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ORIGINAL CONTRIBUTIONS

The Posterior Sagittal Approach: Implications in Adult Colorectal Surgery

Harry E. Bacon Lectureship

Alberto Peña, M.D.

From the Department of Surgery, Division of Pediatric Surgery, Schneider Children's Hospital, Long Island Jewish Medical Center, Clinical Campus of the Albert Einstein College of Medicine, New Hyde Park, New York

Posterior sagittal anorectoplasty was used for the first time in 1980 to treat anorectal malformations. This approach includes a wide exposure, through a midline posterior incision, to determine the limits of the sphincteric mechanism and to place the rectum within its limits. This approach has been used to treat children with anorectal malformations, who underwent conventional procedures that failed. The management of anorectal malformations with this approach rendered significantly better results in terms of bowel control. However, there is still a large number of patients suffering from fecal incontinence and for them a bowel management program was designed to improve their quality of life. The posterior sagittal approach was also used for the treatment of acquired conditions including tumors, post-trauma and postradiation fistulas, and other postoperative complications. A historic review of the posterior approach disclosed that Cripps, a British surgeon, published his experience with a posterior transsphincteric approach to the rectum nine years before Kraske, a German surgeon, whose name has been traditionally associated with the leadership in this approach. Kraske actually approached the rectum through a paramedian incision and never performed a real transsphincteric incision. An experimental study done in dogs by the author demonstrated that it is not harmful to divide the sphincteric mechanism. The posterior sagittal approach represents a useful alternative to treat many pelvic conditions and, therefore, it must be a part of the armamentarium of colorectal surgeons. Fi-

nally, a series of clinical experiences convinced the author that coordinated rectosigmoid motility is the most important single factor in fecal continence and, therefore, our efforts to help patients suffering from fecal incontinence must be aimed at the manipulation of bowel motility. [Key words: Posterior sagittal anorectoplasty; Fecal incontinence; Imperforate anus]

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COLON AND RECTAL SURGERY IN CHILDREN AND ADULTS

Most pediatric surgeons spend a significant amount of their time dealing with colorectal problems in children. Yet, pediatric surgeons and colorectal surgeons have been rather distant. It is conceivable that both groups could create a mutually enriching association by sharing ideas and experiences. The arbitrary separation of the two groups is also inconvenient because it fragments the knowledge of the natural history of many colorectal conditions. For instance, we do not have solid evidence that chronic constipation, fistula-in-ano, and rectal prolapse, to mention only a few conditions seen in pediatrics, are part of the same disease seen by adult colorectal surgeons. It is hoped that this presentation will stimulate a pro-

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ductive dialogue between pediatric surgeons and adult colorectal surgeons.

POSTERIOR SAGITTAL APPROACH FOR THE TREATMENT OF ANORECTAL MALFORMATIONS

Prior to 1953, anorectal malformations were treated empirically and the rectum was pulled down to the perineum through a perineal incision in cases of the so-called "low" defects or by a combination of an abdominoperineal approach for the so-called "high" defects.¹⁻³ Results in terms of bowel control were very poor. In 1953, Dr. Douglas Stephens⁴ of Australia, on the basis of dissection of a few cadavers of children with anorectal malformations, proposed that the rectum should be pulled down as close as possible to the urogenital tract to preserve what he considered the most important element of bowel control, *i.e.*, the puborectalis sling. He also stated that children suffering from high imperforate anus are born without an external sphincter, and, therefore, the puborectalis sling should be preserved as the only potential muscle for continence. For this, he proposed a sacral approach combined with a perineal and/or abdominal stage. This appealing idea was universally accepted, and all of us pediatric surgeons performed operations following the basic principles established by Stephens with minor individual modifications.⁵⁻⁸ All of these procedures included the pulling of the rectum in a blind manner through an anatomic area that was a matter of speculation.

In 1982 we published for the first time our posterior sagittal anorectoplasty for the treatment of these defects.^{9, 10} This consisted of a wide posterior midsagittal incision with the use of an electrical stimulator, which allowed us to explore the basic sphincter anatomy in a detailed manner as well as to establish important correlations among the external anatomy, internal anatomy, surgical technique, and clinical results. The use of an electrical stimulator permits us to determine the precise limits of the sphincteric mechanism and subsequently to place the rectum in an optimal location. The anatomic findings through this approach were very different from the traditional concepts, and, certainly, there was nothing that we could identify with the current conception of the so-called puborectalis sling. The striated muscle mechanism was found to be represented by a funnel-like structure inserted in the pelvis; it runs

down as a continuum to the perineal skin, where one can usually recognize an anal dimple. In this same place, one can find another group of muscle fibers running close to the perineal skin and on both sides of the midline. These were designated parasagittal fibers (Fig. 1).

The funnel-like muscle mechanism is located medial to the parasagittal fibers. It was very obvious that the upper part of this funnel-like muscle structure could be identified with the levator mechanism; it was also clear that we could call the lowest portion of it the external sphincter. We were unable, however, to find any previous description of the middle portion of the funnel and, therefore, the term *muscle complex* was created (Fig. 1). In addition, many other important facts were learned concerning the specific characteristics of the junction between the rectum and urogenital tract. Identifying the parts of this anatomic area is essential in order to repair these defects without provoking serious damage to the urethra, vagina, seminal vesicles, and vas deferens. In retrospect, we now have an explanation for those patients with anorectal malformations previously subjected to blind operations and who suffer from urinary incontinence, urethral stricture, lack of ejaculation, and impotence. It becomes obvious that we should pull the rectum down and place it within the limits of the sphincteric mechanism to take advantage of the available muscle structures. To do this, we have found that it is frequently necessary to tailor the rectum, which is usually very ectatic (Fig. 2).

