

A. Peña • A. Hong

## The posterior sagittal trans-sphincteric and trans-rectal approaches

Received: 16 December 2002 / Accepted: 10 January 2003

**Abstract Background** The posterior sagittal, transsphincteric approach to treat different pelvic problems has been known since the last century. Although some surgeons have embraced it and have enthusiastically advocated its use, it has never become an overly popular technique. The purpose of this study is to evaluate the advantages and disadvantages of the approach, both from a historical perspective and from the authors' experience. **Methods** The international literature on the subject was reviewed since 1877 up to the present date. A retrospective evaluation of the authors' experience was conducted. Specific attention was paid to the final result obtained in the treatment of the original condition, surgical complications and the effect of the surgical approach, on bowel and urinary control. **Results** The review included 114 patients divided into two groups. Group A included 85 patients who underwent a posterior sagittal trans-sphincteric approach. Group B included 29 patients who underwent a posterior sagittal transanorectal approach, in which the anterior wall of the rectum and the sphincter were divided. Postoperative bowel control was normal in all patients except in those whose basic condition had resulted

in fecal incontinence, or who had sustained an irreversible injury prior to the operation. Urinary control was normal except in cases with pre-operative incontinence. Complications included recurrence of rectogenito-urinary fistulae in 3 cases, rectocutaneous fistula in 3 patients with Hirschsprung's disease, and 2 partial wound dehiscences. **Conclusions** The posterior sagittal trans-sphincteric approach represents a useful technical alternative. It seems to be particularly useful to treat complications after surgery for Hirschsprung's disease, presacral masses, acquired rectogenito-urinary fistulae and idiopathic rectal prolapse. The transanorectal approach provides excellent exposure to the posterior urethra and vagina. Bowel and urinary control are not compromised.

**Key words** Trans-sphincteric approach • Trans-rectal approach • Hirschsprung's disease • Presacral mass • Urogenital sinus • Rectal prolapse

A. Peña (✉) • A. Hong  
Division of Pediatric Surgery  
Schneider Children's Hospital  
269-01 76th Avenue, New Hyde Park, NY 11040, USA  
E-mail: psarp@lij.edu

### Introduction

There are multiple clinical conditions, including congenital anomalies, tumors and complications from trauma and injury, that require difficult surgical exposures for treatment. These lesions, located in the region posterior to the pubis and anterior to the concavity of the sacrum, seem to be located too low to be approached comfortably through the abdomen. On the other hand, when approached through the perineum, the lesions then appear to be very high. The inability to achieve adequate exposure in this particular area, perhaps, is the most plausible explanation for many anatomic misconceptions and surgical technical errors that occur during operations performed in this territory.

A posterior approach, between the buttocks, provides a definite advantage to operations performed for these conditions. There are, however, different modalities and variants

to this approach. It is possible to approach these patients posteriorly, but not through the mid-line, which can be called "posterior parasagittal approach". Also, a posterior incision can be extended laterally to the sacrum, in order to reach higher places in the pelvis. This could be called a "parasacral approach". When the incision is located in the mid-line and divides the entire sphincter mechanism posterior to the rectum and anus, the approach is called "posterior sagittal trans-sphincteric" (PSTS).

The posterior approach has been used in the pelvis not only for the repair of rectal conditions, but also to have access to pelvic structures located anterior to the rectum. When the rectum is mobilized laterally to achieve exposure of the genitourinary structures, the approach receives the name of "posterior sagittal pararectal approach".

Finally, the senior author A.P. has experience with the posterior sagittal incision dividing both posterior and anterior rectal walls as well as posterior and anterior sphincter mechanisms, which then is called "posterior sagittal transanorectal" (PSTA) approach.

The name Paul Kraske [1] has been extensively and repeatedly used when referring to the origin of the posterior sagittal approach. Dr. Cripps [2], in England in 1877 (eight years before Kraske), discussed 36 cases of rectal cancer operated by him using a PSTS approach: he did not use a colostomy. In 1901, Weir [3] published 3 cases of patients with rectal cancer operated on via a PSTA. Arthur Bevan in 1917 [4] is perhaps the surgeon who should be credited with the initiation of this approach in the United States. Between 1943 and 1969, other authors [5, 6] presented short series of patients operated on with this kind of approach.

