

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 Hovelacque 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.



swald 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

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)

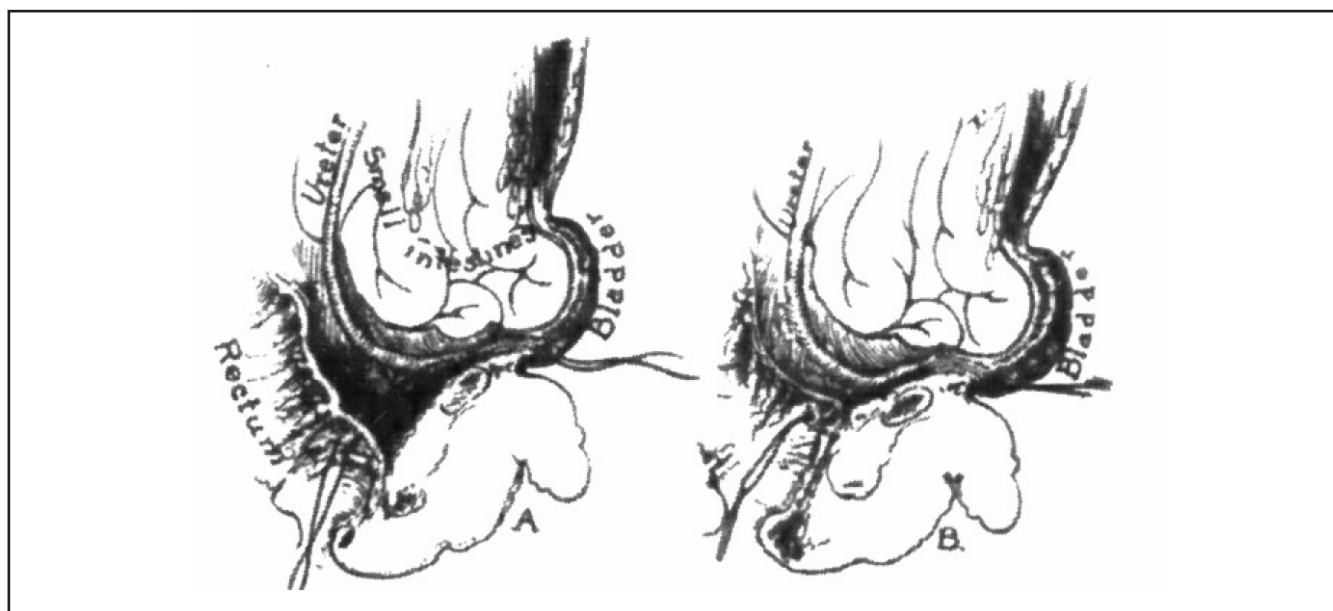


Figure 1. John Simon's method of forming a long fistulous tract between ureter and bowel to address the profound anatomic morbidity caused by exstrophy of the bladder, the first known ureterosigmoidostomy (USS), in 1851, presaging the Bricker ileal conduit by a century (Source: Hinman & Weyrauch, 1936.⁽⁵⁵⁾)

