetary, Jersey City, NJ. Buerger died of a myocardial infarction on October 6, 1943 and was interred at Bayside thereafter.(12) No marker exists for the plot although it is in direct view of the Upper New York Bay and the Statue of LIberty, which he had passed as a 7 year emigre from Vienna in 1886, dreaming of a career in music.(45) (IJUH archives)

CONCLUSION

The unwritten legacy of Leo Buerger (1879–1943) lies not only in his technical innovations but in the complex, often overlooked narrative of a brilliant physician navigating—and challenging—the cultural and institutional barriers of his time. Buerger's unwritten legacy is also one of resilience. He continued to push the boundaries of urologic and vascular diagnostics, even in the face of professional marginalization, skepticism, and what appears to be coded prejudice masked as personality critique. His conflict with figures like Tilden Brown, the dismissal of his work by elite institutions, and his eventual retreat to smaller hospitals after career and personal setbacks reflect the broader challenges of immigrant life in the American states even among the revered halls of medicine. Ultimately, Buerger's story is a case study in how innovation can be forgotten when it challenges hierarchy, disrupts authorship, or comes from the margins. His legacy lives on not just in instruments or diseases that bear his name, but in the historical questions his career forces us to ask about recognition, exclusion, and the politics of memory in medicine.

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DISCLOSURES

The authors received no funding for the preparation or submission of this manuscript.

DECLARATION OF COMPETING INTEREST

The authors declare that there are no competing interests. All contributions were made in good faith and without external influence beyond those acknowledged in the manuscript.

STATEMENT ON USE OF GENERATIVE ARTIFICIAL INTELLIGENCE

The authors affirm that no generative artificial intelligence (AI) tools (e.g., large-language models) were used in the writing, analysis, or figure preparation for this manuscript.

IJUH
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The Rectal Bladder: An Insight into the History of a Urinary Bladder Substitution

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Introduction: The history of urinary diversions is long and complex. Urologists have engaged their creativity and skill in creating an alternative to the bladder that could contain urine, prevent reflux nephropathy, and allow for easy and regular voiding. The purpose of an ideal urinary diversion is to comply with all these functions though never comparable with the native bladder and at the cost of a radical re-conformation of the anatomy and physiology of the urinary and intestinal tracts. The rectal bladder (RB) has been described for a century and was an attempt to avoid an abdominal stoma and allow for perineal voiding. Italian urologist Ulrico Bracci and many others possessed significant expertise in developing the RB, in all its variations, between the 1950s and 1980s. Our objective was to delineate the history, evolution, and demise of the RB technique in the context of the surgical challenges its pioneers faced.

Sources and Methods: We conducted a survey of the existing medical literature on rectal bladder construction, utilizing the resources available at the Medical Area Library of the University of Naples Federico II, PubMed, Internet Archives, and the National Library of France for contemporary and historical medical literature on the topic. The terms used to search the literature for rectal bladder were: "rectal bladder", "bladder exstrophy", urinary diversions, and various historical figures in the history of RB construction.

Results: The use of isolated rectum to serve as a urinary reservoir was first described by Placide Mauclaire (1863-1940) as an alternative to the then standard method of urinary diversion in bladder exstrophy, the ureterosigmoidostomy (USS). Many innovators worked to avoid the cutaneous stoma of urinary or fecal diversion owing to the absence of satisfactory stoma appliances and its social impact. We found that two general uses of RB were described: orthotopic and pararectal intersphincteric. The former was described by Gil Antonio Gil-Vernet (1904-1990) and the latter by a number of individuals including MH Boyer, A Hovelacqu and others. All techniques required significant surgical experience with bowel, placed vascular mesenteric pedicles at risk, and potentially compromised the anal sphincter which, in the case of bladder exstrophy, is congenitally functional.

Conclusions: The rectal bladder (RB) is no longer a commonly used option for internal urinary diversions, originating and being utilized before the advent of modern stoma appliances and detubularized bowel techniques for an orthotopic neobladder. Still, RB proved to be a viable method of internal diversion in cases like bladder exstrophy (BE) or radical cystectomy (BE). The pioneers who described RB aimed to help patients without a functional bladder by providing a functional substitute that preserved the upper tracts and avoided the stigmata of cutaneous urinary diversion.

Key Words: Urinary bladder, Bladder exstrophy, Urinary diversion, Rectal bladder.

Oswald Lowsley, the 30th AUA President, once wrote that "the need for diverting the urinary stream poses a dilemma for the urologist to which at present there is no fully satisfactory answer. (The surgeon) may sacrifice longevity for the sake of preserving the patient's volitional control over feces and urine, or (they) may sacrifice volitional control for longevity." (1) In 1971, Roger Couvelaire (1903-1982) added that "controversies over the choice of urine diversion method after total cystectomy will never extinguish. The arguments provided by the supporters of each process are all respectable and certainly express an element of truth."(2) Various methods of urinary diversions have been developed over the years, to create a reservoir that can function similarly to the bladder, to store urine, prevent it from flowing back into the upper

https://doi.org/10.53101/IJUH.5.1.004
Vol. V (i), pp 19-30, Fall 2025
Electronically distributed

urinary tract, and enable its easy and regular emptying. There was such exuberance in *fin-de-siecle* Europe to find the perfect bladder substitute in this regard that MH Ashken noted, "(the) upper urinary tracts have been connected with virtually every conceivable viscus."(3) Use of the rectum as a reservoir for urinary diversion was at one time a promising technique that had the potential to avoid a cutaneous stoma and preserve perineal emptying, maintained urinary continence, and protected the upper urinary tracts. We aimed to identify the surgical development of the rectal urinary bladder, its proponents and detractors, and its eventual demise for more modern bowel substitutes.

SOURCES AND METHODS

We conducted a thorough research of the existing medical literature on RB, utilizing the resources available at the Medical Area Library of the University of Naples Federico II (www.biblioteca.areamedicina.unina.it/), PubMed (pubmed.ncbi.nlm.nih.gov/), Internet Archives (archive.org/details/texts), and Bibliothèques d'Université Paris Cité – Histoire de la Santé (www.biusante.parisdescartes.fr) for contemporary and historical medical literature on the topic. The terms used to search the literature for rectal bladder were: "urinary diversions", "bladder exstrophy", "rectal bladder", "Robert Gersuny", "Placide Mauclaire", "Maurice Heitz-Boyer", "André Hovelacque", "Ulrico Bracci" and other historical figures.

RESULTS

Methods Using RB to Treat Bladder Exstrophy

Exstrophy of the bladder was first reported in classical times and associated with social abandonment and early demise until well into the 19th century. Théodore Tuffier (1857-1929) wrote "I consider that bladder exstrophy is such an abominable infirmity that one can never be too well-prepared to fight against it."(4) Many reconstructive surgical procedures were designed to treat bladder exstrophy at a time when they could not be performed or could be performed only at the cost of serious and insurmountable complications due to the limited means available in surgery. Basic surgical maneuvers using available tissue, or 'autoplastic' approaches, included covering the bladder with skin flaps or intestinal mucosa, or by suturing the marginal edges of the bladder tissue itself together. Satisfactory results were not achieved. (5)

In 1851, John Simon (1816-1904) described the first known uretero-sigmoidostomy (USS) at St Thomas' Hospital, London, for bladder exstrophy (Fig 1). (6,7)

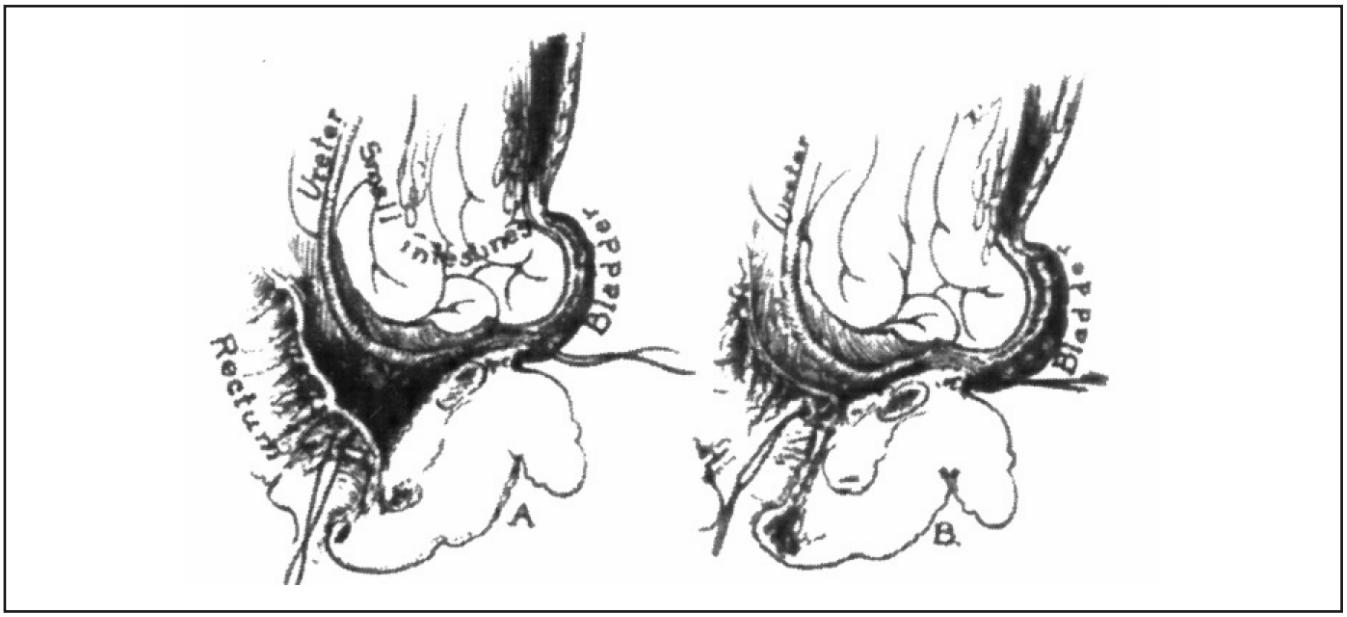


Figure 1. John Simon's method of forming a long fistulous tract between ureter and bowel to address the profound anatomic morbidity caused by exstrophy of the bladder, the furst known ureterosigmoidostomy (USS), in 1851, presaging the Bricker ileal conduit by a century (Source: Hinman & Weyrauch, 1936.(55)

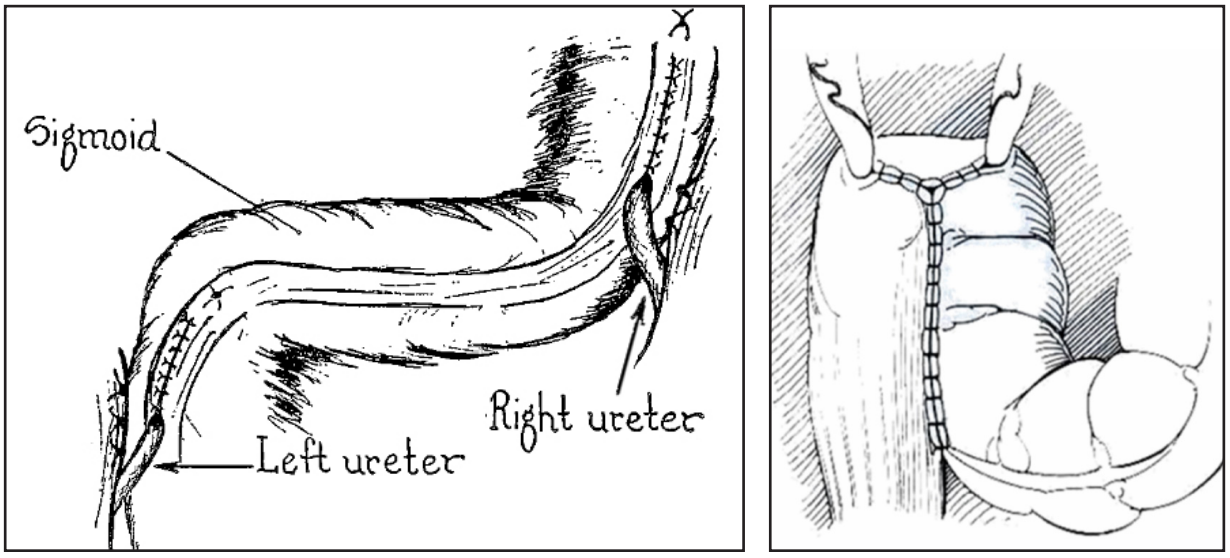


Figure 2. (Left) WF Melick's 1949 modification of the USS thought to avoid ureteral kinking. (Source: WikiCommons) (Right) Sigmoidal-rectal MAINZ II pouch, a partially detubularies USS designed to reduce high intraluminal pressures causing reflux. (13)

The patient survived a year. EA Lloyd (1795-1862), at St. Bartholomew's Hospital, London, and also in 1851, anastomosed the entire exstrophic bladder to the rectum itself. Although Lloyd's patient died a few days after the operation, the report provided the following opinion:

> " [...] Mr. Simon's ideas were now directed to the best means to be used for directing the flow of urine into the rectum, the attempt being based upon the following facts: many... animal excrete the urine in this manner, and it is found that patients whose bladder, after the operation of lithotomy, opens into the rectum, acquire a certain control over the fluid contents of that bowel, by means of both sphincters ani." ... His novel operation testifies to the ardent wish of the surgeon to benefit his patient, but that the risks are perhaps disproportionate with the annoyance of a malformation which the improved apparatus may render bearable... The case is highly important, for it will show how well-directed surgical efforts may effectually change and modify the natural relation and functions of the parts." (8)

Shortcomings of Uretero-Intestinal Anastomosis

From the advent of intra-abdominal surgery in the 1870s to well into early 20th century operating rooms,, the most widely used urinary diversion was obtained with a side to side stent-free anastomosis of the ureters to the intact intestine, primarily in the rectum or sigmoid colon (uretero-sigmoidostomy, USS), due to its simplicity and reproducibility (Fig 2, left).