The most prominent contemporary leader of the trans-sphincteric approach in adults is unquestionably Dr. York Mason [7–9]. When treating recto-urethral fistulae using this approach, he worked with Dr. Kilpatrick, a urologist [10]. From the 1970s and until this day, several authors have developed a degree of experience with this approach [11–50]. Most of them have published short series. The most prominent are represented by Stephenson [43], Carbonell [45], Madsen [46] and Huber [47].

Diverting colostomy as an adjunct to prevent post-operative complications was first recommended by Kilpatrick and Mason [10]. The overwhelming majority of surgeons that used the trans-sphincteric approach reported that bowel control after that operation was good. Through history, there have been enthusiastic surgeons that have supported the use of this approach. Yet, nowadays, it is used rather rarely; at least that is the impression that one gets from the present day literature. This paper represents a retrospective review of the senior author's experience in the use of this approach, mainly in adults, in conditions other than congenital anorectal malformations. The main purpose is to re-evaluate the applications and advantages of this approach, as well as its limitations and potential complications.

## Materials and methods

A Medline search of the international literature on the subject was performed, going as back as far as the last century, and concluding with the present date. Only papers that described a midline PSTS approach were included in this review. The senior author's experience includes 1325 patients with anorectal malformations operated on posterosagittally, and 114 patients, mainly adults, with other conditions. This last group represents the material of this publication.

On 10 August 1980, the senior author, for the first time, explored a child suffering from an anorectal malformation using the PSTS approach and dividing the entire sphincter mechanism located posterior to the urethra. All the available techniques prior to 1980 were based on the belief that children with anorectal malformations, particularly those born with the so-called high malformations, had only one potentially useful muscle that played a role in fecal continence. This muscle, called the puborectalis, theoretically inserted in one side of the posterior aspect of the pubic bone, extended posteriorly to surround the urethra and then swung anteriorly again to insert into the other side of the posterior pubis [51]. It was believed that this muscle was the only functionally useful structure in the reconstruction of patients with anorectal malformations. However, there was significant disagreement related to the actual location and characteristics of this structure. In reality, no one had actually seen the muscle except in post-mortem dissections. The anatomic structures found that particular day, and during all the following explorations, were radically different to what had been previously described. Figure 1 shows the general characteristics of the sphincter mechanism in a male child with imperforate anus and recto-urethral fistula, which is the most common defect seen in males [52, 53]. Further experience in female patients revealed findings that are generally similar to those depicted in Fig. 1 [54]. These findings are considered the basis for current techniques used to repair these malformations. Our clinical experience,



**Fig. 1** Sagittal view showing the general characteristics of the sphincter mechanism seen in the most common type of anorectal malformation in male patients (From [54], with permission)

before and after an experimental study [55], made us believe that the division of the sphincteric mechanism followed by a meticulous reconstruction did not interfere with bowel control. This has also been studied by another group [56].

We retrospectively evaluated the senior author's series, including only patients approached posterosagittally by trans-sphincteric and transanorectal approaches, for the treatment of pelvic conditions other than anorectal malformations. The medical charts were reviewed; patients were contacted by letter, phone or personal interview. Information was obtained concerning type of condition, operative complications, functional sequelae such as fecal or urinary incontinence, and results in the treatment of the specific conditions. One hundred and fourteen cases were reviewed. The ages varied from 1 month to 85 years with a mean of 16 years. The follow-up varied from 16 years to 3 months.

## Results

The patients were distinguished into two groups (Table 1):

- Group A: 85 patients operated on by a posterior sagittal trans-sphincteric (PSTS) approach. This group included 49 cases of Hirschsprung's disease, 15 presacral masses, 10 rectal tumors (6 carcinoma, 2 villous adenomas, 1 inflammatory pseudotumor and 1 leiomyosarcoma), 7 acquired recto-urinary fistulae and 4 patients with idiopathic rectal prolapse.
- Group B: 29 patients operated on by a posterior sagittal transanorectal (PSTA) approach. This group included 12 women with a urogenital sinus with normal rectum; 8 patients with acquired urethral stricture or atresia and 9 patients with a posterior urethral mass.