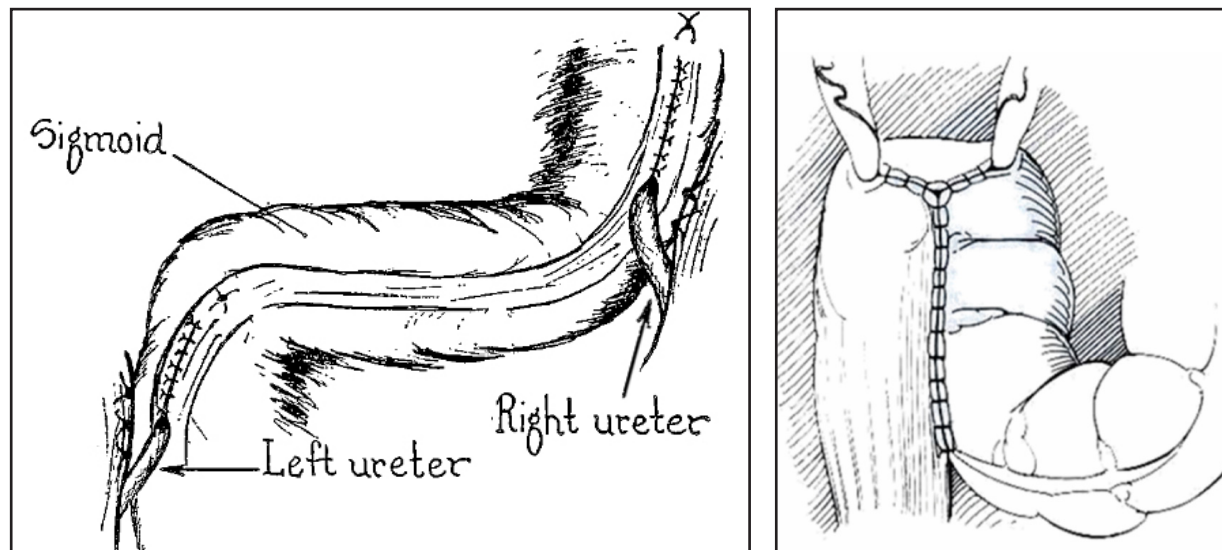


Figure 2. (Left) WF Melick's 1949 modification of the USS thought to avoid ureteral kinking. (Source: WikiCommons) (Right) Sigmoidal-rectal MAINZ II pouch, a partially detubularized USS designed to reduce high intraluminal pressures causing reflux. (13)

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

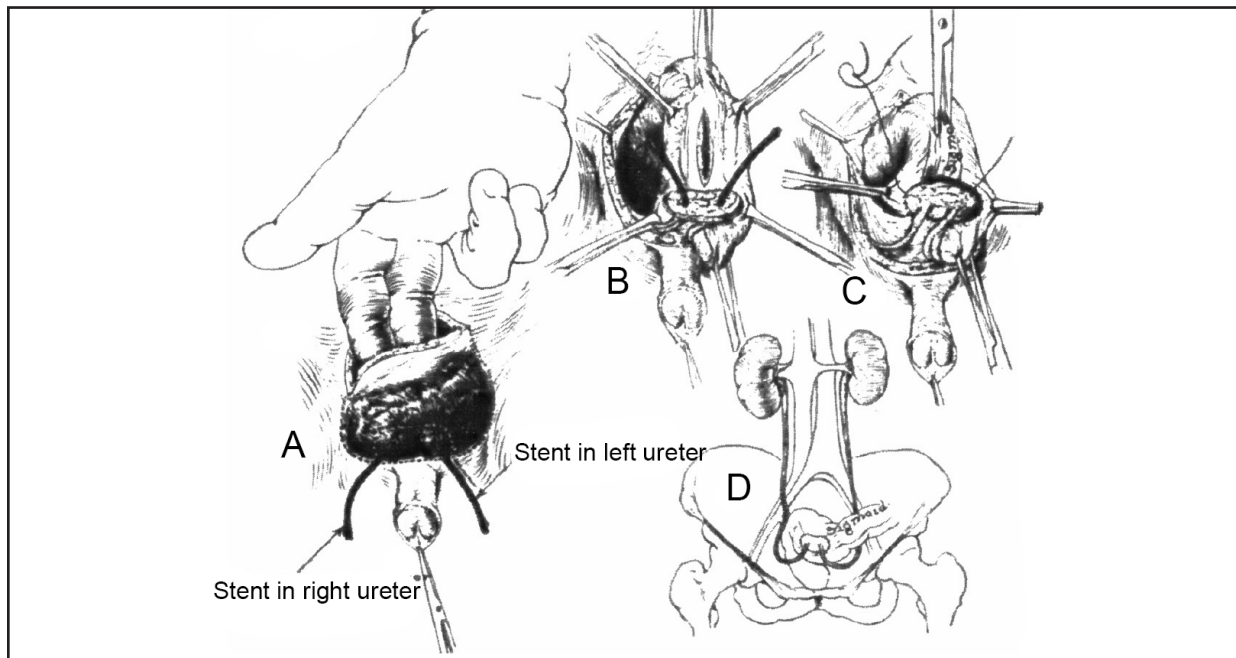


Figure 3. Karel Maydl's 1894 intraperitoneal technique of implanting the trigone (A) and the stented orthotopic ureteral orifices (B) of the exstrophic bladder into the sigmoid colon (C) and his final result (D). (Source Hinman F & Weyrauch, 1936)(55).