USS had important shortcomings, however, specifically related to reflux of stools toward the upper urinary tract and to the large surface area of intestinal mucosa exposed to the absorption of urine, particularly as far as the cecum. This was the cause of electrolyte metabolic imbalance, hyperchloremic acidosis, bone demineralization, and adenocarcinoma. In the non-isolated sigmoid-rectum, also due to the anti-peristaltic waves, the hydrostatic pressure could reach up to 280 cm, while in the isolated sigmoid-rectum, it would rarely exceed 30 cm. (9)

The anastomosis of the ureters in the colon led invariably to ascending infection and subsequently to uretero-pyonephrosis, perinephric abscess, kidney stones, and renal failure. The majority of young people operated on in this way had a short life expectancy. Those who survived the early period, even burdened with immediate or late surgical complications, invariably died with renal insufficiency. (10)

Different and ingenious surgical techniques alternative to direct uretero-intestinal anastomosis began to emerge, with the idea of preserving the

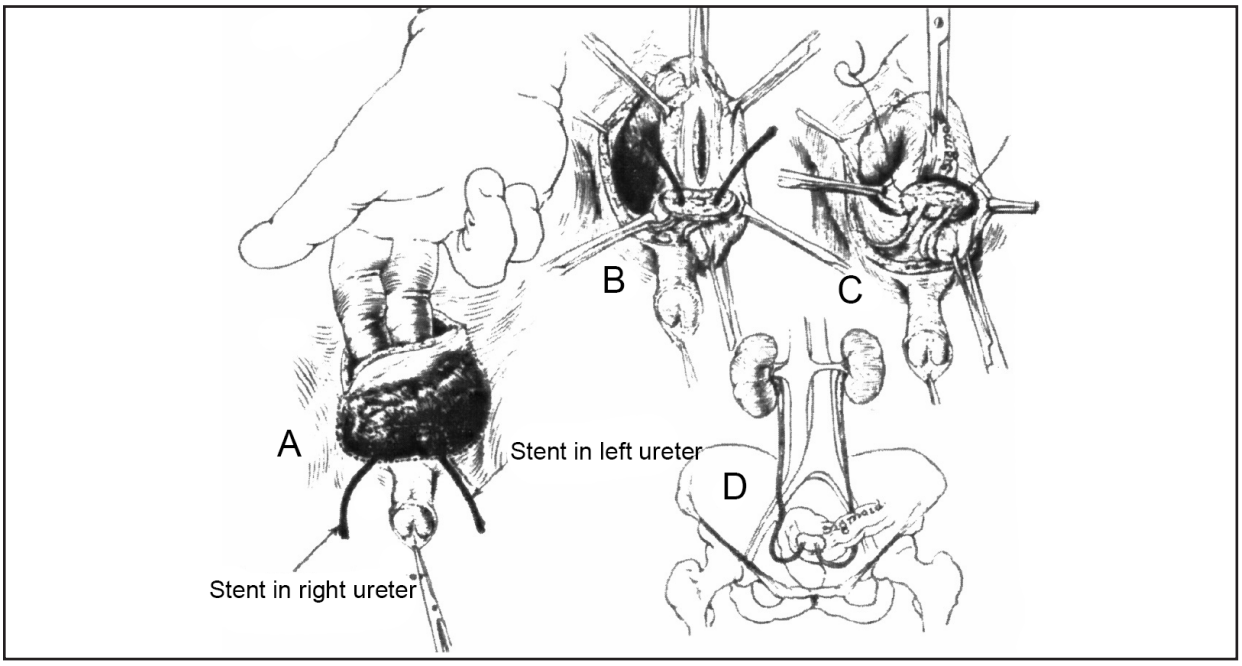


Figure 3. Karel Maydl's 1894 intraperitoneal technique of implanting the trigone (A) and the stented orthotopic ureteral orifices (B) of the exstrophic bladder into the sigmoid colon (C) and his final result (D). (Source Hinman F & Weyrauch, 1936)(55).

function of the uretero- vesical junction included in the anastomosis. With this goal, the Czech surgeon Karel Maydl (1853-1903) presented an extensive case report in 1894 concerning the implantation of the entire exstrophic bladder into the sigmoid flexure (Fig 3).(11) About a year later, Bergenhem **(Fig.3)** implanted the ureters separately with a portion of bladder wall extraperitoneally onto the rectum. Bergenhem's goal was to provide a more physiological course for the ureters, preserving the uretero-vesical junction and it was hoped, to lessen the absorption of urinary metabolites by the intestinal mucosa.(12) However, even with these two adjustments, the shortcomings related to the implantation of the ureters were not avoided.

Still, USS diversion was preferred by surgeons for its ease of execution, lower short term mortality rates, and reduced early morbidity, and by patients for the absence of an external urinary or fecal stoma. In many cases, however, it was necessary to convert a complicated USS into a secondary Rectal Bladder (RB). The USS had many techniques of ureter implantation. One that was commonly used was Goodwin's technique, with a submucosal anti-reflux tunnel. Bracci also tried to improve the function of the anastomosis by a method called axial insertion.

One additional challenge of USS was the relatively high intraluminal pressure associated with bacteriuric reflux. In 1905, Borelius and Berglund increased sigmoidal volume by partially excluding a loop of sigmoid by a side-to-side anastomosis at its base, with the ureters anastomosed to the dome of the loop (Fig15). This concept was revisited in 1991 by Fisch and Hohenfellner with a technique named Sigmoido-rectal MAINZ pouch II, a partially detubularized modification of ureterosigmoidostomy (Fig. 2b).(13)

Surgeons made many efforts over the 20th century to solve the problems related to bladder exstrophy, trying to provide these patients with a better quality of life, a concept stressed by William Boyce (1918-2012) when he wrote in 1952 that "(there) are few chapters in the annals of surgery more intriguing than those dealing with the exstrophy of the bladder: the challenge that these unfortunate children offer the surgeon has resulted in a large number of ingenious operative procedures and a voluminous literature on the subject". (10)

Separation of Urine from Feces

"The different varieties of treatment which have been proposed for the cure of exstrophy of the bladder," wrote Mauclaire in 1895, "the opening of the ureters into the rectum, has been recommended by a number of authors, but what makes one hesitate to use this method is the ascending infection of the ureters and kidneys". (14) "Diversion of the fecal stream," in the words of Boyce, "from the rectal segment of the bowel selected as a urinary reservoir, is necessary to effect the most

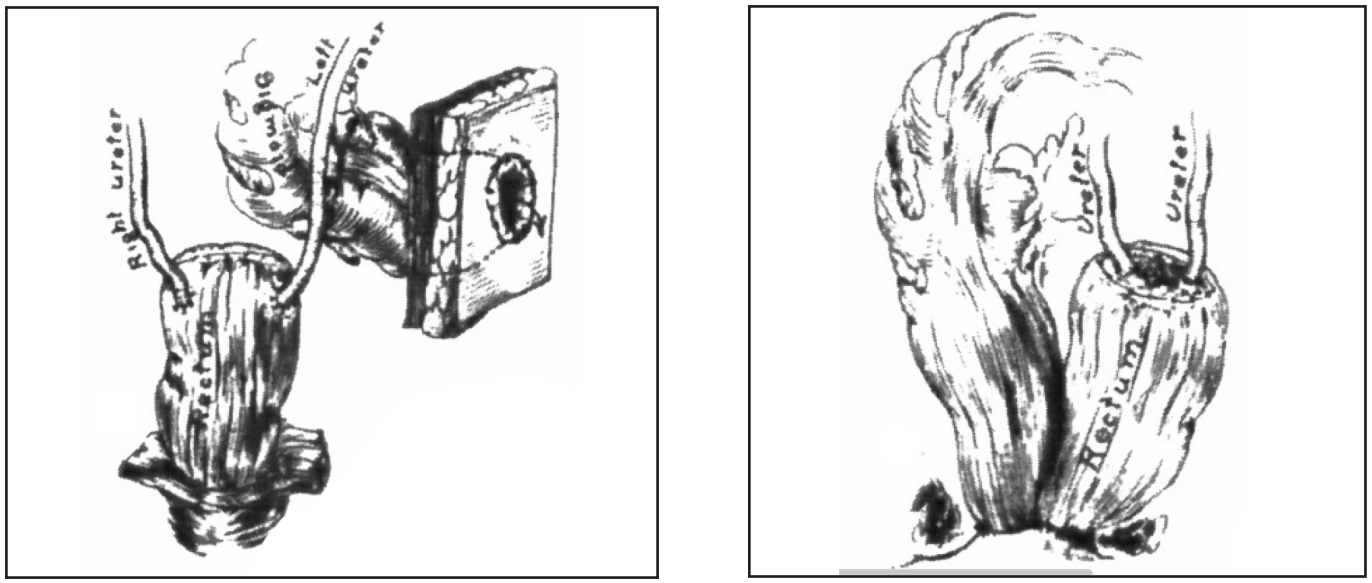


Figure 4. (Left) The first 'rectal bladder' (RB) for bladder exstrophy in 1895 by the pioneering French surgeon Louis Mauclair (1863-1940) associated with a left sided colostomy. (Right) A rectal bladder with the colostomy brought through the anul hiatus, a so called 'anterior perineal inrasphincteric colostmy' by Vienna's Robert Gersuny (1844-1924) in 1898.(55)

ideal situation and function of the urinary tract, that is, one that will result in a normal life expectancy". (10) The Rectal Bladder (RB) responded to the need to separate urine from feces and was conceived as "an aseptic continent cavity, evacuating through an independent channel, like the cavity itself, from the intestinal tube."

An artificial bladder made from a blind rectal loop could be created through several modalities: an iliac sigmoidostomy (i.e. a RB with LLQ colostomy), a perineal sigmoidostomy through the anal sphincter, a sigmoido-proctostomy, or a true orthotopic rectal bladder with anastomosis to the urethra.

RB with Iliac Sigmoidostomy

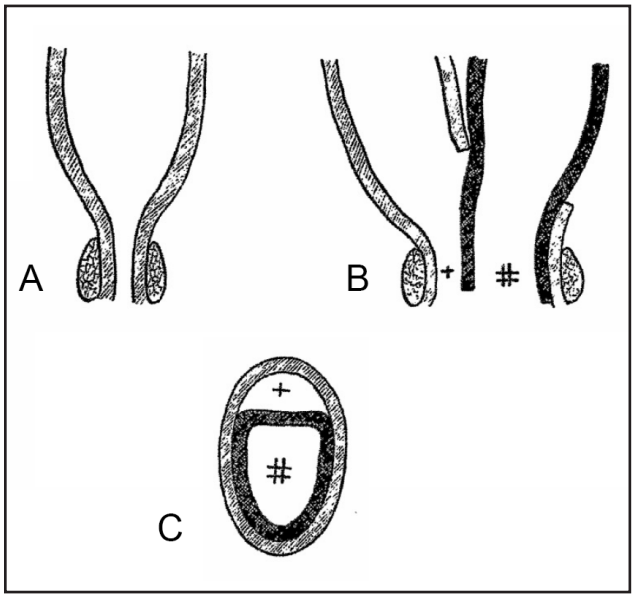
The Rectal Bladder (RB) was first devised experimentally by Louis Mauclaire (1863-1940, professor of Surgery in Paris) in 1895 for BE, by associating the urinary diversion with a left iliac colostomy (Fig. 4 Left).(15) Mauclaire's idea was to create an internal urinary diversion conceptually similar to the bladder, in terms of its functions, in an "aseptic rectum" mainly as an autonomous reservoir where urine would not mix with stools.. Mauclaire himself also performed the experimental perineal colostomy through the elevator of the anus and the right ischio-rectal fossa along with the rectal bladder, although this system would theoretically produce urinary continence and fecal incontinence. Mauclaire added the following comment: " [...] These experimental surgery trials seemed interesting to me to report here because it is possible to make them practical and feasible in the living child, without fear of adding new infirmity."(15)

RB with perineal sigmoidostomy via the anal sphincter

The presence of a cutaneous, transabdominal fecal diversion proved in practice to be unacceptable to 19th century patients. Thus, Robert Gersuny (1844-1924), at Vienna's Karolinen-Kinderspital, devised a technique in 1898 that anastomosed the exstrophic bladder (Maydl's technique) to a blind rectal loop.(16) The proximal descending colon was brought through the anal sphincter for a perineal colostomy (Fig.4 Right). In 1910, Georges Marion (1869-1960) put into practice a procedure that later became known as the Heitz-Boyer and Hovelacque technique after MH Boyer, 1876-1950) and A Hovelacque (1880-1939), a rectal bladder (RB) with a retrorectal intrasphincteric perineal colostomy (Fig.5 Left).(17) The procedure was first performed in a female patient in 1911 who had been previously diverted with nephrostomies, Marion created a rectal bladder and an intrasphincteric perineal colostomy thus allowing the patient to void diverted urinary and fecal streams via the perineum. Initially crowned with surgical and clinical success, Marion also experimented with a neo-urethra which proved to be surgically unreliable.