**Table 1** Medical conditions indicating surgery in 114 patients, by type of surgical approach

| Clinical indication                                     | Patients, n |
|---------------------------------------------------------|-------------|
| Posterior sagittal trans-sphincteric approach           |             |
| Hirschsprung's disease                                  | 49          |
| Primary operation (n=21)                                |             |
| Secondary operation (n=28)                              |             |
| Presacral mass                                          | 15          |
| Rectal tumor                                            | 10          |
| Acquired rectogenito-urinary fistula                    | 7           |
| Rectal prolapse                                         | 4           |
| Total                                                   | 85          |
| Posterior sagittal trans-anorectal approach             |             |
| Urogenital sinus                                        | 12          |
| Urethral stricture or acquired (post-traumatic) atresia | 8           |
| Posterior urethral mass                                 | 9           |
| Total                                                   | 29          |

**Table 2** Posterior sagittal trans-sphincteric (PSTS) approach for Hirschsprung's disease

|                                     |                           |
|-------------------------------------|---------------------------|
| Patients, n                         | 49                        |
| Age, years                          | 6.8 (0.5–23) <sup>a</sup> |
| Previous operations, n              | 28                        |
| Primary cases, n                    | 21                        |
| Covering stoma, n                   | 15                        |
| Postoperative fecal incontinence, n | 5                         |
| Rectocutaneous fistula, n           | 3 <sup>b</sup>            |

<sup>a</sup> Values are mean (range)

<sup>b</sup> None had a covering stoma

## PSTS approach

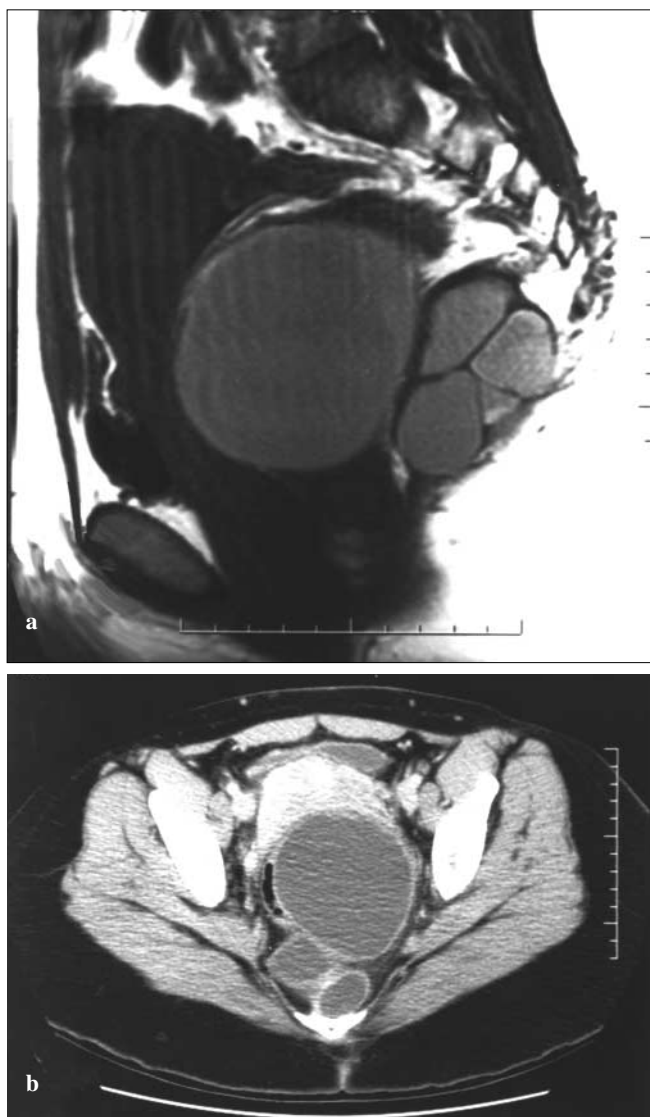
### *Hirschsprung's disease*

A total of 49 patients were operated on posterosagittally for the treatment of Hirschsprung's disease (Table 2). Complications that led to referral included strictures, anastomotic dehiscence and retraction, rectocutaneous fistulae, or acquired recto-urethral or vaginal fistulae. Three patients had previously undergone Duhamel's operation, and suffered from intractable constipation. The PSTS approach allowed the resection of the aganglionic pouch, resection of any strictured bowel and closure of any abnormal fistula when indicated, and dissection of the normo-ganglionic bowel and re-anastomosis above the pectinate line.