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 Mauclair 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

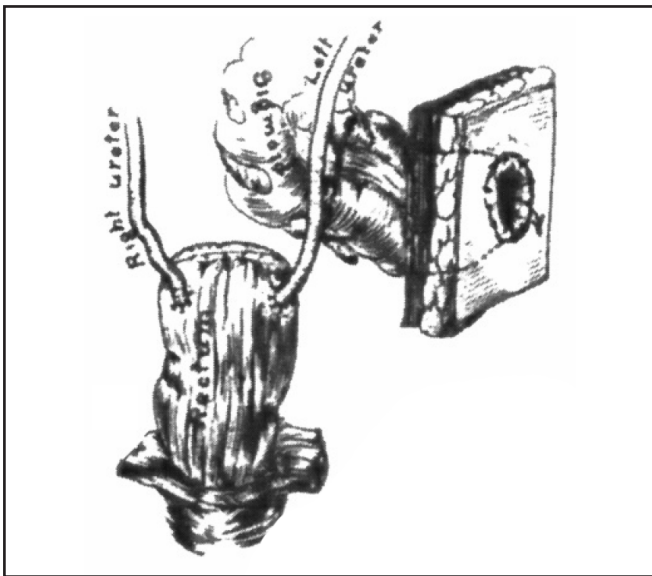


Figure 4. (Left) The first 'rectal bladder' (RB) for bladder exstrophy in 1895 by the pioneering French surgeon Louis Mauclair (1863-1940) associated with a left sided colostomy. (Right) A rectal bladder with the colostomy brought through the anal hiatus, a so called 'anterior perineal inrasphincteric colostomy' 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

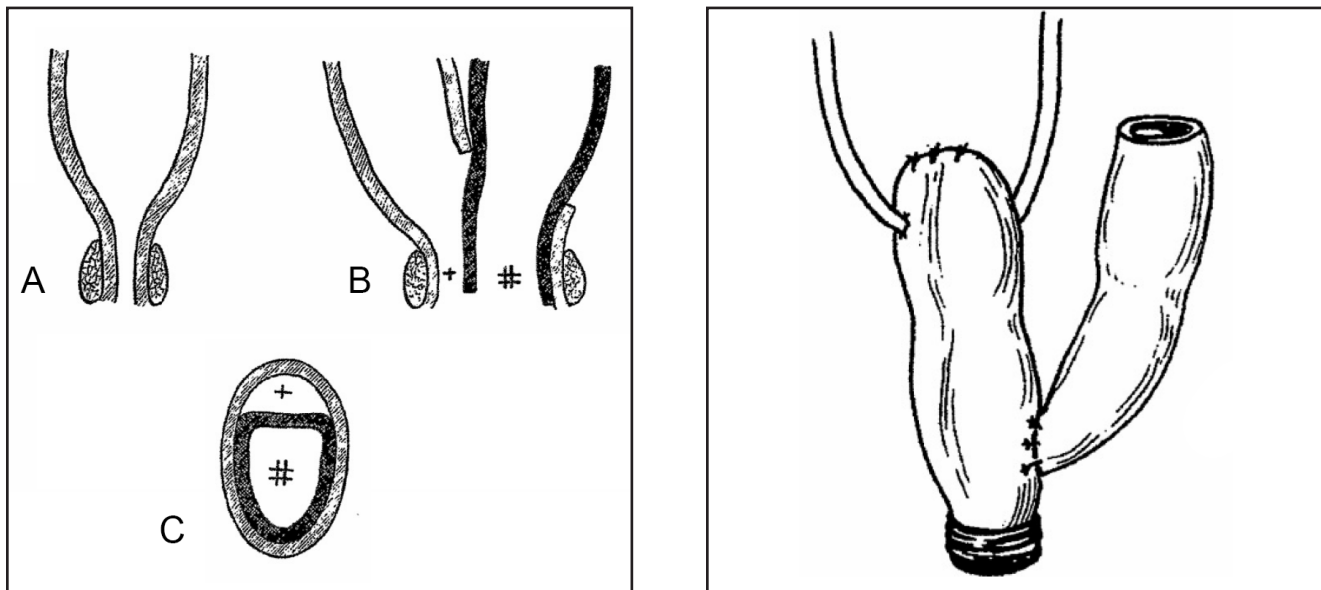


Figure 5. (Left) Schematic of a rectal bladder by Georges Marion showing the (A) native rectum, (B) an intrasphincteric perineal colostomy (black segment), and the isolated USS segment thus allowing the patient to void diverted urinary (+) and fecal (#) streams via the perineum and was initially crowned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