RB with Sigmoido-Proctostomy

Many different techniques were developed through the years to address the vascular limitations of the descending and sigmoidal bowel mesentery, notorious for their limited collateral circulation. Modelsky introduced a modification of the RB to take into account the RB and the shortness of the sigmoid loop: the sigmoid-proctostomy (Fig.5 Right). In



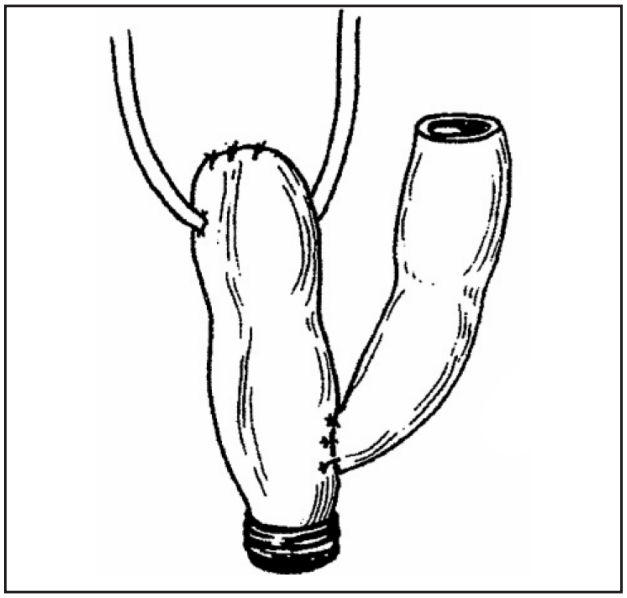


Figure 5. (Left) Schematic of a rectal bladder by Georges Marion showing the (A) native rectum, (B) an intrasphincteric perineal colostomy (black segment), and the isolated USS segment thus allowing the patient to void diverted urinary (+) and fecal (#) streams via the perineum and was initially crowned with great success in 1911 Paris.(4)

1962, he anastomosed the distal end of a transected sigmoid loop to the rectum, excluded from becoming a rectal bladder with the ureters inserted into it.(18) This technique was later adopted by Leiter and Brendler in 1964 and by Kamidono in 1985 which favored a convenient, anal emptying of both urine and feces in hopes of preserving the upper tracts (Fig. 6).(19,20) Also noteworthy is the technique of Werelius in 1911, another type of sigmoido-proctostomy with the ureters anastomosed to the sigmoid loop instead of being anastomosed to the excluded rectum (Fig. 7 Left). (21)

Orthotopic Rectal Bladder with anastomosis to urethra

Lemoine, in 1912, performed, albeit with little success, a rectal neo-bladder anastomosed to the urethra, with the sigmoid anastomosed in an intrasphincteric perineal position (Fig 7 Middle). (22) Important for both its historical value and technical significance was the technique published by Gil Vernet in 1960, which involved creating a neo-bladder with an anastomosis to the urethra from an isolated segment of the sigmoid colon. (23)

The Ileum

For 100 years since Simon and Lloyd's surgical reports, a large number of techniques, or variations of techniques, aimed at creating a continent reservoir were developed but were limited by surgical experiences with small

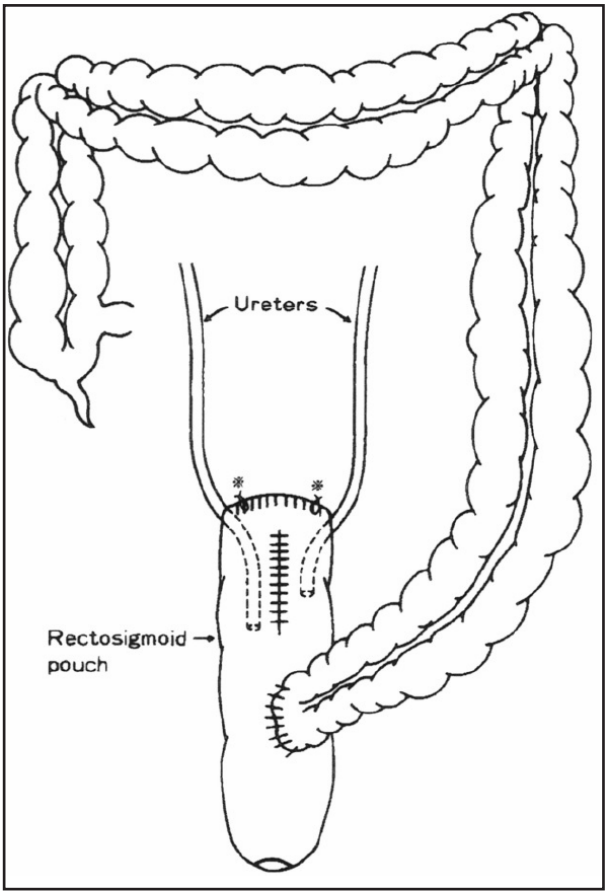


Figure 6. Sadao Kamidono's 1985 version of the RB which hoped to preserve the upper tracks and allow for anal emptying of both urine and feces.(20)

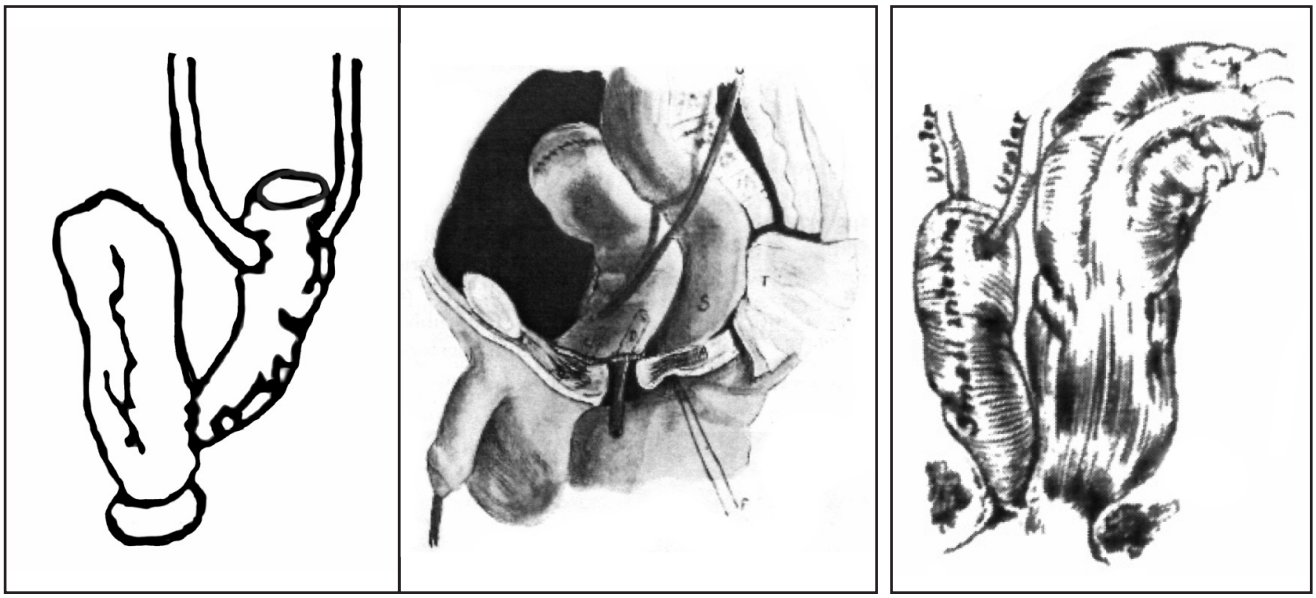


Figure 7. (Left) Schematic showing Werelius' sigmoido-proctostomy and transplantation of ureters into a partially excluded rectum of 1911. (Middle) RB anastomosed to the urethra with a perineal intraspincteric sigmoig loop by G. Lemoine in 1913. (22) (Right) An ileal resevoid diverted to the interspincteric anal hiatus, by Cuneo in 1913.(25)

bowel. G. Tizzoni and A. Foggi, two Italian surgeons in 1888 Bologna, conceived of an performed an orthotopic ileal bladder in a canine model. (24) They anastomosed the ureters at the proximal end and the urethra at the distal end to an isolated loop of ileum. This procedure did not have clinical follow-up at the time but certainly represented an important milestone in the study of continent urinary diversions. By 1911, however, BJ Cunéo (1873-1944) developed an ileal bladder for two cases of bladder exstrophy. The Cuneo technique consisted of isolating a loop of small intestine, with one end brought to the perineum in an intrasphincteric position through a submucosal pathway in the rectum, while the other end had the ureters anastomosed, in one case along with the exstrophic bladder trigone and separately in a 2nd case (Fig. 7 Right). (25)

Subsequent ileal diversion techniques, pioneered by Verhoogen, Makkas,, and Lengemann, used the excluded ileocecal segment as a reservoir and the appendix as an outlet valve (Fig.8 Left).(26-28) This technique was later championed in 1983 by Hohenfellner (1928-) and Thüroff, in what was named a 'MAINZ pouch I' for Mixed Augmentation Ileum 'N' Cecum and as homage to Thuroff's practice in Mainz, Germany (Fig.8 Right).(29)

Renewed life of the RB or a Transient Rebirth

Since the 1950s, several urologists have been focused on finding the ideal urinary diversion. Tracy Powell publicized his experience with the old Cunéo technique, and at the same time, many urologists shifted their attention toward the rectal bladder (RB), including HG Hanley, GL Smith, SS Ambrose, OG Stonington, and Garske et al.. (30-34). All focused on voluntary control of both urine and stool and safeguarding the upper urinary tract in this type of diversion. Boyce devised a very complex modification of the Mauclaire RB: a left iliac colostomy combined with the anastomosis of the exstrophic bladder to the rectal bladder and a complex reconstruction of the epispadic penis to safeguard the kidneys from reflux and preserve ejaculation.(35) The paper included medical artwork by the American urologist and illustrator William P. Didusch (1895-1981). A milestone in the history and 'new life' of RB was the 1955 report by Oswald Lowsley who wrote,

> "(the) need for diverting the urinary stream poses a dilemma for the urologist to which at present there is no fully satisfactory answer. He may sacrifice longevity for the sake of preserving the patient's volitional control over feces and urine, or he may sacrifice volitional control for longevity." (1)

Bracci published his relevant experience in a chapter about RB in Mayor and Zingg's widely used text Urologische Operationen and in reports on the advantages of RB over other diversions. (36-37)

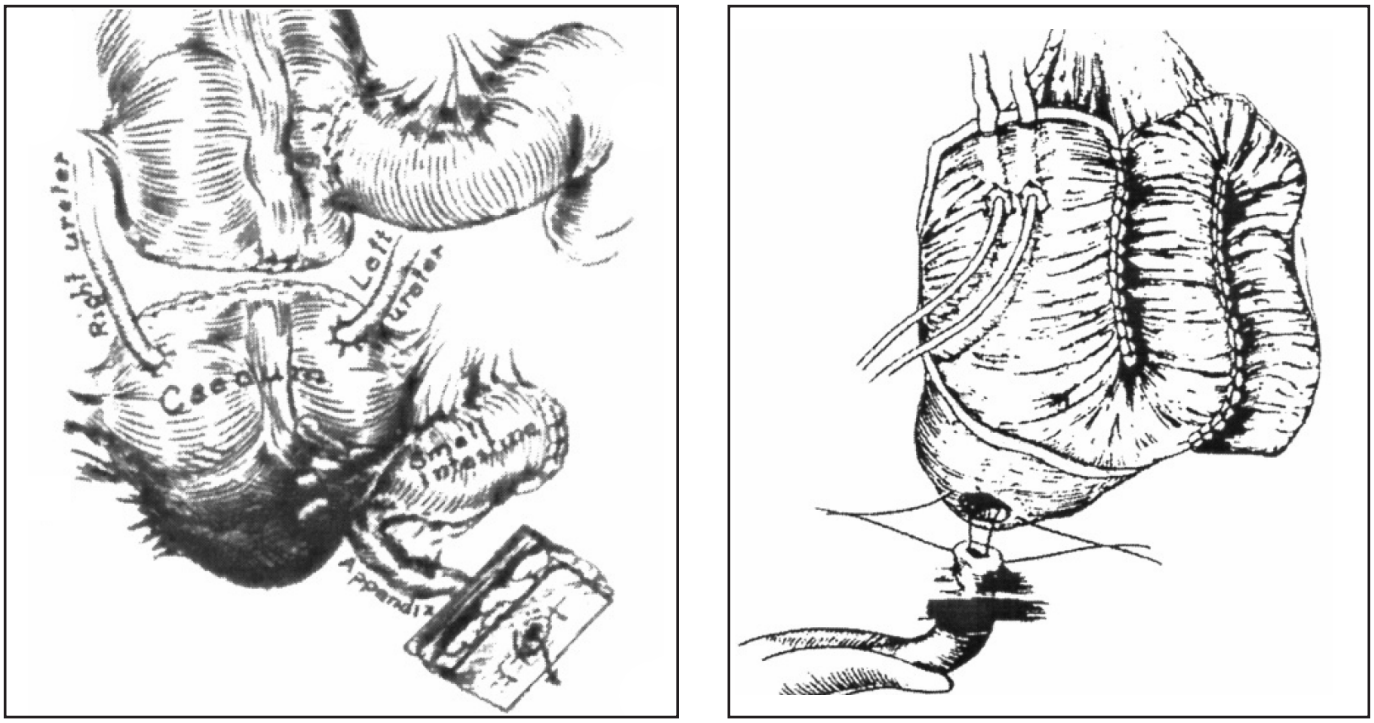


Figure 8. (Left) Verhooogen's ileal cecal reservoif with an appendiceal afferent limb. (Right) A MAINZ I ileal orthotopic diversion

Subsequently, several reports in the worldwide urological literature included RB and relevant statistics, such as those by Frank Hinman Jr, Novak et al., Costantini et al., Culp et al., Sadi et al., Rigatti et al., Ghoneim et al., and others (38-45). Couvelaire reported a use of RB in a patient who need urinary diversion and had already a defunctionalized rectal reservoir, and a report of a laparoscopic RB created by Hai et al. in 2021 for a patient with a prior ileostomy. (46-47)

During the 1980s, the evolution of modern techniques for continent urinary diversion was a major step forward in the search for the "best operation" for both the surgeon and the patient. Two fundamental findings were essential for the realization of new concepts: the principle of detubularization of the bowel for creating a low-pressure reservoir and the use of clean intermittent catheterization.