This experience gained in re-operative surgery prompted us to use the approach in primary cases of Hirschsprung's disease. Twenty-one patients underwent primary repair by this approach. In each of the three patients, who developed rectocutaneous fistulae, a colostomy was then created and the fistulae closed. In retrospect, it is not surprising that a fistula formed, given that in each case a sphincter mechanism was present that closed the rectum below the anastomosis. Furthermore, an aggravating factor is the fact that it is actually a T-shaped anastomosis, since it is a posterior sagittal incision plus a transverse bowel anastomosis. Because of this, we now use the transanal approach for most cases of primary Hirschsprung's disease, and use the posterior sagittal approach for re-operations. It truly seems to be the ideal way to treat many of the patients who have suffered catastrophic complications after previous failed operations.

### *Presacral Masses*

Fifteen patients with presacral masses were operated on by this approach. The average age was 19.2 years, with a range of 3 months to 47 years. Histologic diagnoses included teratoma, dermoid, lipoma, anterior meningocele or a combination of these. Most patients complained of constipation pre-operatively. One patient came to the hospital for the first time when she was 19 years old and suffered from an unexplained abscess in the area of the coccyx. She was found to have an infected teratoma. Magnetic resonance imaging (MRI) renders the best images of this type of condition. Figure 2 pre-



**Fig. 2a, b** MR images of a presacral mass. **a** Sagittal view. **b** Transverse view

sents an MR study, showing a presacral mass. Included in this group are two patients that suffered from chronic draining sinuses previously operated on multiple times under the belief that they had a recurrent pilonidal sinus. In reality, both of the patients had chronically infected teratomas.

The approach includes the complete division of the posterior sphincter mechanism, removal of the mass, and reconstruction of the sphincter. Postoperative bowel control was unchanged in all cases. There were no cases of postoperative fecal incontinence, and those patients who had significant constipation prior to the procedure continued to have the same problem.

#### Rectal tumors

Our experience has been limited to 10 cases (Table 3). All patients were approached posterosagittally; the entire posterior sphincter mechanism and distal posterior rectal wall

**Table 3** PSTS approach for rectal tumors

|                                     |                         |
|-------------------------------------|-------------------------|
| Patients, n                         | 10                      |
| Age, years                          | 68 (14–85) <sup>a</sup> |
| Rectal cancer, n                    | 6                       |
| Large villous adenoma, n            | 2                       |
| Inflammatory pseudotumor, n         | 1                       |
| Rectal leiomyosarcoma, n            | 1                       |
| Postoperative complications, n      | 0                       |
| Postoperative fecal incontinence, n | 0                       |
| Cancer recurrence, n                | 2                       |

<sup>a</sup> Values are mean (range)

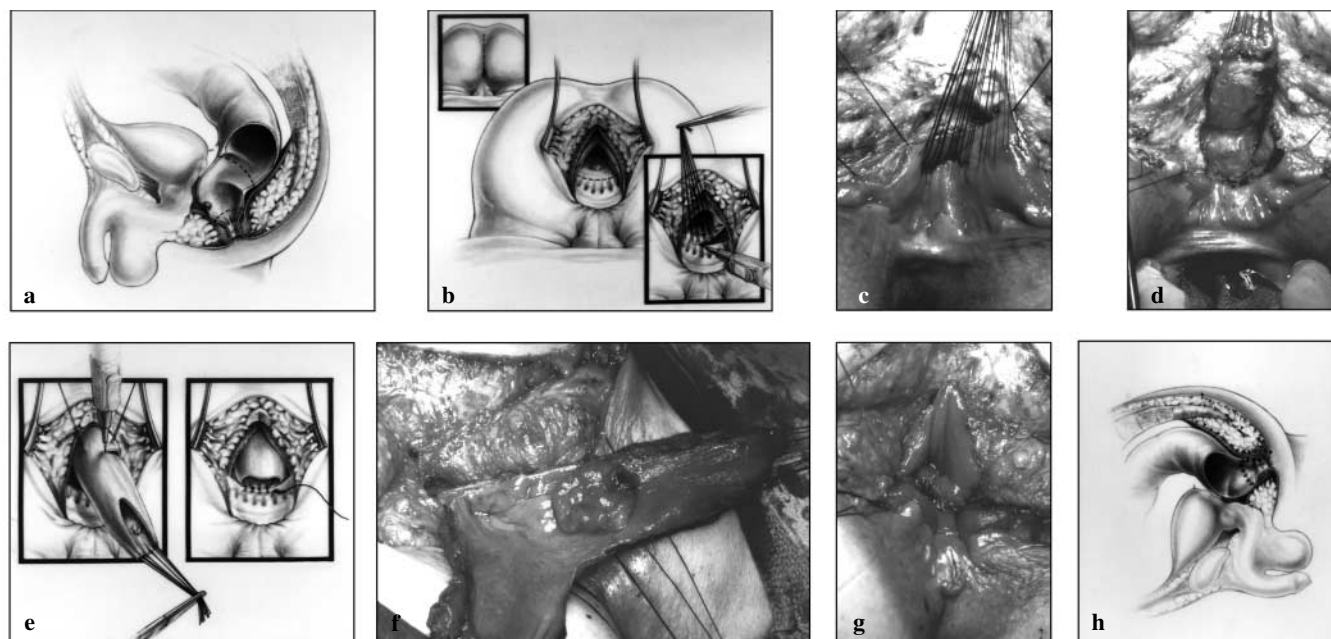
were divided. The rectum was divided transversely 1 cm above the pectinate line, and then dissected proximally in a circumferential manner, pulling it down until an adequate margin above the tumor was reached. The upper rectum was then anastomosed to the lower rectum above the pectinate line. Figure 3 shows the details of the surgical technique used to resect a rectal tumor. All patients recovered from the procedure without complication, and all of them had bowel control after the operation. The operations were found to be technically easy. This experience demonstrates that this approach may be useful for tumors in the rectum. However, the limited number of cases does not allow us to give an opinion about the value of the technique from an oncologic point of view. Of the 6 patients with cancer, 2 died within the first year for unrelated medical reasons.