After the original experience, the use of the posterior approach was extended to treat many other varieties of anorectal malformations,¹⁰⁻¹⁴ the most challenging one being a persistent cloaca.¹² A cloaca is a defect in which the rectum, vagina,

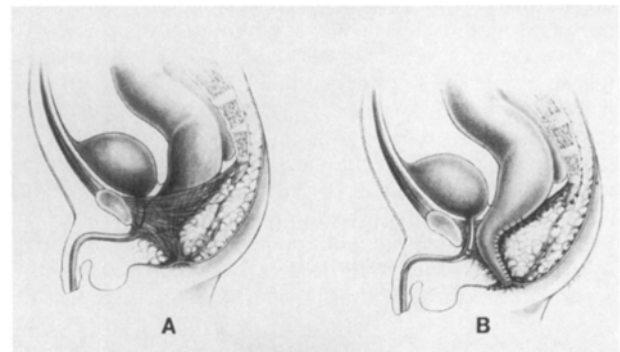


Figure 1. Diagram showing a sagittal view of the anatomy of the most common anorectal malformation in males. A. Before operation. B. Repaired malformation.

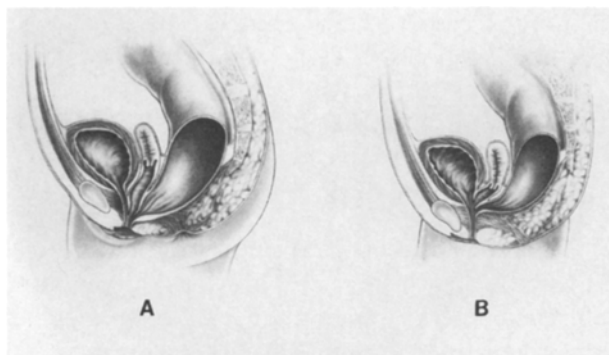


Figure 2. Diagram showing the anatomy of a persistent cloaca. Rectum, vagina, and urinary tract are fused into a single common channel. A. Low cloaca. B. High cloaca.

and urethra meet and fuse into a single common channel (Fig. 3). Before 1982 there was no consistent, rational approach for the treatment of these defects, which are still considered to be the most serious challenge in pelvic malformations. Our goal in the treatment of these defects is to separate the three basic structures (rectum, vagina, and urethra) and reconstruct them with the purpose of

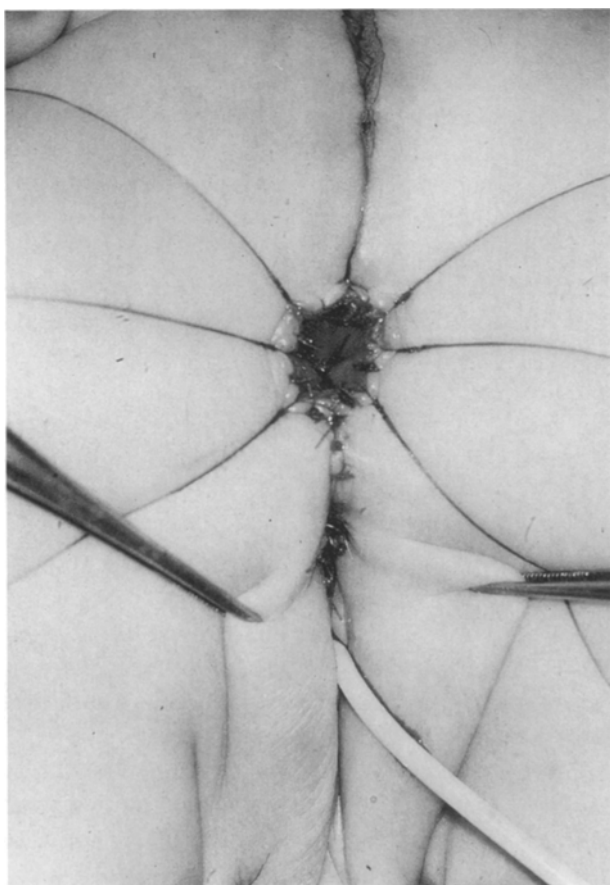


Figure 3. Repaired cloaca. Rectum, vagina, and urinary tract have been completely separated.

achieving bowel control, urinary control, and sexual function. The surgical repair of cloaca deformities entails formidable, long, and tedious operations, requiring very meticulous and delicate techniques.¹² Figure 4 shows repaired cloaca.

We soon learned that we were dealing with a spectrum of defects, which means that some patients were born with rather benign conditions who had a normal sacrum, good muscles, good nerves, and, therefore, a potential to achieve bowel and urinary control. In contrast, others are born with very high defects, poor sacrum, poor muscles, and poor nerves, and, therefore, the results in terms of bowel and urinary function are frequently deficient and sometimes they are totally incontinent.¹³ Yet, the results obtained in the management of anorectal malformations with the new approach are better than those obtained with previous operations.^{5,6,8,13} There is still a long way to go, however, before we can say that we obtain excellent results in all cases.