The rise of one, the demise of the other: Ileum and Rectum

The state of affairs in radical cystectomy by the 1920s was bleak. As GG Smith wrote in 1921, "in no field of genito-urinary surgery are the results more disheartening than those which follow operations for carcinoma of the bladder....Many cases now operated upon with the 'hope of relief' but without the slightest logical reason for believing that relief will be gained, either should not be operated on at all or should have diversion of the urinary stream."(48) Urinary diversion was almost always, in this manner, accomplished via USS and had made little progress since radical cystectomy was first reported in the 1880s.(49-50) The use of ileum was not popularized until the improvement in surgical anastomotic techniques and abdominal urostomy appliances. Eugene B Bricker had experimented on many cutaneous continent and incontinent urinary diversions, with small and large bowel, but it was his pioneering work with small bowel and a straight uretero-intestinal ileal conduit for which he is largely known.(51) His initial report in 1950 was heralded as a breakthrough in the management of urinary diversion in children and adults. Ileum was easily handled and was devoid of the metabolic abnormalties of jejunum as an isolated segment. Ileum could be more easiy detubularized and reconfigured into a large volume reservoir than any other bowel segment. Future AUA historian RM Engel wrote in 1969 that since Bricker's description "the ureteroileal cutaneous diversion has found wide utilization as a form of urinary diversion" and reported a 5-year complication and post operative mortality rates, considered very low at the time, of 50%

and 3.8%.(52) Detubularized ileal segments, as espoused by Kock in his seminal cystometrography work as a graduate student, could provide continence and did not rely on preserved peristalsis which were thought to be important in early orthotopic neobladders like the non-detubularized segment espoused by Camey.(53) The Kock non-refluxing orthotopic neobladder, the Hautman W-neobladder, the Studer pouch, and a variety of large volume urinary reservoirs became published throughout the last half of the 20th century. Publications on novel forms of rectum as a primary choice for a urinary reservoir ceased after 1985 while the literature on the ileal neobladder has largely increased 100 fold (Fig. 9). Those few papers published on the RB as a urinary reservoir were still largely related to exstrophy, and RB complications, the last of which was published in 2021. (48)

DISCUSSION

The idea of the RB was conceived as an alternative to the uretero-sigmoidostomy (USS), whose shortcomings significantly impacted quality of life and life expectancy. The primary goal of the RB was to avoid the problems associated with the mixing of urine and stool, to create an independent reservoir with sufficient capacity, low endocavitary pressure, continence, easy and complete emptying, and accessibility for exploration. Moreover, some techniques for creating an RB did not require an external stoma. Even in the Mauclair version requiring a colostomy, an advantage over Bricker's uretero- ileo-cutanostomy is that a fecal diversion may be easier to manage than a urinary diversion, especially in times when medical devices did not have the current technology or in countries where such devices were unavailable. The RB may not be feasible in all urology departments and has other surgical disadvantages. The RB requires urologists who are proficient in both bowel surgery and perineal surgery. of the RB is contraindicated in conditions with concurrent anorectal pathologies, when the colonic mesentery does not allow for descent of the sigmoid loop to the perineal plane, or in cases of anal sphincter incompetence, such as in spina bifida. The anatomy of the transposed sigmoid loop may be compromised by ischemia, leading to stenosis, retraction, or necrosis. Functional issues, such as gas and/or stool incontinence

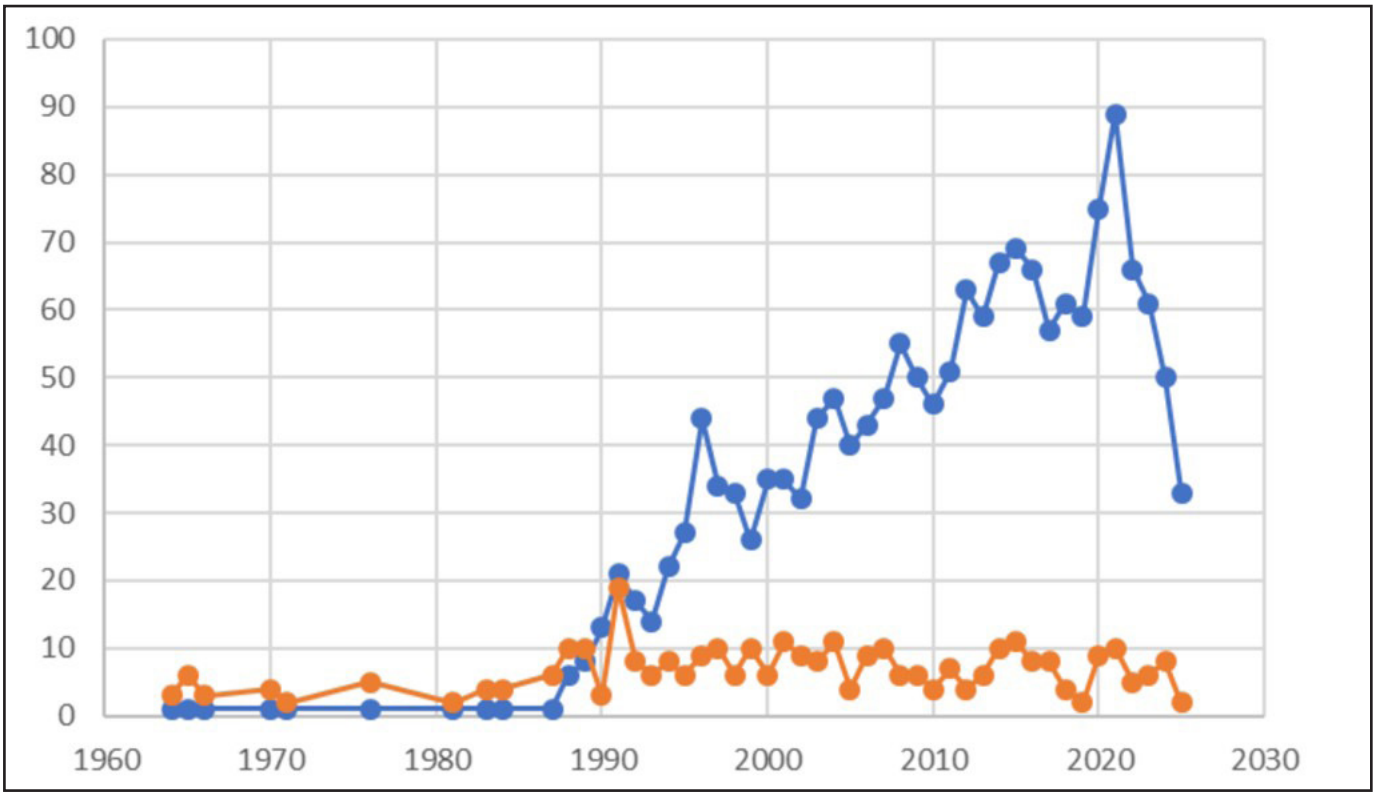


Figure 9. Number of publications from 1965-2025 on the topic of the rectal bladder (orange) versus the use of ileum (blue) for urinary diversion, as derived from the National Library of Medicine's PubMed search engine.

or lack of adequate urinary stimulus, may arise. In a variable percentage of cases, reflux to the ureters can occur, potentially resulting in pyelonephritis and renal failure. Finally, like all reservoirs, reabsorption by the colonic walls can lead to hyperchloremic acidosis, but potentially at a lower rate compared to the USS. One of the longer risks of the RB in which there is an admixture of stool and urine is the potential for the development of mucosal adenocarcinoma.

The rectal bladder has had its day. Nevertheless, the RB remains a historical legacy that reflects the inventiveness and skill of pioneering urologists. Today, it has been largely replaced by other reconstructive techniques involving the bowel, such as ileal orthotopic reservoirs or cutaneous diversions. The RB had the merit of safeguarding, in many cases, the function of the upper urinary tract, albeit at the cost of disrupting both the anatomy and function of the bowel and the urinary tract. The life of the rectal bladder unfolded in the context of alternatives considered over the years. Historically, it addressed the complications of the uretero-sigmoidostomy and the unwelcomed problems with external urinary diversion. More recently, the RB is seen in the context of appliance-free continent reservoirs with abdominal ostomies and orthotopic diversion. As asserted by Ashken in 1982, "(the) merit of any urinary reservoir must be measured against a successful ureterosigmoidostomy" (3).

Couvelaire wrote in 1971, "(and) the rectal bladder? Although its execution has provided the urologists who have highlighted its interest with remarkable success, and without contesting their results, I do not recognize the demonstrated superiority of the rectal bladder over uretero-colic implantation and attribute risk to it, that of altering the functioning of the only sphincter remaining intact, the anal sphincter" (54). Many urologists in the past years made the RB a real workhorse with impressive statistics and success but were largely supplanted by the 1960s when the Bricker conduit and the concept of ileal detubularization became more widely reproducible. (55-56)

CONCLUSION

The rectal bladder reflected the attempts by extremely innovative and pioneering surgeons to develop some solution to the congenital or acquired loss of the urinary bladder that would minimize the impact of the surgery on the subject's health and quality of life. The rectal bladder served as an important milestone towards subsequent, and more widely adoptable, urinary diversions, both orthotopic and cutaneous, based on ileum. The history of the rectal bladder reminds us that today's standards of care, no matter how well-founded, must be continuously and critically assessed towards the improvement of future patients who may require definitive urinary diversion.

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DISCLOSURES

The authors received no funding for the preparation or submission of this manuscript.

DECLARATION OF COMPETING INTEREST

The authors declare that there are no competing interests. All contributions were made in good faith and without external influence beyond those acknowledged in the manuscript.

STATEMENT ON USE OF GENERATIVE ARTIFICIAL INTELLIGENCE

The authors affirm that no generative artificial intelligence (AI) tools (e.g., large-language models) were used in the writing, analysis, or figure preparation for this manuscript.

IJUH
The International Journal of Urologic History
www.ijuh.org

Urology's 20th Century Battle: Securing Its Place in the Clinic and the Curriculum

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Introduction: Urology became an established specialty around the turn of the 20th century. These new genito-urinary specialists left behind their original roles as the "clap-specialist" and began to take greater ownership over urological surgery. However, in doing so, many early urologists were ostracized by general surgeons who endeavored to keep them out of the hospitals and sought the reabsorption of this breakaway field back into general surgery. We examine these conflicts with general surgery and the impact this had on the field during its infancy.

Sources and Methods: We reviewed primary sources from the late 19th century to the middle of the 20th century regarding educational practices in urology, the current status, and progress made towards gaining full acceptance as a specialty.

Results: Urology around the turn of the 20th century had a decidedly diagnostic focus. Many of the first urologists viewed the field as a diagnostic specialty before later taking ownership of genito-urinary surgery. However, in attempting to claim urological surgery for themselves, these urologists came into conflict with general surgeons who resented the continued fragmentation of their field. These conflicts were a source of bitterness as criticism between general surgeons and urologists included personal to professional accounts. Some of these conflicts would occasionally enter the academic literature and leaders of professional societies would take official stances on the disagreements. Due to this, the development of the surgical aspects of urology was delayed in the first two decades of the 20th century with this being rectified in part due to its practitioners' unceasing advocacy for their field and its legitimacy.

Conclusions: Urologists at the time of its formal establishment as a specialty had great pride in their diagnostic capabilities. However, urologists faced resistance in expanding their surgical services. Through continual advocacy, urologists were eventually able to solidify their role as complete surgical and medical genito-urinary specialists.