#### Acquired rectogenito-urinary fistulae

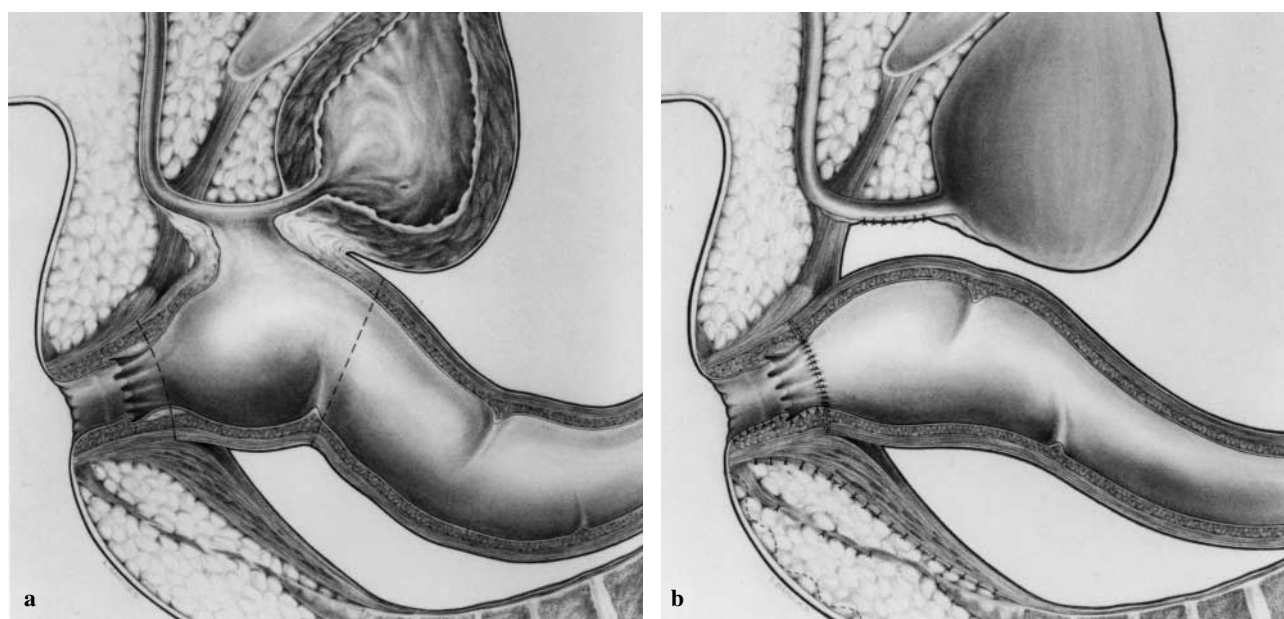
Seven patients were treated for acquired fistulae (Fig. 4a) between the rectum and the vagina or urethra. All 7 cases were associated with radiation therapy: 6 men had prostatic cancer and one woman had cervical cancer. The average age was 61 years (range, 55–66 years). All patients were approached posterosagittally. The technique used was similar to that described for rectal tumors, except that once the proximal rectum was mobilized, the opening in the vagina or urethra was repaired and new rectosigmoid was pulled down, leaving a completely normal anterior rectal wall in front of the urethral or vaginal sutures (Fig. 4b). Three patients, 1 woman and 2 men, experienced recurrences. All three had giant fistulae, measuring 3–4 cm diameter, before surgery. The recurrent fistulae were all small, and healed after repeat operations. Five patients kept bowel control. Two patients have a degree of occasional soiling, most likely due in part to loose stool associated with radiation enteritis.