The posterior sagittal approach has also been used for the treatment of patients who were born with an anorectal malformation and underwent conventional operations but were suffering from fecal incontinence or suffered from a catastrophic complication and required a secondary procedure.¹⁴ The most common finding in patients suffering from fecal incontinence was an anteriorly mislocated rectum; sometimes the rectum was found posteriorly mislocated and sometimes even laterally mislocated (Fig. 5). The treatment in these cases consists in relocating the rectum within the limits of the sphincteric mechanism as well as reconstruction of the sphincters.

The operative findings in patients who suffered

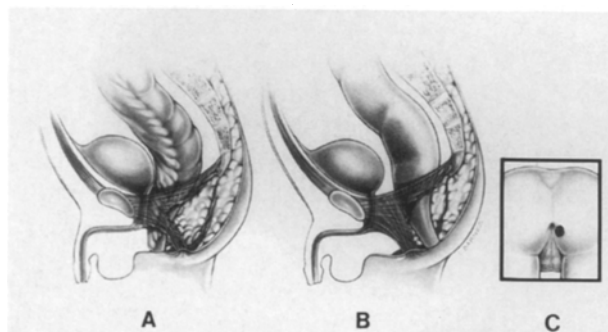


Figure 4. Diagram showing the most frequent operative findings in cases of patients suffering from fecal incontinence after an attempted repair with conventional techniques. A. Anterior mislocation of the rectum. B. Posterior mislocation. C. Lateral mislocation.

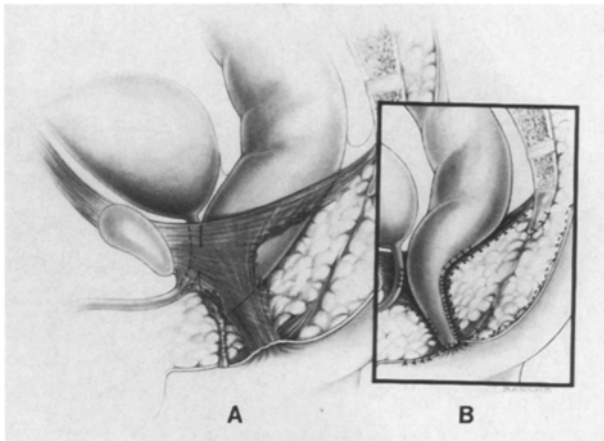


Figure 5. Diagram showing some of the most frequent operative findings in patients who suffer from catastrophic complications during an attempted previous repair with conventional techniques. A. Stenotic mislocated rectum and persistent rectourethral fistula. B. Repaired condition.

from catastrophic complications during previous procedures included stenosis of the rectum, persistent rectourethral or rectovaginal fistula, or acquired urethral atresia (Fig. 6). The clinical results obtained in patients who suffered from fecal incontinence and were subjected to secondary operations *via* the posterior sagittal approach varied; one-third of them experienced a dramatic improvement in bowel control, another third had some clinical improvement, and at least one-third remained incontinent.^{13, 14} Because of this experience, I have now become more selective and consider as "good" candidates for reoperations only those patients who have good sacrum and muscles and evidence of a completely mislocated rectum.

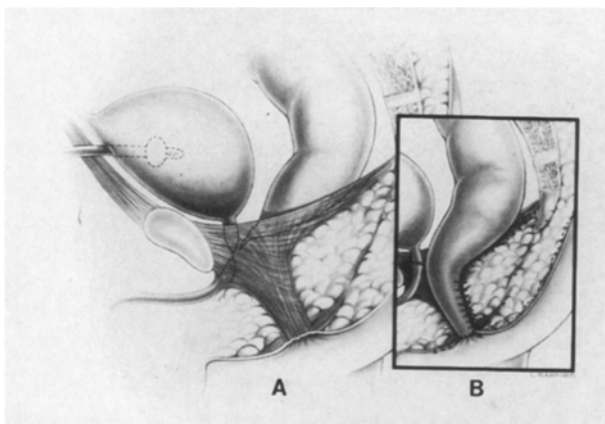


Figure 6. Diagram showing a common complication seen after blind attempts to repair anorectal malformations. A. Acquired urethral atresia and acquired rectal atresia. B. Repaired condition.

Through October 1992, the author's personal series included 699 posterior sagittal operations.