Key Words: History, urology, general surgery, conflict, scope of practice

Urology became a formalized specialty around the turn of the 20th century during a particularly tumultuous period in medicine. This era saw the establishment of the residency system, the reorganization and standardization of the medical school curriculum, and landmark advances in medical care such as antibiotics and X-ray. Navigating these changes was unique for urology given the broad nature of the disease processes seen by urologists and that many of these diseases may be managed by medications or surgery depending on the entity and presentation. Urologists had many hurdles to overcome including: how to recruit and train new practitioners; how to present the specialty in the limited time they had in the new medical school curricula; and navigating the impacts of medical advancements which reshaped the relationships between various specialties. While many urologists saw the treatment of venereal diseases being taken over by the general practitioner with the advent of antibiotics, the general surgeon saw some of their cases being performed by the urologist. Several of the first presidents of the American Urological Association (AUA) and other prominent urologists came to see their greatest obstacle to growth in the field of urology as the general surgeon who felt threatened as the new field of urology expanded into surgery. A few general surgeons sought nothing less than the destruction and reabsorption of urology back into the fold of general surgery. We sought to examine some of the factors that contributed to these conflicts and how

https://doi.org/10.53101/IJUH.5.1.005
Vol. V (i), pp 31-38, Fall 2025
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this impacted the trajectory of the new field of urology.

SOURCES AND METHODS

We reviewed primary sources from the late 19th century to the middle of the 20th century on educational practices in urology, its current status, and progress made towards gaining full acceptance as a specialty. Literature sources were obtained through online searches using PubMed, the National Library of Medicine, Google Scholar, and the University of Rochester's DiscoverUR search engine. Select resources were accessed via hard copy at the Edward G. Miner Library at the University of Rochester Medical Center.

RESULTS

Early Perspectives on Urology

Ostensibly a surgical subspecialty, surgical prowess was not necessarily the basis of urology's claim to specialization in the beginning of the 20th century. Instead, diagnostic capabilities and interdisciplinary connections were often championed by practitioners. These urologists saw their role as not so much the ones to treat a condition, but rather as consultants with knowledge of the urogenital tract to help other fields of medicine and surgery establish a diagnosis.

Urologic papers in the early 1900s often reflected how the growing field would balance its medical versus surgical scope in the medical school curriculum. Martin Krotoszyner (1861-1918), a prominent west coast urologist, in 1911 stated that, "No student of medicine should be permitted to enter upon his practical career without at least a superficial knowledge of the modern urological diagnostics methods which furnish the key to the correct interpretation of many gynecological, neurological and abdominal lesions". (1) Others, such as Montague Boyd, founder of the AUA southeastern section, stressed in 1930 that medical students should be taught to employ the "urologist as an assistant in giving the special knowledge which is needed." (2) This suggested that training should focus on when other specialties should consult with their urologic colleagues whenever the diagnosis was in doubt. These perspectives placed a relatively greater emphasis on the diagnostic side of urology, with less focus on the surgical aspects. The diagnostic value that urologists could provide was not just for those suffering from genito-urinary disorders, and early practitioners saw their field as occupying a central place in the body and the medical community.

The interdisciplinary connections of urology were reflected in the writings of those such as William Quinby (1878-1953), 1st chief of urology at Brigham and Women's Hospital, who, in 1929, argued: "Because the diseases in which urology is concerned have many borderline aspects between both medicine and surgery, this intimate relation between the specialty and the more general subjects should be emphasized continuously." (3) Charles Higgins (1897-1987), the 43rd AUA president, had a similar viewpoint, writing, in 1939, that the primary focus of undergraduate instruction in urology was to impress upon students its multitude of connections to broader surgery and medicine. (4)

Some portrayals took the broad interdisciplinary connections of urology a step further. Henry Bugbee (1882-1945), the 17th AUA president, in 1941, shared his belief that urologists dealt with "A system more closely associated with the entire organism than any other single unit in the body". (5) A similar viewpoint was shared in a 1956 report from an AUA committee established to study the status of urology in medical schools which included the line: "Many contend that all specialties must be given identical treatment. But urology is a unique field, for it encroaches upon general medicine, general surgery, endocrinology, pediatrics, neuropsychiatry and radiology." (6)

Diagnostic Excellence

These diagnostic portrayals of urology presented by those such as Krotoszyner and Boyd are somewhat surprising as urology was ostensibly a surgical subspecialty. The emphasis of diagnostic advancement and excellence by prominent urologists is likely what led some to view urology as a field of diagnosticians. When justifying the necessity of a separate genito-urinary specialty, many early urologists writing in the first half of the 20th century based their arguments on diagnostics. Their diagnostic proficiency was used as evidence for a distinct set of skills that set them apart from other physicians. Technological advancements such as the cystoscope and X-ray provided a new ability for urologists to directly visualize genito-urinary pathologies. These advancements broadened the field and its potential. Keeping up with this amount of new knowledge and information thus required devotion to this field alone as a specialist. (7-11)

Figure 1. (Left) Hugh Cabot (1872-1945), 8th president of the AUA, whose 1911 justification of urology's right to be a specialty left a strong impact on later writers. (Source: Wikimedia Commons) (Right) Clyde Deming (1885-1969), AUA president from 1946-47, first chief of urology at Yale. (Courtesy, Medical Historical Library at Yale)

Diagnosis was at the very core of the new specialty of urology. In a 1911 AUA presidential address by Hugh Cabot (1872-1945), questioning if urology was entitled to be regarded as a specialty, he argued that:
"The cystoscope, the ureter catheter, the various tests of renal function, are the work of the specialist, and upon these depends almost wholly our well-founded belief that accurate preoperative diagnosis in lesions of the urinary tract is today not exceeded in any other branch of surgery, and perhaps not equalled"(Figure 1).(7)

Cabot's address resonated strongly with other urologists at the time and afterwards as later writers often pointed to it as a defining moment for the specialty. (10-15) However, Cabot did not ignore the surgical aspects of urology. Supposed improved surgical outcomes for urologists compared to general surgeons was part of his argument for greater independence and acceptance, but was not the basis of urology's claim to specialization. (7)

Similar viewpoints to Cabot's were shared by others at the time. Henry Bugbee, writing in 1922, noted of urology that "The detailed study of the urinary tract, made possible by the modern cystoscope, led to accuracy which entitled it to be considered a specialty". (12) This accuracy was highly valued by many early urologists and what many felt set them apart from the other areas of medicine. Clyde Deming (1885-1969), the 40th AUA president, writing in 1946, opined that "Urology is the most exact of all the specialties with regard to the execution of a diagnosis"(Figure 1).(13)

To many of these authors, Max Nitze (1848-1906), the inventor of the modern cystoscope, held a position of the highest esteem, one of the 'fathers of urology' whose invention resulted in the creation of the specialty. (9,11,15,16) Martin Krotoszyner wrote in 1911 that the history of urology could be best divided into pre-cystoscopic and cystoscopic eras.(1) Krotoszyner described how in the pre-cystoscopic era, there were two populations of genito-urinary practitioners. One was the limited number of exceptionally skilled surgeons who could perform genito-urinary surgery. The other was the genito-urinary and skin doctors, less respectfully known as the 'clap-specialist'. (1) The former primarily diagnosed conditions and performed only minor surgery. The modern cystoscope was an 'equalizer' that combined these groups and put urological science within the reach of any who would devote their time to its study. (1)

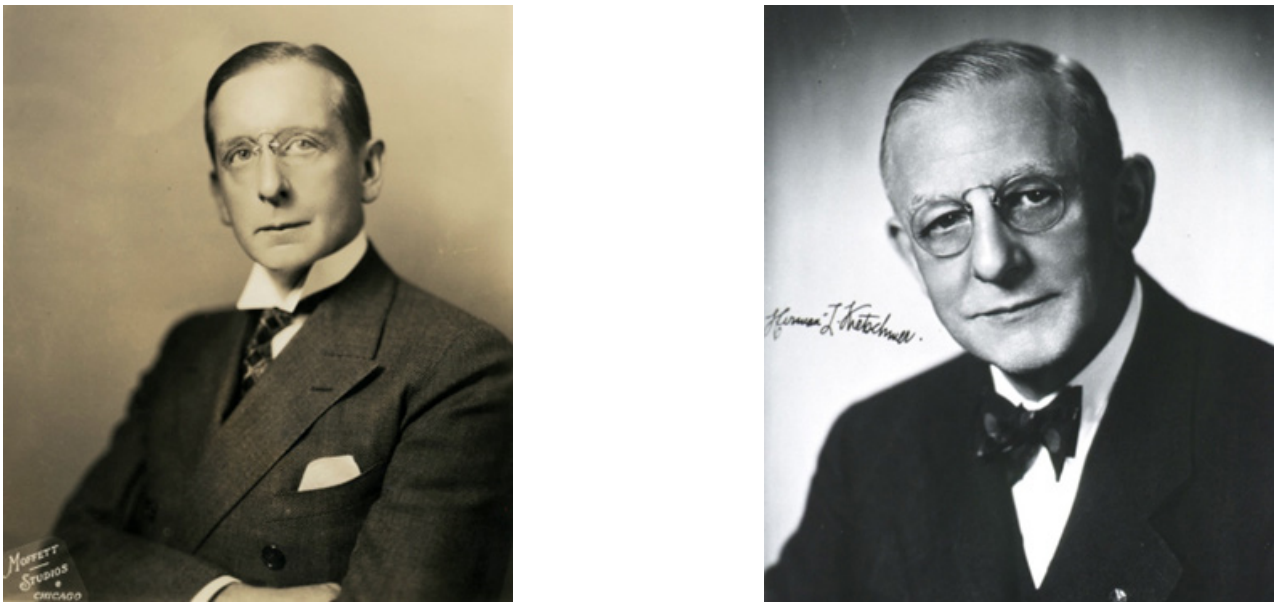

Figure 2. (Left) J. Bentley Squire (1873-1948) was both an ACS (1933) and AUA president (1914). Squier denied an offer from Columbia to chair a urology division under their surgical department which led to the creation of an independent urology department. (Courtesy, Archives of the American College of Surgeons) (Right) Herman Kretschmer (1879-1951) was an AUA and American Medical Association president who was known as one of the earlier physicians to devote his practice entirely to genito-urinary surgery. (Source: NLM Digital Collections)

Diagnosticians to Surgeons

Urology may have been founded on the art of diagnosis but the cystoscope is an example of how a diagnostic instrument allowed urology to expand its surgical role as better instruments meant conditions could be found and treated at the same time. This transition was noted by the 20th AUA president Herman Kretschmer (1879-1951) who said, in 1924, "The development of the diagnostic side was the prime factor in the development of urologic surgery". (Figure 2) (17) The 21st AUA president, C.R. O'Crowley (1880-1959), also agreed with this noting how urologists had advanced from "venereal specialists to diagnosticians, from diagnosticians to surgical collaborators and thence to the established urological surgeons of today." (10) However, this progression did not proceed smoothly. O'Crowley noted how just 25 years prior "the support of our brother practitioners was withheld and our institutional standing insecure and unreliable," and that urology was seen as "a new medical fad originated to digest another portion of the dissected skeleton of General Medicine." (10)

As the surgical depth of urology grew, urologists came into conflict with the other fields of medicine. Henry Bugbee stated that, as urology's scope expanded, "strong opposition was encountered. While it was generally acknowledged that special skill was necessary for diagnosis, the treatment or operative genito-urinary work was thought by internists and surgeons to be their part." (12) Others such as Clyde Deming agreed with Bugbee's sentiment and noted that "surgeons were loathe to accept the advancement of surgery in this special field." (13) This opposition was not taken lightly.

Conflicts with General Surgery

General surgeons were viewed as a major opponent and obstacle to urology expanding its surgical scope. Indicative of this bad blood were statements such as one made by John A. Hawkins of Pittsburgh who said, "I feel that the one great reason for the genito-urinary surgeon being held in derision by the general surgeon is the almighty dollar. I believe that the egotism of the general surgeon is only excelled by the man who knows nothing". (7) This statement came as a response to the address of Hugh Cabot, 8th president of the AUA, who commented on how general surgeons relied upon on the diagnostic skills of urologists of the time. Cabot went further when he stated, "I would deny that these operators are entitled to be regarded as surgeons at all, and must insist that the surgeon is one who can collect his own facts." (7) Henry Bugbee also acknowledged these early conflicts between general surgery and urology. By 1941, he believed that superior surgical outcomes helped settle the conflict, stating "[urology] was not separated from general surgery without a struggle, its accomplishment requiring years of

effort, and the production of results more satisfactory than could be obtained in like cases by the general surgeons." (5) Charles McMartin (1880-1954), the 41st AUA president, suggested that opposition to urology was particularly fierce with his belief that "The general surgeon's field has been encroached upon by various surgical specialists, but none were resented quite so much as the urologist." (18) Statements such as these showed that urology's expanding role in genito-urinary surgery was not well received by general surgeons.