#### Idiopathic rectal prolapse

Four patients underwent surgery to treat rectal prolapse after all predisposing medical conditions were ruled out. The average age was 5.6 years (range, 2–8 years).



**Fig. 3a-h** Resection of a rectal tumor. **a** Sagittal view of the rectum with a tumor. Dotted lines represent the limits of the resection. **b** Posterior view of the incision, with the rectum open. The dotted line shows the limits of the resection. Multiple silk stitches allow significant and uniform traction to be placed on the rectum. **c** Operative field. **d** The rectum has been divided above the pectinate line and is being lifted and dissected. **e** The rectum is fully mobilized and is being resected with the tumor. The upper, healthy rectum is anastomosed to the distal anorectum above the pectinate line. **f** Operative field showing the rectum open, fully mobilized with a villous adenoma. **g** Posterior view of the rectum sutured above the pectinate line. **h** Sagittal view of the operation finished. (From [54], with permission)



**Fig. 4a, b** Acquired recto-urethral fistulae. **a** Sagittal view. **b** Finished operation: the fistula is closed and new healthy rectum has been pulled down and anastomosed to the rectum above the pectinate line. (From [54], with permission)

The operation consisted of a posterior sagittal midline incision, with division of the upper part of the sphincter mechanism. The anus itself was not divided. The rectal wall was identified and fixed with stitches to the cartilage of the coccyx and sacrum.

The procedure was done on ambulatory basis. Postoperative pain was minimal. The patients have been followed for 1–10 years, and there has been one recurrence. All patients have normal bowel control.

### PSTA approach

Twenty-nine patients were operated with a posterior sagittal trans-anorectal (PSTA) approach. In all cases, the posterior as well as the anterior sphincters, anus and rectum were divided at the midline, allowing exposure of the lesion. After repair or resection, the anterior and posterior walls were meticulously reconstructed.