BOWEL MANAGEMENT FOR THE TREATMENT OF FECAL INCONTINENCE

Of all our patients who suffer from fecal incontinence with a history of a previous operation for the treatment of imperforate anus, only a few are considered good candidates for reoperation and the others, who number approximately 200, are subjected to our bowel management program. This has been a very rewarding experience. Most of these patients describe a rather dramatic history of frustration and suffering. They have been socially segregated and live a very secluded life. Many of them have been unsuccessfully subjected to different types of operations aimed at improving their bowel control. The medical treatment they received in the past has been completely empirical. We were unable to find any literature containing logical, consistent, and scientifically oriented management for these patients. In addition, this is a "nonelegant" disease that is kept as a secret. Most patients are unaware of the fact that it is a very common condition. After reviewing their medical records, it is very common for one to read notes by their surgeons indicating that the repair has been technically correct; that the "puborectalis has been well preserved, and therefore, the patients have the capacity to control their bowel movements"; and that, in order to explain why the patients are still incontinent, "they should now be seen by a psychiatrist." My conviction is that most of these patients are mentally healthy, except for the effects of the trauma of being severely handicapped, suffering from fecal incontinence. Because I felt morally obligated to these patients, I decided to try a medical management program implemented by trial and error with the goal of improving their quality of life. Over a period of 12 years, I learned many important lessons and am pleased to say that more than 95 percent of these patients dramatically improved their quality of life and most of the time remain clean.

The evaluation of these patients includes x-ray films of the sacrum and spine, voiding cystourethrogram, magnetic resonance imaging, study of the pelvis, contrast enema with a hydrosoluble material, rectal manometry, and clinical evaluation. Interestingly enough, for the purpose of our bowel

management program, we can now classify all of these patients into two large categories:

1. *Patients with Tendency for Constipation.* All of these patients previously underwent repair of their imperforate anus with a technique that included the preservation of the rectosigmoid. These types of techniques were sacral approaches, anoplasties, and posterior sagittal operations. The contrast enema in this group of patients showed different degrees of megarectum and megasigmoid (Fig. 7). A good enema or colonic irrigation to empty the sigmoid was given and resulted in these patients' being clean at least for 24 hours. In other words, the management of these patients is a relatively easy affair. There was a specific subgroup of these patients who had a good previous operation during which the rectum was well located, and, in addition, the patients have good sacrum and muscles. A sigmoid resection with the preservation of the rectum and an anastomosis between the descending normal-caliber colon and the rectum, as shown in Figure 8, not only improves the problem of constipation but also may render these patients fecally continent.¹⁵

2. *Patients with Tendency for Diarrhea.* This group of patients was previously subjected to op-

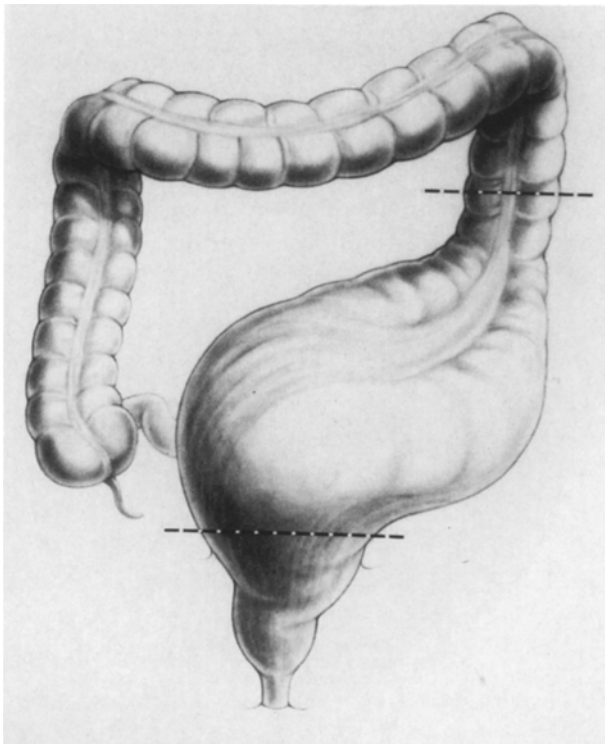


Figure 7. Diagram showing a megasigmoid in patients with severe constipation and pseudo-overflow incontinence.

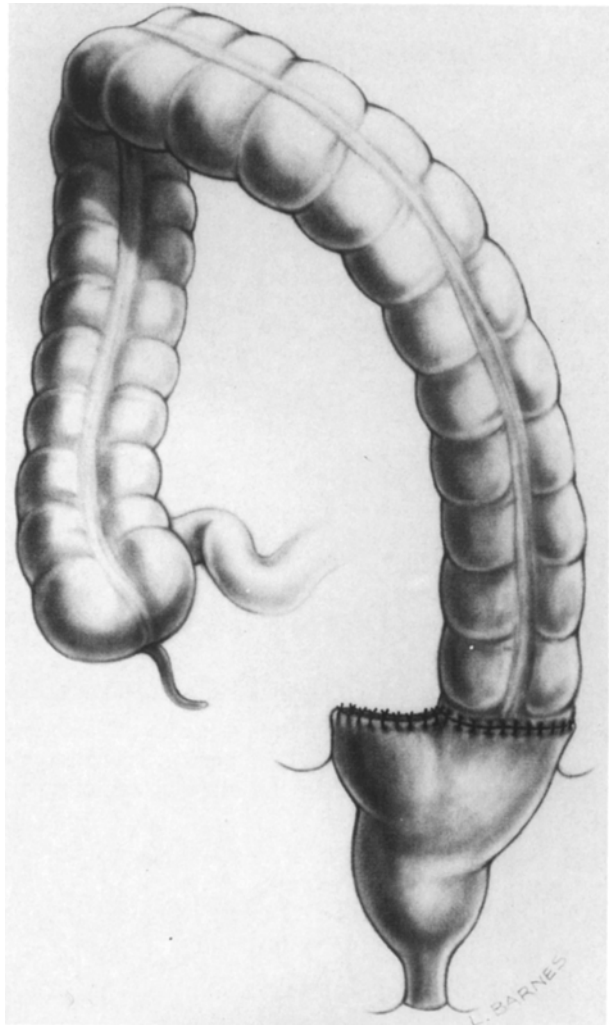


Figure 8. Sigmoid resection and anastomosis of the descending nondilated colon to the rectal pouch.