These conflicts lessened by the late 1920s to early 1930s as papers from that time tended to portray these conflicts as having been largely, but not completely, resolved in urology's favor. (10,13,15,16). The 21st AUA president C.R. O'Crowley had noted urology's cold reception upon its establishment but later stated that, "Today we stand accepted by the general surgeon not because he has been harangued into granting us recognition but because in a harmonious and efficient way we have proven to him our ability". (10) However, the desire of some surgeons to reclaim aspects of urology back into the realm of general surgery did appear to persist into the 1950s as noted by Davis M. Davis (1886-1968), the University of Rochester's first urology chair, who, in a 1956 manuscript on the history of urology, wrote of the "consuming ambition of a number of surgeons to absorb urology, along with certain other so-called "surgical specialties," back into the fold of general surgery". (19)

Similar recollections were shared by Harry Herr, a founder of the Society of Urologic Oncology, during a personal interview on the subject of his friend and mentor Willet Whitmore (1917-1995) who was often dubbed the 'father of urologic oncology'. (Herr H to Gudell E, personal communciation, 9/23/2025) Herr noted that when Whitmore first arrived at Memorial Sloan Kettering Cancer Center (MSKCC) in the ealry 1950s, urology was not regarded as a surgical specialty. Urologists were primarily limited to performing endoscopic work and placing catheters with only some minor perineal procedures. The surgical chiefs as MSKCC (all of them general surgeons) had opposed the establishment of a urologic oncology fellowship as, according to Whitmore, such a fellowship could be a threat to the training of the "cancer man" and the general surgeon's field itself. Whitmore was often denied the chance to operate and perform open procedures due to the culture in surgery at this time that denied urologists such opportunities. However, he overcame these limitations through slowly integrating himself with the general surgeons by scrubbing in for their cases and demonstrating his surgical ability. The opposition to Whitmore's expanding surgical role faded and he was able to lay greater claim to the operative treatment of genitourinary cancers.

The General Surgeon's Perspective

While early urologists often wrote about their conflicts with general surgery, urology was not the only specialty that seemingly threatened general surgery. Articles from general surgeons on this did not necessarily single out

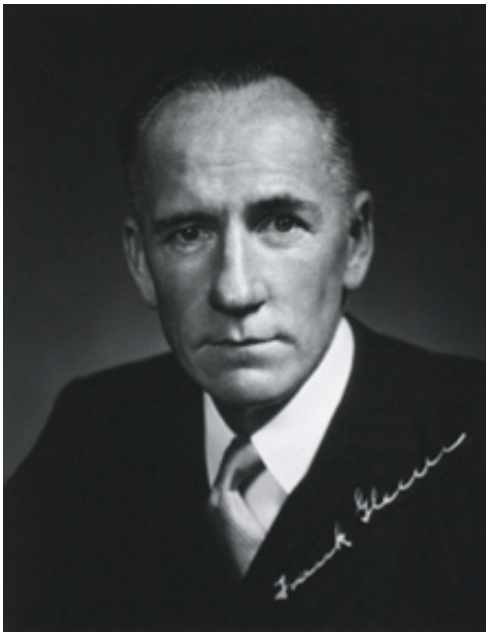

Figure 3. (Left) Daniel Jones Fiske (1868-1937), who in his 1933 ASA presidential address highlighted his concerns about the effects of specialization on general surgery. (Source: NLM PubMed Central) (Right) Frank Glenn (1901-1982), ACS president in 1954, was a renowned surgeon who was once called upon to perform surgery on the Shah of Iran. In a 1949 editorial he also shared his concerns over the effects of specialization on general surgery. (Source: NLM Digital Collections)

Figure 4. (Left) Oswald Swinney Lowsley (1884-1955) was the AUA president from 1941-1942. Lowsley was renowned for performing the first successful dorsal vein plication, although this also made him a tabloid target for headlines due to controversies surrounding his personal life. (30) (Source: Wikimedia Commons) (Right) 75th AUA President William Malik (1914-1984) presenting the 1984 Ramon Guiteras award to Willet F. Whitmore, Jr. (1917-1995), who persevered against resistance from general surgeons skeptical that a distinct specialty of urologic oncology should exist.(Source: AUA WP Didusch Museum, LInthicum)

urology amidst the threats their field faced. Writing in 1934, Daniel Jones Fiske (1868-1937), then president of the American Surgical Association (ASA), shared his belief that "Specialization has robbed the general surgical service to such an extent that it really does not exist." (Figure 3) (20) Of the specialties of gynaecology, urology, orthopaedic surgery, and neurosurgery he said that, "While I have no objection to this at the present time, I am almost convinced that some of these major specialties should be brought back into the general service." (20) Others such as Frank Glenn (1902-1982), an American College of Surgeons (ACS) president, and Arthur Dean Bevan (1861-1943), an ACS founder, writing at this time similarly questioned the wisdom of continued divisions of general surgery and flirted with their reabsorption back into the fold. (Figure 3) (21, 22)

The concerns that some surgeons in the 1920s and 1930s had regarding continued divisions of their field and specialization were not particularly unusual ones. There was a small, but vocal, subset who believed that overemphasis on specialization in medicine, especially within medical school curricula would lead to the "death" of the general practitioner. (17, 22-26) Entertaining the potential reabsorption of branches of medicine back into the larger body of general medicine or surgery was not the norm, but it was also not just a fringe reaction by disgruntled practitioners. Even the illustrious Harvey Cushing (1869-1939), the father of neurosurgery, put forth ideas that considered the reabsorption of his very own field back into general surgery. (24, 26-28) Certainly some of the discontent from general surgery stemmed from general surgeons being accustomed to their prior breadth of scope that had extended to nearly every body system, with perhaps otolaryngology and ophthalmology being the only notable exceptions. (21)

Some general surgeons resented the divisions of their field into various new specialties and assuredly there were attacks on urology's scope and legitimacy as a distinct specialty. However, urology was not seen as a particularly egregious example of specialization. Most general surgeons simply flirted with the idea of its reabsorption into general surgery along with various other surgical subspecialties through addresses and articles.

DISCUSSION

Effects of Conflict

As a result of conflicts with general surgeons, many early urologists felt like they were relegated to outpatient clinics. This was due to insufficient inpatient urology beds for full care of the urologic patient leading to slow development of the urologist's surgical skills. (7, 13, 17) Some urologists felt they were only called upon for their diagnostic skills, but their surgical abilities were ignored. (13) This slowed the transition of early urologists from diagnosticians into full surgeons.

Hugh Cabot's 1911 address touted the supposed improved surgical outcomes in urology but some urologists did not agree. J. Bentley Squire (1873-1948), future AUA and ACS president, stated that the "sneer" urologists receive from general surgeons is because general surgeons understood that current urologists did not have sufficient training for major surgery. (Figure 1) (7) Contemporaries of Squire, such as Martin Krotoszyner, had a similar view of the current status of the typical urologists' surgical capabilities. Writing in 1906, Krotoszyner acknowledged the higher standard of surgical skills in general surgeons but also asserted that "he who diagnoses better will be able to effect a better cure". (8) This was a fitting argument for a diagnostician attempting to advance his scope into surgical treatments of the maladies being diagnosed. Some later writers also had similar recollections. Oswald Swinney Lowsley (1884-1955), AUA president in 1941, recalled how in the early days of urology, "the surgical ability of some (urologists) was, to say the least, sketchy" (Figure 4).(9) In 1924, Herman Kretschmer noted how earlier critiques of urologist's technical skills had been partially addressed, but he still felt that "the opportunities for the development of the surgical side of our work are not what they should be". (17) Kretschmer believed that continuously pushing for independent urological services and an unremitting attention detail in all aspects of care had advanced the skills of urologists and their standing.

Such conflicts had slowed the development of surgery in urology but they also led to a later overcorrection of these trends. It was noted by AUA president Charles McMartin, in 1947, that urologists had made their "clinical courses to the undergraduate too much of a show place for highly technical diagnostic and operative procedures", something he attributed directly to conflicts with general surgeons. (18) Edward Cook, a prior chair of the American Medical Association (AMA) Urology Section, came to believe that new urologists were too 'knife happy' and that "In respect to training for specialty recognition, qualification for membership in societies, and presentations at meetings, the surgical aspects of urology have seemed to be stressed preponderantly." (29). This reflected how urologists had largely solidified their claim over urological surgery, if only perhaps a little too much.

CONCLUSION

Early practice and perspectives of urology around the turn of the 20th century had a decidedly diagnostic focus. Many of the first true urologists saw themselves, and the field, as originating as a diagnostic specialty before later taking ownership of genito-urinary surgery. However, in attempting to claim urological surgery for themselves, these urologists came into conflict with general surgeons who resented the continued fragmentation of their field. With our benefit of hindsight, it must be said that these fears of general surgeons over the division of surgery into smaller and smaller fields were not unwarranted. The many surgical subspecialties that exist today are the most convincing evidence that their concerns were valid. However, as surgical care grows more complex, we continue to see further specialization of general surgeons with many surgeons seeking fellowships following residency. Furthermore, integrated cardiothoracic, plastic, and vascular surgery programs are becoming more commonplace.

The conflicts between urology and general surgery at the turn of the 20th century were not taken lightly by urologists and were a source of bitterness. These conflicts may have delayed the development of the surgical aspects of urology in the first two decades of the 20th century. However, today, urology is now an independent surgical subspecialty in part due to its practitioners' unceasing advocacy for their field and its legitimacy.

Acknowledgements

The authors thank Harry Herr, MD for the information he shared in a personal interview on the subject of Willet Whitmore and his own experiences regarding the establishment of the urologic oncology fellowship at Memorial Sloan Kettering Cancer Center.

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DISCLOSURES

The authors received no funding for the preparation or submission of this manuscript.

DECLARATION OF COMPETING INTERESTS

The third author is an editor for the IJUH. They were not involved in the evaluation or peer review process for the manuscript. There are no other disclosures to make.

STATEMENT ON USE OF GENERATIVE ARTIFICIAL INTELLIGENCE

The authors affirm that no generative artificial intelligence (AI) tools (e.g., large-language models) were used in the writing, analysis, or figure preparation for this manuscript.

IJUH
The International Journal of Urologic History
www.ijuh.org

Traditional Use of Herbs in Treating Urinary Disorders Among Indigenous Peoples of North America

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Introduction: Indigenous Peoples historically created medicinal treatments derived from plants native to their environments. This review explores the herbs employed by different tribes across North America for treating presumed Urinary Tract Infections (UTIs) signs and symptoms, such as burning, frequency, urgency, and incontinence. Antibiotics are the standard treatment for UTIs. The increase in microbial resistance prompts the exploration of alternative therapies. This review identifies these herbs to investigate whether they could be a potential alternative to antibiotics in modern medicine.

Sources and Methods: Field notes, species descriptions, illustrations, and primary North American Indigenous Peoples' phenological observations were reviewed for the herbs used to treat and prevent UTI symptoms in various tribal communities. Additionally, the geographic distribution of the herbs and the tribes was researched.

Results: Wild mint (*Mentha arvensis*), was used by the Cherokee, Ojibwa, and Cree tribes. Bearberry (*Arctostaphylos uva-ursi*) grows throughout North America, was used by the Cree, Innu, Inuit tribes of Northeastern Canada, and contains arbutin, which has antiseptic and diuretic properties. The Iroquois, Micmac, Wampanoag, and Algonquin-speaking tribes, which spanned across Canada, used cranberry (*Vaccinium macrocarpon*) to treat irritative urinary symptoms. Like cranberries, mossberries (*Vaccinium oxycoccos*) are found on low shrubs in northern, cold regions and were used by Inuit and Cree tribes. Algonquin-speaking tribes used Goldenrod (*Solidago spp.*) as the leaves and flowers have diuretic properties. The Eastern Cherokee used a mix of herbs that included *Solidago odora* for urinary problems.

Conclusions: Indigenous People of North America employed a variety of herbs and berries to manage irritative urinary symptoms that may have been indicative of a UTI. Many of these natural remedies have since been discovered to contain compounds with proven antibacterial, antiseptic, and diuretic qualities. Exploring herbal therapeutics as alternatives to antibiotics is a promising avenue, especially given the rise in antibiotic resistance.

Key Words: Indigenous Peoples, Herbal Therapy, Urinary Symptoms

The Indigenous people of North America have a rich tradition of medicinal herb use, drawing on natural resources available in their diverse environment. While there are variations from tribe to tribe, some methods of treatment are universal. Common modalities include prayer, chanting, music, herbalism, counseling, and ceremony. This manuscript explores the traditional use of herbs in treating the signs and symptoms of urinary disorders among various indigenous North American tribes, with a focus on five key herbs: Wild Mint (*Mentha arvensis*), Bearberry (*Arctostaphylos uva-ursi*), Cranberry (*Vaccinium macrocarpon*), Mossberry (*Vaccinium oxycoccos*), and Goldenrod (*Solidago spp.*). By examining the growth patterns, indications, and clinical documentation of these herbs, we aim to achieve a deeper understanding of the sophisticated and culturally rich practices of indigenous medicine. The management with herbal remedies preceded the treatment of urinary symptoms with antibiotics and remain a viable option for adjunctive treatment.(1)

https://doi.org/10.53101/IJUH.5.1.006
Vol. V (i), pp 39-47, Fall 2025
Electronically distributed

SOURCES AND METHODS

To investigate the use of herbal remedies by indigenous peoples across North America for treating urinary symptoms, a comprehensive review of field notes in rare books, species descriptions, illustrations, and primary observations recorded by North American Indigenous Peoples in tribal literature was conducted. This study focused on the medicinal plants used by various tribes, analyzing their properties and traditional applications.

RESULTS

This section is organized by the most used herbs, highlighting their utilization by indigenous tribes across North America for the treatment of various urinary tract signs and symptoms that may be consistent with the present-day diagnosis of a urinary tract infection (UTI) (Tables 1 and 2). Understanding the locations and migration patterns of these tribes is essential, as it directly correlates to the natural habitats of the herbs and their usage patterns discussed in this paper. Indigenous tribes distinguished between plants such as mint and bearberry through careful observation of key characteristics, including appearance, taste, smell, texture, and color. These sensory cues—along with knowledge passed down through oral tradition and hands-on experience—served as reliable methods for plant identification. Traits like leaf shape, growth pattern, and habitat were also used to differentiate species. While this differs from modern taxonomic classification, it was highly effective within its cultural and ecological context.