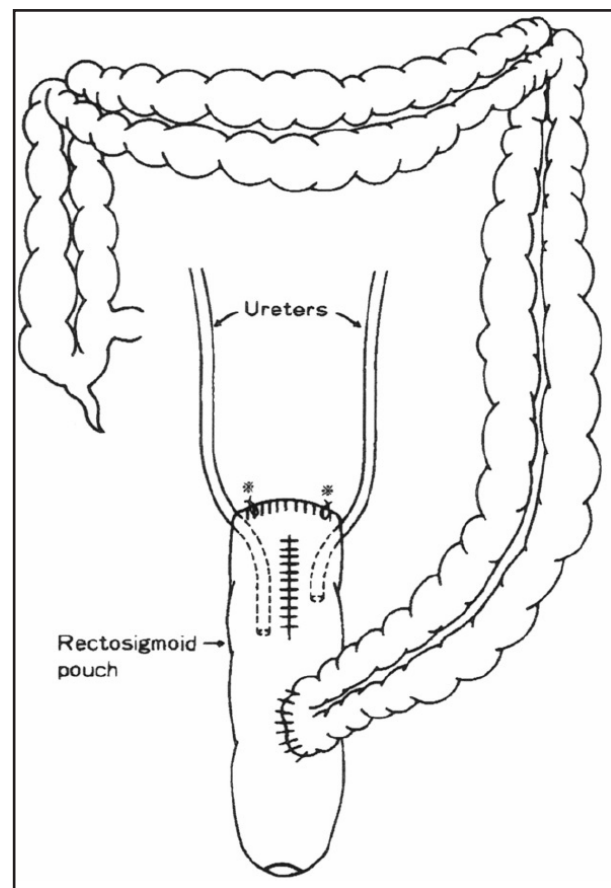


Figure 6. Sadao Kamidono's 1985 version of the RB which hoped to preserve the upper tracts and allow for anal emptying of both urine and feces.(20)