erations in which the rectosigmoid was resected. This happened in all of the patients who had endorectal dissections or abdominoperineal operations in which surgeons elected to resect the rectosigmoid and pull the colostomy end down to the perineum. In these cases, the natural reservoir of the patient was removed and that explains their tendency to suffer from diarrhea and the constant passing of stool. This is the most difficult group to manage. The treatment in these cases includes colonic irrigations daily, a strict constipating diet, and medications to decrease the colonic motility. A few failures that we had in our experience belonged to this category and underwent the opening of a permanent colostomy. The contrast enemas in these patients showed typical findings, including normal size of colon, good motility, and absence of rectosigmoid (Fig. 9).



Figure 9. Contrast enema in a patient with the tendency to suffer diarrhea after surgical treatment of an imperforate anus, including the resection of the original rectosigmoid of the patient.

POSTERIOR SAGITTAL APPROACH FOR THE TREATMENT OF ACQUIRED CONDITIONS

During the last several years, many patients have been referred to the author because they suffered from acquired conditions that might be approached posteriorly. This included tumors, post-trauma and postradiation fistulas communicating the rectum to the urogenital tract, presacral masses, and complications secondary to failed attempts to treat Hirschsprung's disease.¹⁶ In comparing the clinical results obtained after the repair of anorectal malformations¹³ with the results obtained from the management of acquired conditions, the most conspicuous impression that one gets is that this last group of operations are easier to perform and the results in terms of urinary and bowel control are better. This group of patients also provided a great opportunity to compare the anatomy of the sphincteric mechanism in patients with normal anatomy with that in patients born with anorectal malformations. The conclusion derived from this experience is that children with anorectal malformations do have all of the basic components of the normal sphincteric mechanism but with different degrees

of hypodevelopment. On one side of the spectrum we find patients with a good prognosis and almost normal sphincters, whereas, on the other side, we find patients with minimal voluntary sphincteric mechanism. The basic components of the sphincteric mechanism for patients suffering from anorectal malformations described earlier in this presentation, are seen in normal individuals but fully developed (Fig. 10).

Many patients successfully operated on posteriorly were originally suffering from conditions for which several previous approaches were unsuccessfully attempted either through the abdomen or the perineum. Therefore, it is my conviction that this approach must be part of the armamentarium of colon-rectal and general surgeons and is particularly useful to treat conditions located in the pelvis in a place too high to be approached through the perineum and too low to be approached through the abdomen. The division of the entire sphincteric mechanism in the midline, followed by a meticulous reconstruction, has been innocuous and did not interfere with fecal continence.

Based on the experience obtained during the surgical exploration of all of those patients referred to me who had had failed attempted repairs for Hirschsprung's disease with other techniques, and impressed by the magnificent exposure obtained with this approach, I decided to perform primary pull-throughs for the treatment of Hirschsprung's disease via the posterior sagittal approach. This has been done in three cases: the patients recovered uneventfully; they are fully continent; and the resection of the rectum and the rectal anastomosis after the pull-through were performed in a smooth and

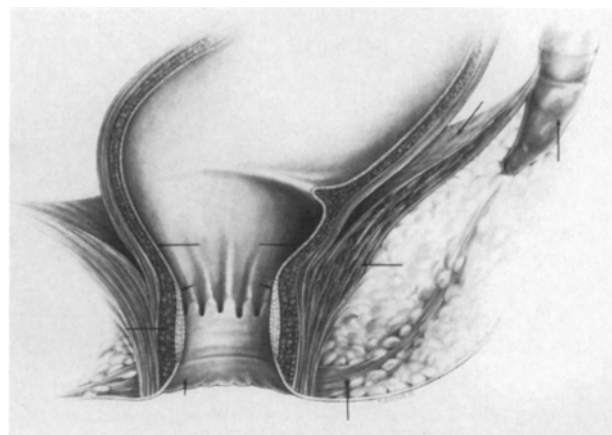


Figure 10. Schematic representation of the normal sphincteric mechanism.

easy manner (Fig. 11). The same approach has been used for the treatment of one patient with ulcerative colitis. Again, the resection of the rectum was carried out easily without the need for an endorectal dissection, and the ileoanal anastomosis was performed in a very precise and easy manner.