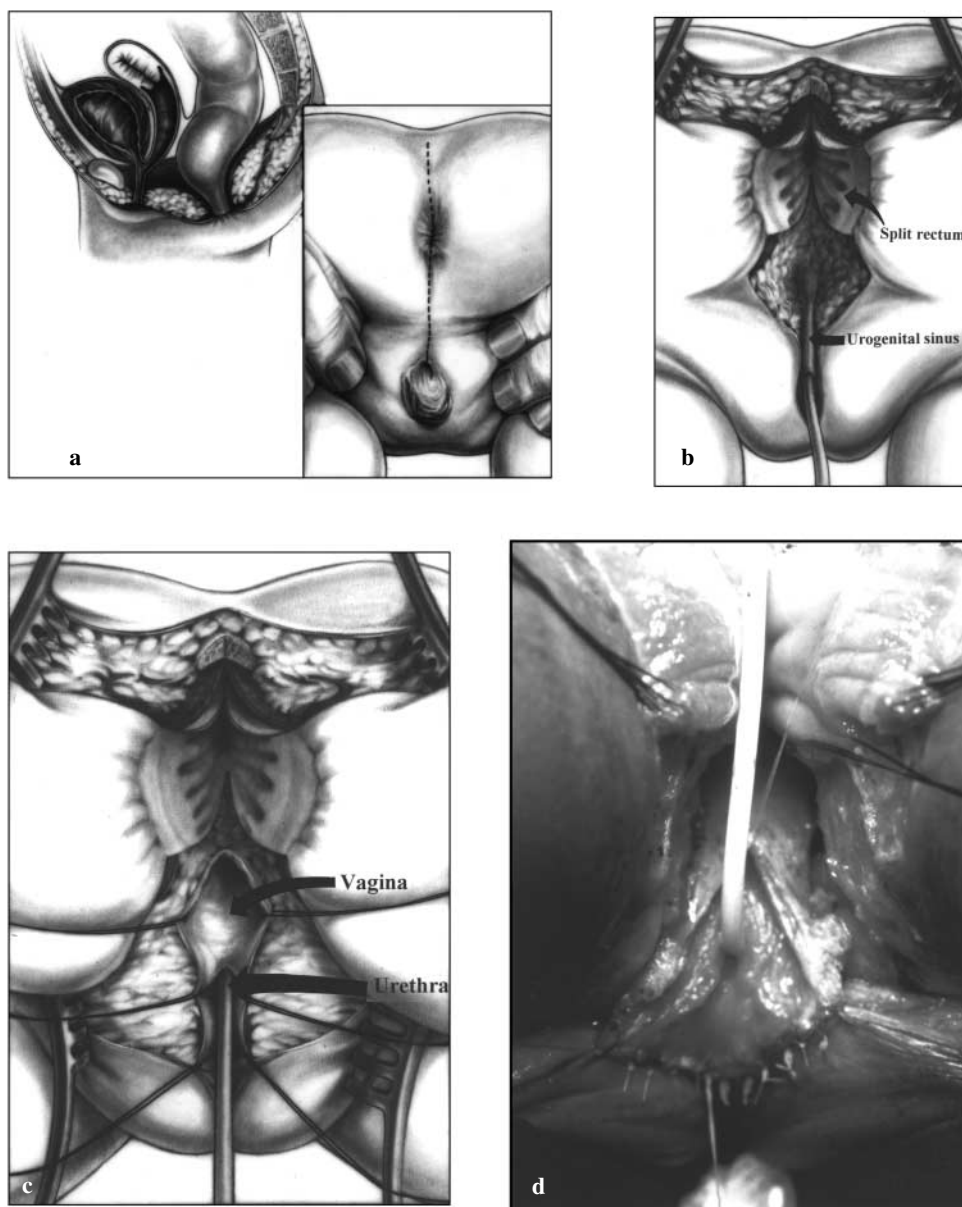
### Urogenital sinus

The average age of these patients was 5.6 years (range, 6 months to 12 years). Figure 5b shows a diagram of a posterior view of the rectum completely divided. Deep in the wound lies the urogenital sinus. Figure 5c shows the vaginal and urethral openings after the urogenital sinus has been opened posteriorly. The technique to repair the urogenital sinus itself is termed a “total urogenital mobilization.” Originally developed