Geographic Distribution and Migration Patterns of Indigenous Tribes

The Indigenous tribes mentioned in this study are distributed across various regions in North America. The Cherokee primarily resided in the southeastern United States, particularly in areas that are now Georgia, Tennessee, and North Carolina.(2) The Ojibwa and Cree tribes were predominantly located in the northern United States and Canada, spanning from the Great Lakes region to the plains of Manitoba and Saskatchewan (Figure 1).(3) The Innu and Inuit tribes of Canada inhabited regions in northeastern Quebec and Labrador, and the Arctic regions, respectively. (4) The Iroquois Confederacy, including tribes like the Mohawk, Onondaga, and Seneca, were primarily located in the northeastern United States, especially New York.(5) The Micmac and Wampanoag tribes were situated in the northeastern United States and eastern Canada, particularly in present-day Nova Scotia and

Figure 1. Nearly 50 nations of indigenous peoples spanned the 4,000 mile Canadian American continent with as many as 12 distinct languages,. The Cree spoke a form of Algonquian and had a particulalry sophisticated ethno-botanical tradition and plant-based medicine tailored to their subarctic and prarire environs. (By courtesy of Encyclopædia Britannica, Inc. Copyright 2014, used with permission).

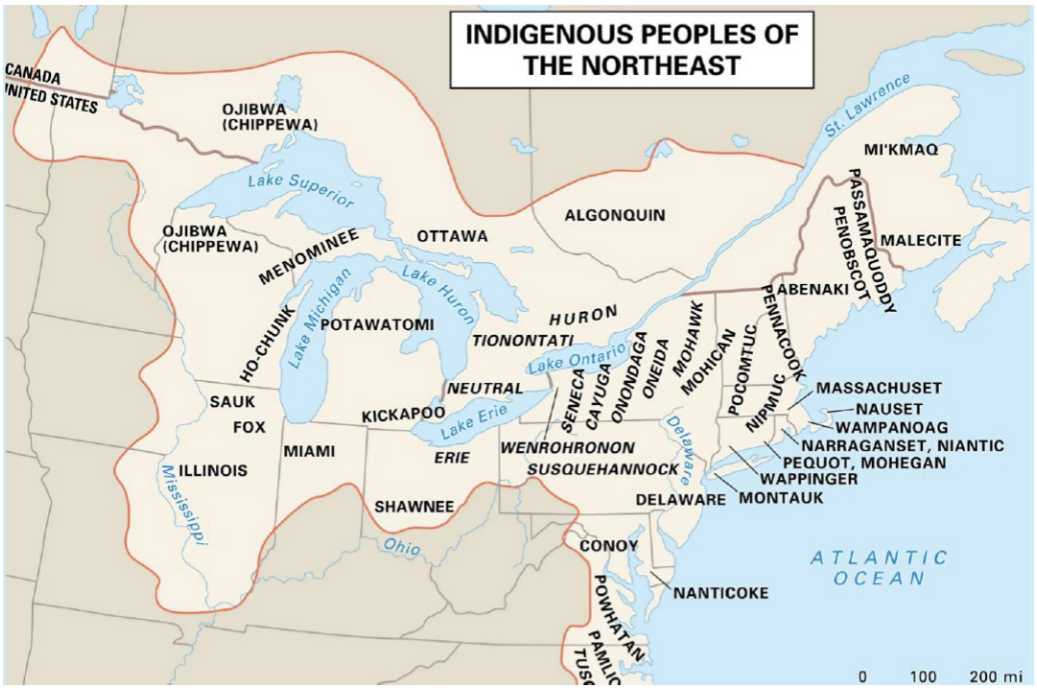

Figure 2. Many modern pharmacological discoveries, including aspirin and berberine-based therapies, have roots in the traditional plant-based medicine of Algonquian and Iroquoian peoples of the Northeast, drawn from trees, roots,and medicinal herbs unique to the region. Beyond compounds, their holistic emphasis on balance, diet, and communal care presaged contemporary approaches to preventive and integrative medicine.(By courtesy of Encyclopædia Britannica, Inc. Copyright 2002, used with permission)

Massachusetts (Figure 2).(6) The Algonquin-speaking tribes were spread across the northeastern United States and southeastern Canada.(7)

Migration patterns of these tribes were influenced by various factors, including climatic changes, territorial conflicts, and European colonization. For example, the Cherokee were forcibly relocated to Oklahoma during the Trail of Tears in the 1830s, while the Ojibwa and Cree gradually moved westward due to European settlement and fur trading pressures.(8,9) Maps illustrating the historical and contemporary locations of these tribes provide a visual understanding of their distribution and migration patterns (Figure 1 and 2).(10, 11)

Growth Patterns of Wild Mint (Mentha arvensis)

Wild Mint thrives in moist environments, such as the banks of rivers and streams, wetlands, and damp meadows. It is widely distributed across North America, aligning well with the territories traditionally inhabited by the Cherokee, Ojibwa, and Cree, who used Wild Mint as medicine (Figure 3),(10, 12). The overlapping presence of wild mint in these regions highlights its significance and availability as a natural remedy in these indigenous communities.(13)

Use and Documentation of Wild Mint

The Cherokee, Ojibwa, and Cree, along with Algonquin, and tribes throughout the landscape of present-day California used wild mint to make teas and to treat various urinary, gastrointestinal, and respiratory ailments.(13) Wild Mint tea was used to relieve the discomfort associated with urinary disorders through its diuretic properties, soothe stomachaches, aid digestion, and alleviate symptoms of colds and coughs. According to the historical medical records of a Cherokee physician, "Mint grows in great abundance in most parts of America, on the banks of streams and in wetlands. It has a strong aromatic smell, and a warm, rough, bitter taste. It possesses properties like those of the peppermint but in a smaller degree. It may be used in decoction, oil, or essence...The spearmint is said by some to be an efficacious remedy for suppression of urine."(14) The Ojibwa and Cree tribes similarly utilized the leaves of Wild Mint for their antimicrobial and diuretic properties,

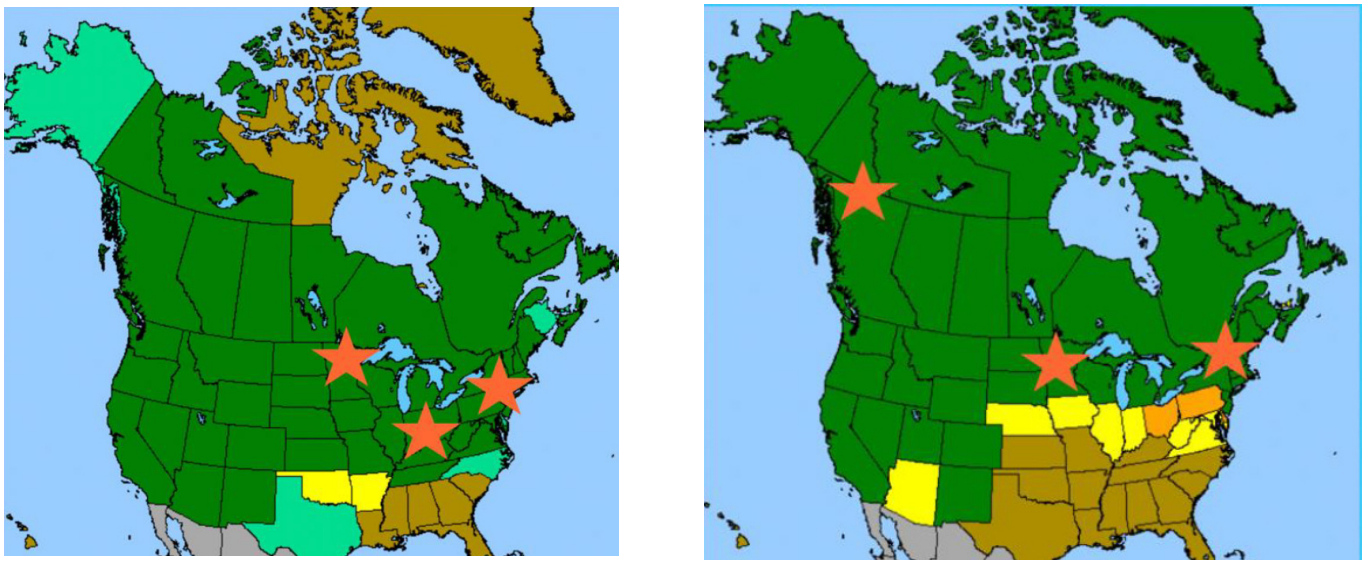

Figure 3. (Left) Growth patterns of Wild Mint (*Mentha arvensis*), where the species grew natively highlighted by green, and the geographic locations of the Cherokee, Ojibwa, and Cree tribes, indicated by orange stars, respectively. (Right) Native growth pattern of Bearberry and the geographic locations of the Cree, Innu, and Inuit peopels (left to right, orange stars, respectively).

making it a versatile remedy for urinary disorders and other health problems.(15)

Growth Patterns of Bearberry (Arctosyaphylos iva-ursi)

Bearberry is a low-growing evergreen shrub found in the northern regions of North America. It thrives in dry, sandy soils and open woodlands, well-aligned with the regions inhabited by the habitats of the Cree, Innu, and Inuit tribes (Figure 3). This plant is well-adapted to cold climates and is often found in boreal forests and tundra regions. Bearberry's ability to grow in nutrient-poor soils and its tolerance for cold temperatures made it a resilient and accessible plant for indigenous communities in these areas.(16)

Use and Documentation of Bearberry

The Cree and Innu tribes used Bearberry leaves to prepare teas and poultices.(17) The antiseptic and diuretic properties of arbutin, found in Bearberry leaves, make it effective for treating urinary disorders and documented UTIs.(18) The Inuit used Bearberry similarly, brewing it into a tea that promotes urination and flushes out bacteria from the urinary tract. Additionally, Bearberry was used for other ailments, including kidney stones. Bearberry has a long history of medicinal use. According to the Health Library at Mount Sinai, "Uva ursi (*Arctostaphylos uva ursi)*, also known as bearberry (because bears like eating the fruit), has been used medicinally since the 2nd century... Native Americans used it as a remedy for urinary tract infections."(19) This highlights the longstanding significance of Bearberry in traditional medicine and its specific application for urinary symptoms.

Growth Patterns of Cranberry (Vaccinium macrocarpon)and Mossberry (Vaccinium oxycoccos)

Cranberry is a native North American shrub that grows in bogs and wetlands, particularly in the northeastern regions where the Iroquois, Micmac, Wampanoag, and Algonquin-speaking tribes resided. This plant thrives in acidic, peat-rich soils and requires a steady supply of water which makes the wetland habitats ideal for its growth (Figure 4 left).(12) Cranberry plants have long, trailing vines and produce small, red berries that are harvested in the fall. (20-23)

Mossberry, also known as the small cranberry, is found in the northern regions and cold climates of North America. They thrive in bogs and wetlands, similar to its relative, the larger cranberry. This plant is well-suited to the harsh conditions of the Arctic and sub-Arctic regions, where it grows close to the ground and spreads through a network of trailing vines (Figure 4 right). Mossberry plants prefer acidic, nutrient-poor soils and are commonly found in peat bogs and wet meadows.(20)

Use and Documentation of Cranberry and Mossberry

The Iroquois used cranberry and mossberry to prevent and treat urinary disorders, and possibly UTIs, by potentially inhibiting bacteria from adhering to the urinary tract lining.(24) The Micmac and Wampanoag tribes also utilized cranberry, making it a staple in their medicinal toolkit. The Algonquin-speaking tribes documented the use of cranberry in traditional remedies, highlighting its efficacy in preventing recurrent urinary

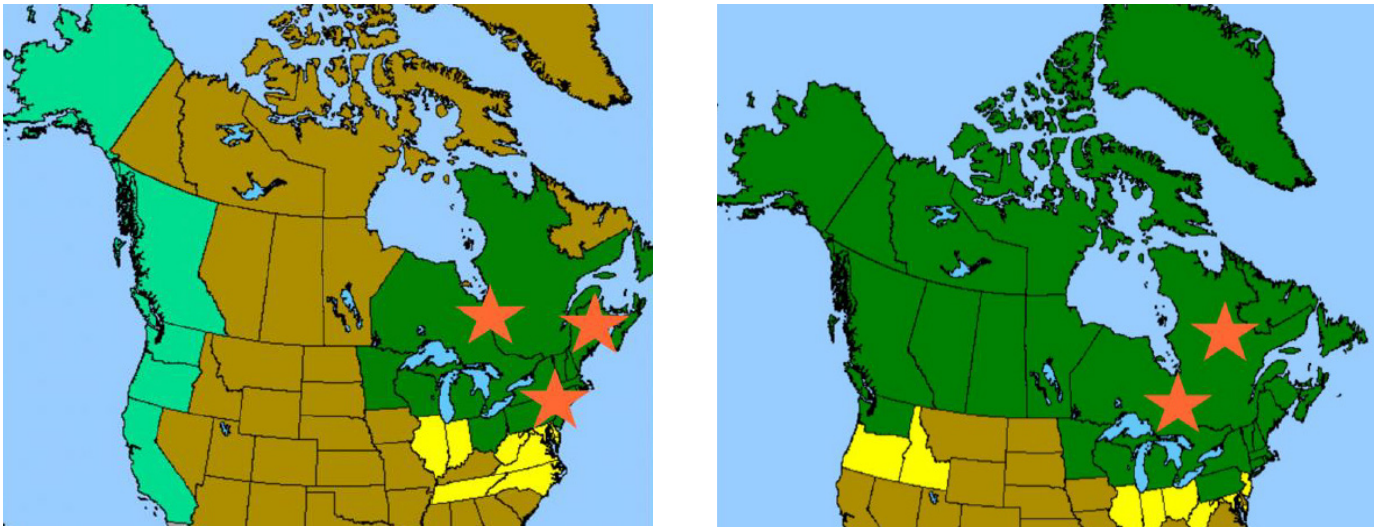

Figure 4. (Left) Native growth pattern of cranberry (*Vaccinium macrocarpon*) used extensively by the Iroquois, Micmac, and Wampanoag Algonquin speaking tribes (left to right orange stars, respectively). (Right) Native growth pattern of Mossberry (*Vaccinium oxycoccus*) (green), used extensively by the Cree and Aloconguin speaking tribe (left and right orange stars, respectively).

disorders consistent with UTIs.(25)

A notable insight into the historical and nutritional significance of cranberries is provided by the gastronomist Jessica Loyer (University of Adelaide), who states, "The cranberry provides an ideal case study for historicizing the construction of the superfoods trend and examining its relationship to hegemonic nutrition because it has a history of human use as a healthful food in North America dating to pre-colonial times."(24) This highlights the cranberry's long-standing role in both Indigenous medicine and nutrition, underscoring its continued relevance in modern health contexts (Figure 5).