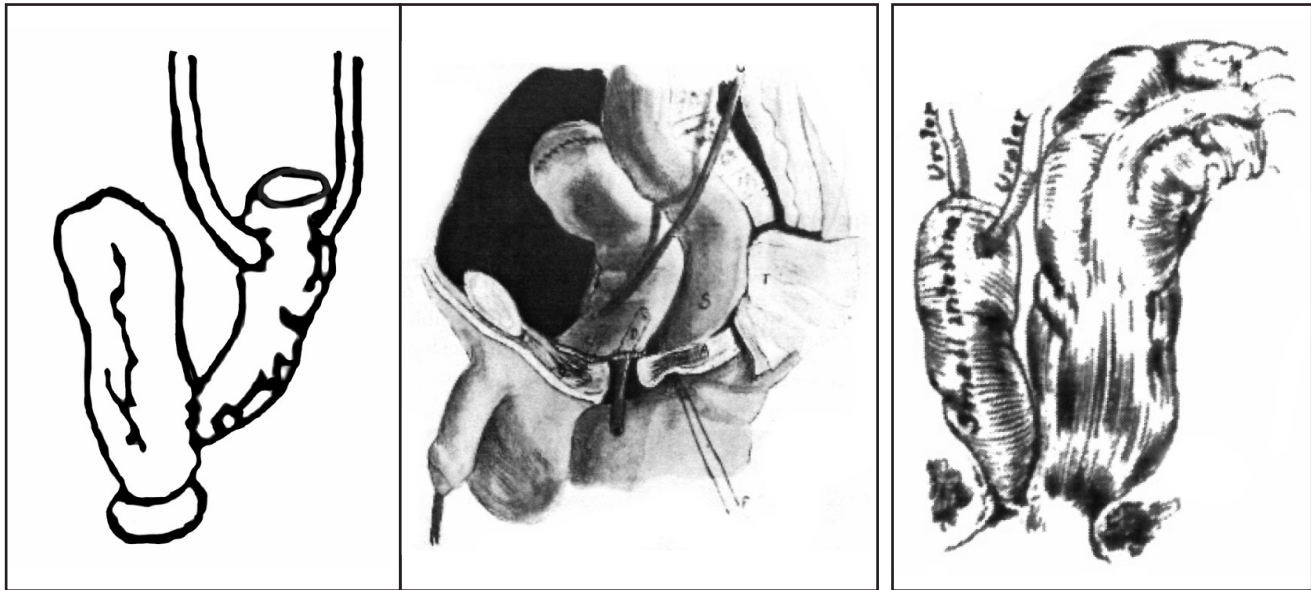


Figure 7. (Left) Schematic showing Werelius' sigmoido-proctostomy and transplantation of ureters into a partially excluded rectum of 1911. (Middle) RB anastomosed to the urethra with a perineal intrasphincteric sigmoid loop by G. Lemoine in 1913. (22) (Right) An ileal resevoid diverted to the intersphincteric 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 Mauclair 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)

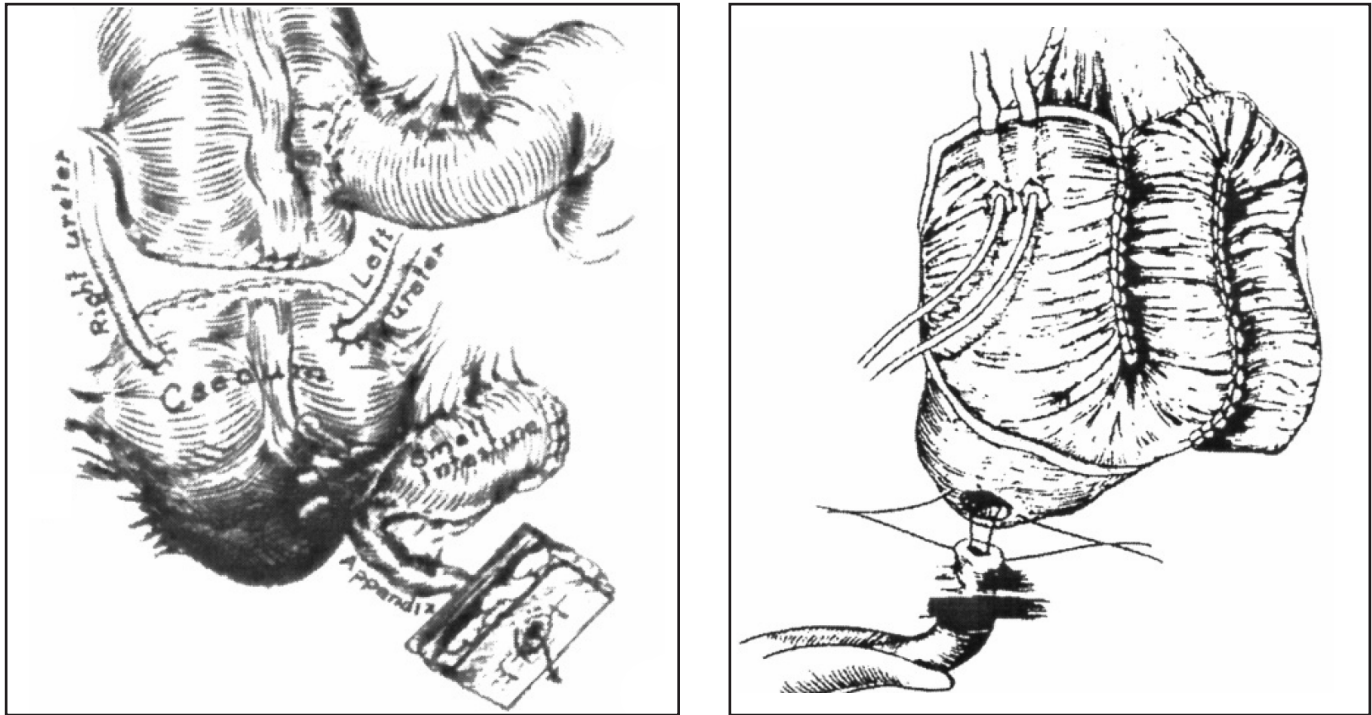


Figure 8. (Left) Verhooogen's ileal cecal reservoir with an appendiceal afferent limb. (Right) A MAINZ I ileal orthotopic diversion