TRANSANORECTAL APPROACH

During the last four years, a novel approach has been used for the treatment of a very challenging congenital defect called persistent urogenital sinus in patients with normal rectum.^{16, 17} These are females with a urogenital sinus. Most of them have a low, implanted vagina and that condition can be treated perineally. However, a few cases have a very high, implanted vagina that is very difficult to mobilize through the perineum or through the abdomen. For this specific type of patient, a transanorectal approach was performed. Figure 12 shows a diagram of the perineum and the incision of a patient with a urogenital sinus. In these cases, the entire normal rectum was divided including the posterior and anterior portions of the sphincteric mechanism and posterior and anterior rectal walls (Figs. 13 and 14). The vagina was separated from the urinary tract, followed by a circumferential dissection that allowed its mobilization to place it in a normal position. Four of these patients were operated on with a previously performed protective colostomy. One additional male patient was approached the same way for the treatment of an infected cystic seminal vesicle that provoked inter-

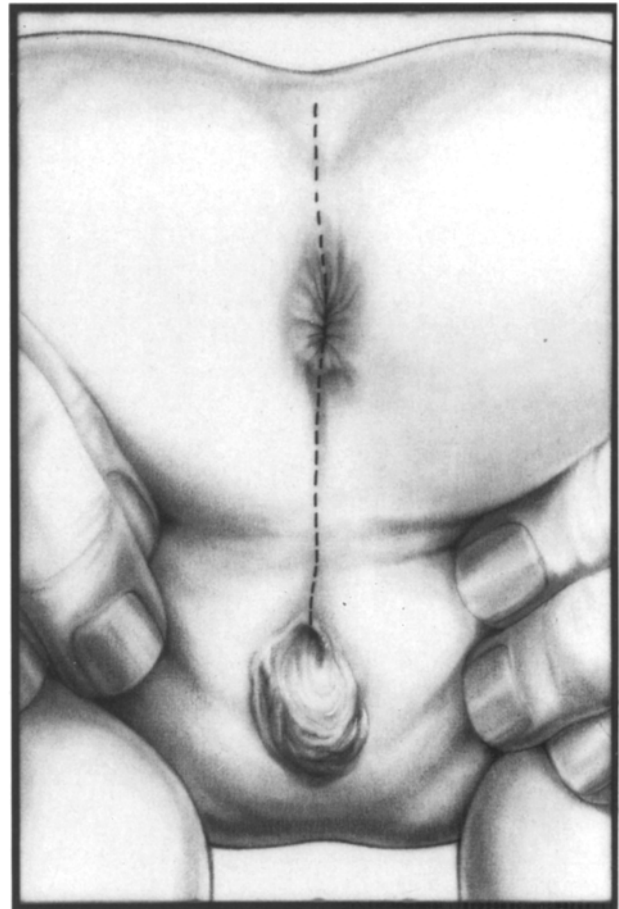


Figure 12. Transanorectal approach for the treatment of a urogenital sinus. Diagram showing the perineum and incision.

mittent epididymitis, and that particular patient was operated on with a strict bowel preparation but without a colostomy. This experience has not been previously published. All patients recovered very well and enjoyed normal bowel and urinary function.¹⁷

HISTORIC PERSPECTIVE OF THE POSTERIOR APPROACH IN ADULTS

An exhaustive literature review was conducted to learn the history of the posterior approach to the rectum. Many adult surgeons refer to Kraske's operation when they hear about the posterior sagittal approach. From the literature review, several important lessons were learned. Kraske¹⁸ actually published data on his posterior approach in 1885 for the treatment of rectal tumors. Interestingly enough, his incision was a paramedian one and not a real transsphincteric. Even more interesting is the fact that in 1876, 9 years before Kraske, a British surgeon named Cripps¹⁹ published a more aca-

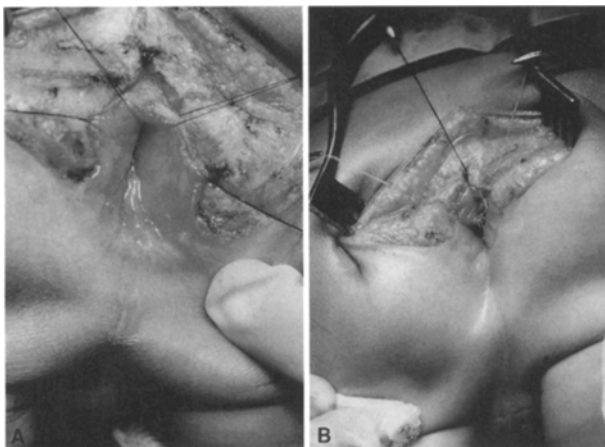


Figure 11. Operative view of the rectum of a patient with Hirschsprung's disease during a posterior sagittal approach. A. Open rectum prior to the resection of the aganglionic segment. B. Suture of the normal ganglionic rectum to the anal canal.