Growth Patterns of Goldenrod (Solidago spp.)

Goldenrod is a genus of flowering plants found in meadows, prairies, and open woodlands across North America. It thrives in well-drained soils and full sunlight, making it a common sight in disturbed areas such as roadsides and fields. Goldenrod is characterized by its tall, slender stems and clusters of bright yellow flowers that bloom in late summer and early fall. The plant's adaptability to a range of soil types and conditions makes it widely accessible to many indigenous tribes.

Use and Documentation of Goldenrod

The leaves and flowers of Goldenrod were utilized for their diuretic properties and potentially play a role in the mechanical excretion of bacteria from the urinary tract. The Eastern Cherokee mixed Solidago odora with other herbs to treat urinary problems. The herbs utilized by both the Cherokee and the Ojibwa tribes are listed in Table 1 and Table 2. Historically, "goldenrod (Solidago canadensis or Solidago virgaurea) has been used on the skin to heal wounds. The name Solidago means 'to make whole'."(19) Research indicates that *Solidago virgaurea* extract exhibits significant antibacterial and anti-inflammatory properties, making it effective in treating UTIs. Wojnicz et al. found that the extract limits the survival of bacteria and reduces biofilm formation, which is crucial in managing chronic and recurring UTIs.(26) This highlights Goldenrod's potential as a complementary treatment in combination with antibiotics to enhance the therapeutic outcomes for the treatment of UTIs. Goldenrod has been widely used by Indigenous groups across North America. According to Moerman in Ethnobotany in Native North America, there are 19 species of goldenrod used by Indigenous groups.(16) The diverse usage of Goldenrod underscores the plant's importance in traditional medicine and its versatile healing properties.

DISCUSSION

The traditional medicinal practices of Indigenous tribes in North America are a testament to their deep understanding of the natural world and its healing properties. Descriptions of urinary symptoms by Indigenous groups were typically framed in holistic views of the body. Symptoms such as painful urination, difficulty voiding, or frequent urination were described in terms reflecting imbalance, heat, and inflammation. Remedies were chosen based on observed efficacy and traditional knowledge passed orally through generations. The use of specific plants was often tied to their perceived properties—such as cooling, cleansing, or diuretic effects—and their ability to restore balance.(16) The use of Wild Mint, Bearberry, Cranberry, Mossberry, and

Figure 5. Native American Ho-Chunk men and women harvesting wild cranberries (Vaccinium macrocarpon) near Black River Falls, Wisconsin, circa 1900. For the Ho-Chunk and other Native nations of the Upper Midwest, cranberries were not only a seasonal food source but also held importance in trade and traditional medicine. (Photograph by Charles Van Schaick, courtesy, Wisconsin Historical Society)

Goldenrod in treating urinary symptoms demonstrates the sophisticated knowledge these communities had in addressing health issues using available natural resources.

The findings from this study underscore the need for integrating traditional Indigenous knowledge with modern medical practices. The documented long-term use of these herbs in treating urinary symptoms provides a foundation for developing alternative and complementary therapies to antibiotics, especially in the face of increasing antibiotic resistance.

By understanding and respecting the traditional uses of these herbs, contemporary medicine can explore sustainable and holistic approaches to treating UTIs. This integration requires a multidisciplinary effort, combining ethnobotany, pharmacology, and clinical research to validate and standardize these traditional remedies. This review not only honors the legacy of Indigenous medicine but also paves the way for innovative treatments in the face of global health challenges.

CONCLUSION

This manuscript reviews the use of herbs by the Indigenous People of North America to treat urinary tract infections and disorders in the pre-antibiotic era. The historical use of these herbal remedies highlights the extensive knowledge and application of natural medicine in indigenous cultures, offering valuable insights for contemporary healthcare practices.

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Herb	Uses	Implementation
White Snake Root (Pool Root)	Gravel, diseases of the urinary organs, fever	Used in decoction or tincture form. The root is stimulant, tonic, and diuretic with a warm, aromatic taste.
Skervish (Frost-Root)	Gravel, diseases of the urinary organs, incontinence, suppression of urine, inflammation of the kidneys, and gout	Employed fresh or dry in decoction, infusion, tincture, extract, or oil form. The plant is astringent, diuretic, and sudorific.
Horse-Mint	Weak bowels and stomach, diuretic for urinary discharge, promotes perspiration	Leaves and top used in a decoction.
Strawberry (*Frigaria*)	Diseases of the kidneys and bladder, suppression of urine, jaundice, and scurvy	Fruit is used, but vine can be used when fruit is unavailable.
Tobacco (*Nicotian Tobacum*)	Diuretic, emetic, cathartic, antispasmodic, sudorific, expectorant, anthelmintic	Leaves steeped in vinegar or warm water for external application, tincture for internal use.
Rush (Cah-no-yah)	Gravel, incontinence	Decoction of the rush is diuretic and safe for consumption in large quantities.
Smart Weed (Oo-ne-ta-we-tag-tse-ker)	Gravel, suppression of urine, strangury (painful discharge of urine)	Decoction thickened with wheat bran or cornmeal used as a poultice.
Indian Hemp (Cah-ter-lah-tah)	Pox, incontinence, uterine obstructions, rheumatism, asthma, coughs	Root infusion taken in gill doses every three to four hours.
Flax Seed	Gravel, burning in making water, violent colds, coughs, diseases of the lungs	Flax seed tea or syrup made with honey.
Sumach (Black and White)	Clap, strangury (painful discharges of urine), gleet, ulcerated bladder	Decoction of the root, berries used as a tonic.
Silk Weed (*Asclepias Syriaca*)	Sexually transmitted infection, incontinence, gravel	Root used in decoction, tonic for laxative purposes.
White Elder (*Sambicus Niger*)	Incontinence, urinary issues, mild ailments in children	Inner bark used in decoction or tincture form, flowers for mild ailments.
Pumpkin (*Cucurbita Pepo*)	Gravel, incontinence	Decoction of seeds, oil from seeds.
Queen of the Meadow (*Spergula Ulmaria*)	Diseases of the urinary organs, incontinence, gout, rheumatism	Root used in strong decoction.
Parsley (*Apium Petroselium*)	Inflammation of the kidneys and bladder, suppression of urine, incontinence, female obstructions	Top and root used in decoction.
Cat-Tongue (We-sek-kah-char)	Diseases of the kidneys and bladder, suppressed urine, gravel	Root used in strong decoction.
Twin Leaf (*Jeffersonia Odorata*)	Incontinence, suppression of urine, gravel, sores, ulcers	Used in tea, decoction, tincture, or syrup form.
Wild Potato (*Convolvulus Panduratus*)	Incontinence, gravel, suppression of urine, coughs, asthma, consumption	Root used in decoction or powder form.
Clap Weed (Oo-stee-cah-ne-quah-le-skee)	Sexually transmitted infection	Root used in decoction or tincture form or chewed.

Table 1 (part 1). List of the herbs commonly used by the Cherokee, along with their specific uses and methods of implementation as documented extensively in *The Cherokee Physician, or Indian Guide to Health*, as Given by Richard Foreman, a Cherokee doctor.

Herb	Uses	Implementation
Poor Robbin's Plantain	Suppressions of urine, gravelly complaints, spitting of blood, epilepsy	Leaves used in decoction.
Highland Big-Leaf (Oo-kah-to-ge-a-quah)	Sexually transmitted infection, gravel, diseases of the urinary organs	Root used in decoction, tonic in spirits.
Southern Yaupon	Incontinence, gravelly complaints	Leaves used in decoction, toasted for tea.
Burdock (*Arctium Lappa*)	Sexually transmitted infection, mercurial complaints, rheumatism, gravel, scurvy	Roots or seeds used in decoction, root in spirits for bitters.
Wild Rats Bane (Winter Green)	Incontinence, diseases of the urinary organs, rheumatism, scrofula, cancers, ulcers	Decoction or bitters, stewed in lard for skin conditions.
Piney Weed (No-tse-e-yau-stee)	Sexually transmitted infection, bites of copper head or rattlesnake	Decoction taken internally, bruised herb applied externally.
Rattle-Snakes' Master (E-nah-le-up-loh-skoch-la-nur-wa-tee)	Snake bites, stimulant, diaphoretic	Mucilage in leaves.
Wild Mercury	Incontinence, gravel, pox	Root used in decoction.

Table 1 (continued). List of the herbs commonly used by the Cherokee, along with their specific uses and methods of implementation as documented extensively in *The Cherokee Physician, or Indian Guide to Health*, as Given by Richard Foreman, a Cherokee doctor.

Herb	Uses	Implementation
Bush Honeysuckle (*Diervilla lonicera Mill.*)	Urinary remedy, diuretic, and to relieve itching	The root is used together with other plants like Ground Pine to create the most valued urinary remedy among the Flambeau Ojibwa.
Common Burdock (*Arctium minus Bernb.*)	Dissolving urinary deposits, diaphoretic, diuretic, alterative, aperient, and depurative	The root is used as one of the ingredients in a medicine for pain in the stomach. It is also used externally as a salve or wash for various skin conditions.
Joe-Pye Weed (*Eupatorium purpureum L.*)	Chronic urinary disorders, diuretic, stimulant, astringent, and tonic	A strong solution of the root is used to wash a papoose until the age of six to strengthen him. It is also used in the treatment of gout, rheumatism, and hematuria.
Prince's Pine (*Chimaphila umbellata [L.] Nutt.*)	Diuretic, stimulant of the genitourinary tract mucous membrane, renal incontinence, scrofulous conditions, chronic ulcers, and skin lesions	Used as a tea for treating stomach troubles and employed both internally and as an embrocation.
Tamarack (*Larix laricina* [DuRoi] Koch)	Chronic inflammation of the urinary passages, chronic bronchitis with profuse expectoration, and phases of hemorrhage	The dried leaves are used as an inhalant and fumigator.
Wood Nettle (*Laportea canadensis* [L.] Gaud.)	Diuretic properties, cures various urinary ailments	The root is used to make a medicinal tea.

Table 2. Urinary Herbs Used by the Ojibwa. List of the herbs commonly used by the Ojibwa for urinary ailments, including their specific uses and methods of implementation as documented extensively in the Bulletin of the Public Museum of the City of Milwaukee, Vol. 4, No. 3, Pp. 327-525, Plates 46-77, May 2, 1932, *Ethnobotany of the Ojibwe Indians* by Smith HH.

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DISCLOSURES

The authors received no funding for the preparation or submission of this manuscript.

DECLARATION OF COMPETING INTEREST

The authors declare that there are no competing interests. All contributions were made in good faith and without external influence beyond those acknowledged in the manuscript.

STATEMENT ON USE OF GENERATIVE ARTIFICIAL INTELLIGENCE

The authors affirm that no generative artificial intelligence (AI) tools (e.g., large-language models) were used in the writing, analysis, or figure preparation for this manuscript.

LOCATIONS: HUDSON TOWERS

The structure above, at 263 West End Avenue, New York, was, in the 1920s, to be the Hudson Towers, one of the most innovative hospital concepts in existence, according to its developer, the urologist Leo Buerger featured in this issue of the *IJUH*.(1) The structure was to address the then recognized gap between hospital and home care and which, a century later, still remains a challenge to us. "The distinctive feature that we are aiming at," said Buerger in 1924, "is the human factor in the care and treatment of the patient. The physical side of this is to be accomplished by providing a hospital that will combine… the comforts of a private home and the service of a first class hotel… Relatives of patients, may, if they desire, live there while their sick are being cared for."(2) The projected cost was $3,5 M (> $66 M in 2025 dollars) but cost overruns and the 1929 market crash permanently shuttered the building until it became luxury Co-Ops in 1947.

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