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 abnormalities of jejunum as an isolated segment. Ileum could be more easily 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 Maclair 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

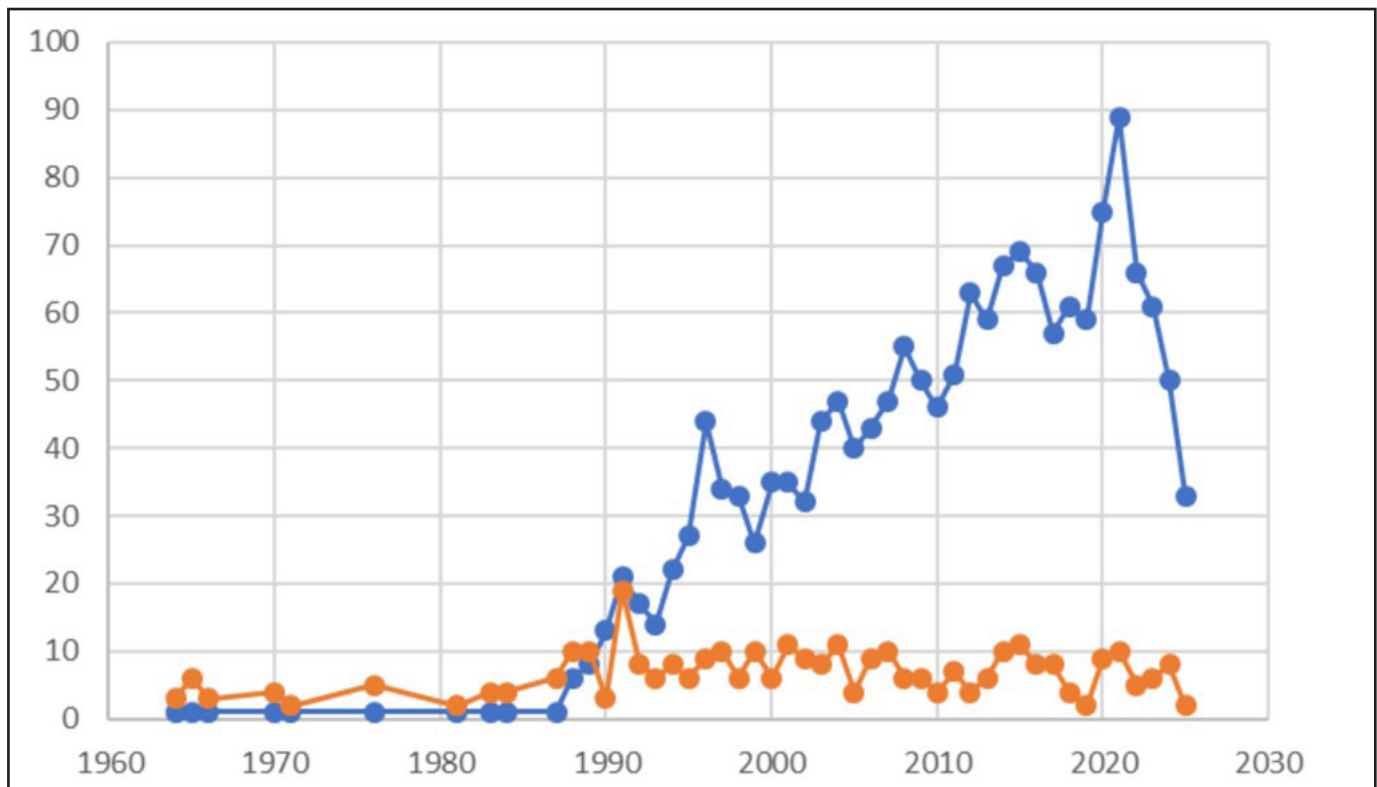


Figure 9. Number of publications from 1965-2025 on the topic of the rectal bladder (orange) versus the use of ileum (blue) for urinary diversion, as derived from the National Library of Medicine's PubMed search engine.

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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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.