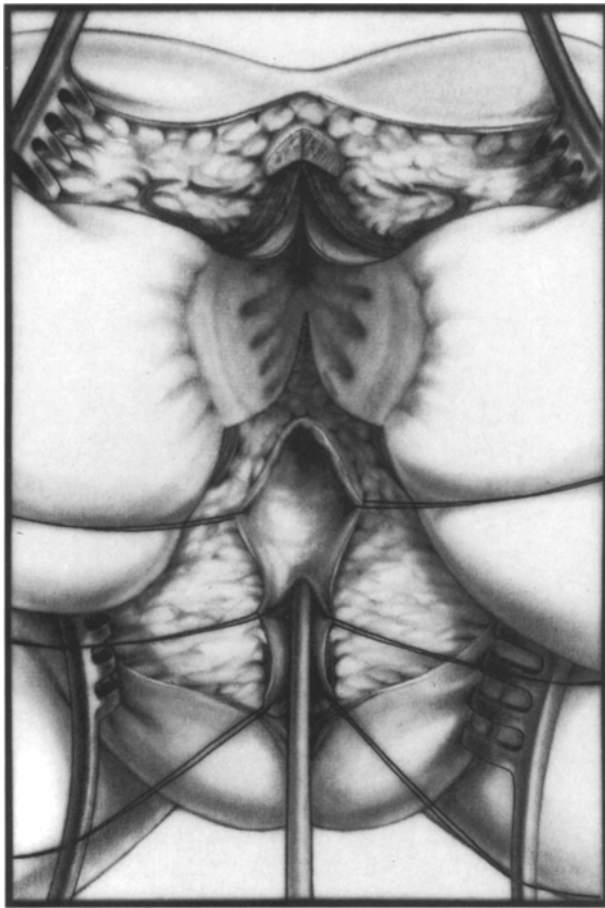


Figure 13. Diagram showing the anatomy of a urogenital sinus exposed by a transanorectal approach. The rectum has been completely divided, including the posterior and anterior rectal walls.

demically and consistently reported on the posterior approach to the rectum, as mentioned in a comprehensive Jacksonian Prize Essay. His incision was midsagittal and he divided the entire sphincteric mechanism. Hence, if we want to use eponyms, we should call this the "Cripps approach."

There are many historic publications concerning posterior approaches to the rectum. However, most of them did not include midline incisions, and their approaches were not really transsphincteric. A few surgeons were performing real transsphincteric incisions throughout history. Bevan,²⁰ in Chicago, introduced this approach to the United States in 1917. From all of the contemporary surgeons using real transsphincteric approaches to the rectum, Mason²¹⁻²³ became the most prominent leader. He published the largest series and proved that the patients preserved bowel control after division of the sphincters.

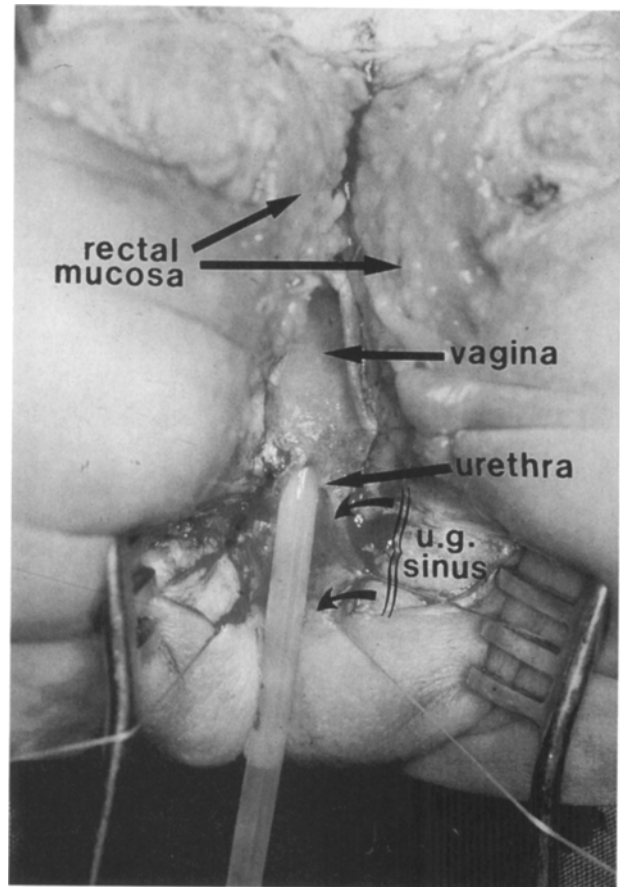


Figure 14. Operative findings, transanorectal approach of a urogenital sinus.

IS IT HARMFUL TO DIVIDE THE SPHINCTERS?

In spite of previous clinical experiences indicating that the division of rectal sphincters does not have deleterious effects on bowel control, there has been a marked reluctance on the part of the surgical community to perform such operations. I was unable to find any experimental evaluation of the potential damage of this approach on bowel control. Therefore, an experimental study in dogs was recently concluded at our institution.²⁴ One group of animals underwent a posterior sagittal incision, without opening of the rectum, including the division of all of the sphincteric mechanism posterior to the rectum. Another group of animals underwent a transrectal division of the rectum and the entire sphincteric mechanism, posterior and anterior to the rectum. A third group of animals underwent perirectal dissection of the rectum, preserving the entire sphincteric mechanism. The animals were followed up for three months and were evaluated every four weeks, from the clinical and

manometric point of view. Only those animals who underwent perirectal dissection suffered from fecal incontinence and severe manometric abnormalities, in spite of the fact that we preserved their entire sphincteric mechanism. Our explanation is that we denervated their anal canal and they were left, therefore, with no sensation. The division of the sphincters posterior and anterior to the rectum proved to be an innocuous maneuver.

SURGICAL TREATMENT OF FECAL INCONTINENCE

Many operations have been designed for the treatment of fecal incontinence. These include the creation of new sphincters using gracilis muscle,²⁵ gluteus muscle,²⁶⁻²⁸ and other tissues from the same patients.²⁹⁻³³ Others have favored the insertion of artificial sphincters,³⁴⁻³⁸ including electronic devices.^{39, 40} The proponents of these procedures claim different degrees of success. Yet, the surgical community as well as the patients subjected to these procedures are not entirely satisfied with the results. My experience has been limited to an experimental study in pigs using a silastic AMS 800 (American Medical Systems, East Minnetonka, MN) hydraulic silastic device, currently used as an artificial sphincter in the urinary tract. This sphincter was implanted in 15 pigs that were previously rendered fecally incontinent with an operation aimed at destroying their sphincteric mechanism. The sphincter proved to be useful to hold the stool inside the colon. However, when the sphincter was deactivated, the rectum did not necessarily empty and the animals required an enema to empty their rectums. In addition, the frequency of local complications, including intrusions and extrusions of the sphincter as well as the incidence of megacolon in these animals, convinced us that, at least at the present time, it is not a good therapeutic alternative for humans.

THE FUTURE IN THE MANAGEMENT OF FECAL INCONTINENCE

Bowel control requires the integrity of three important functional and anatomic elements:

1. *Sensation*
 - A. Exquisite sensation of the anal canal.
 - B. Proprioception.

2. *Sphincters*

- A. Voluntary sphincters (external sphincter, muscle complex, levator muscle).
- B. Involuntary sphincters (internal sphincter).

3. *Coordinated Rectosigmoid Motility*

In retrospect, the bulk of our medical literature dealing with the problem of fecal incontinence has been focused on the possibility of improving sphincteric mechanisms. Very little has been done with the goal of improving sensation, and I was unable to find any publications concerning the improvement of colonic and rectosigmoid motility for the treatment of fecal incontinence.

After 12 years of my dealing with patients suffering from fecal incontinence of different origins and different degrees, the problem of abnormal bowel motility has emerged as perhaps the most important single factor for bowel control. Several important illuminating clinical experiences have been very convincing to reach this conclusion. The first one includes patients who have normal sphincters and normal sensation and yet suffer from different degrees of fecal incontinence due to a very abnormal motility. Under this category, one can see patients who underwent a total colectomy for the treatment of inflammatory bowel disease or for the treatment of total colonic aganglionosis. The terminal ileum in these patients was connected to the anal canal. Even if the operation was meticulously done, many of these patients have a hard time controlling their bowel movements. These patients lost their natural reservoir. They have normal sphincters and normal sensation, and, yet, sometimes they are not effective in controlling the almost constant urgency to pass liquid stool. The second group of patients includes individuals with normal sphincteric mechanism and normal sensation who suffer from a very severe problem of colonic and rectosigmoid hypomotility. These patients complain of severe constipation. Some of them have never had a voluntary bowel movement in their entire life. Instead they have constant soiling, also called overflow pseudoincontinence. They represent a dramatic example of individuals with normal sphincter and normal sensation in whom the only disturbed mechanism is bowel motility. Yet, for all practical purposes, they behave like fecally incontinent patients. If one is able to improve their problem of constipation, they become continent again.

Finally, the most dramatic and illuminating ex-

ample is the rather unusual case of a patient with absent or very damaged sphincters and very poor sensation who happens to have an almost normal coordinated rectosigmoid motility, which produces a bowel movement at a predictable time during the day and which allows the patient to reach the bathroom and remain clean the rest of the time. Here is the example of patients with no sphincters who behave like continent individuals.

Interestingly, the sphincters are used in a normal individual only during very short periods of time, to avoid escape of gas or stool during the episodes of peristaltic waves of the rectosigmoid. The rest of the time the stool remains inside the colon even in the absence of sphincters, provided there is no peristalsis of the rectosigmoid. Theoretically, by manipulating the rectosigmoid motility so as to be able to empty it completely once a day and then by maintaining the rectosigmoid and the colon quiet for the rest of the day, we could keep a patient clean even if the patient had no sphincters.

Therefore, in the near future it is reasonable to believe that we will be able to help many patients suffering from fecal incontinence after we conduct the necessary experimental studies to learn to pharmacologically manipulate the colonic and rectosigmoid motility.

CONCLUSION

The posterior sagittal approach in the treatment of anorectal malformations allows the direct exposure to an anatomic area that was, until recently, a matter of speculation. This approach allowed us to perform a more rational type of repair, to preserve the available structures useful for bowel control, to avoid damage to neighboring structures, and, finally, to obtain better clinical results. The posterior sagittal approach has many other potential applications, both in pediatrics and adult colorectal surgery, particularly in dealing with conditions located too high to be approached through the perineum and too low to be reached through the abdomen. This approach represents a useful alternative and, therefore, it must be a part of the armamentarium of colon rectal surgeons. The sphincteric mechanism both anterior and posterior to the rectum can be divided in the midline without interfering with bowel control provided it is done in the midline and reconstructed in a meticulous way. Lateral dissection of the rectum, particularly

in the area of the anal canal, must be avoided to prevent nerve damage.

The importance of the sphincteric mechanism in bowel continence probably has been overemphasized. Our efforts to help patients who suffer from fecal incontinence must be mainly directed toward knowing more about the coordination of colorectal motility and the possibility of learning about its pharmacologic manipulation.

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