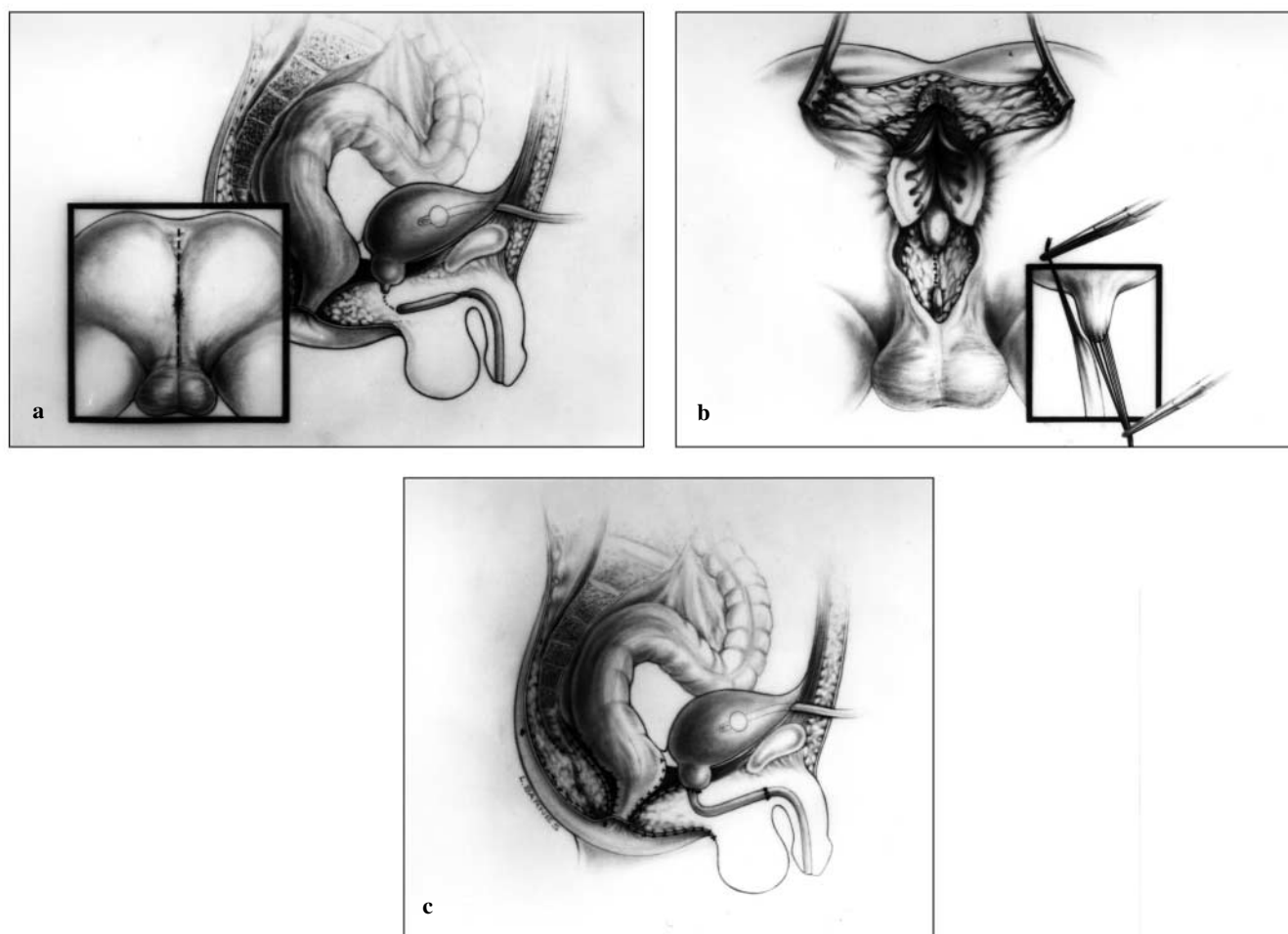
for the repair of cloacal malformations [61], it is also useful to repair this abnormality. The common channel is divided posteriorly, and the urethral and vaginal openings are exposed. The urethra and vagina are mobilized and pulled down together until the urethral opening reaches a normal position. Figure 5d shows a picture of the operative field during one of these operations. These patients have been followed for 1–9 years. They all have normal postoperative bowel function as well as urinary control. The vaginal opening appears to be adequate, although none have become sexually active as of this time.

### Post-traumatic acquired urethral strictures or atresias

Eight male patients suffered from severe urethral strictures or acquired urethral atresias after trauma. All were associated with severe pelvic fractures. The average age was 13.9 years (range, 7–22 years). Figure 6a shows a diagram of a sagittal view of an acquired urethral atresia. The subframe



**Fig. 5a-d** Urogenital sinus with a normal rectum. **a** Sagittal view. **b** Posterior view of a sagittally divided rectum. Deep in the wound lies the urogenital sinus. **c** The urogenital sinus has been opened posteriorly, showing the vaginal and urethral openings. **d** Operative field after the urogenital sinus has been mobilized and the urethra has been positioned in a normal location. (From [32], with permission)



**Fig. 6a-c** Acquired urethral atresia. **a** Sagittal view showing the incision used in the transanorectal approach. **b** Posterior view of the transanorectal approach. Both proximal and distal urethral blind ends are mobilized and anastomosed. **c** Sagittal view of the completed repair

shows the incision line used for the transanorectal approach. This approach allows excellent exposure and comfortable repair of the urethra (Fig. 6b, c). The patients have been followed for 1.5–9.0 years. There were no recurrences. Bowel function is completely normal in all patients. Six of the 8 patients have urinary control, and two patients have urinary incontinence. Both had a frozen pelvis due to severe fibrosis at the time of the repair. We believe that the magnitude of the initial trauma is associated with their incontinence.

#### Posterior urethral masses

Nine male patients were operated on for posterior urethral masses (Table 4). Seven of them had giant infected seminal

vesicles that resulted in recurrent orchioepididimitis (Fig. 7). Follow-up ranges from 1 to 8 years. No recurrent infections have been seen. All patients have normal bowel and urinary control.

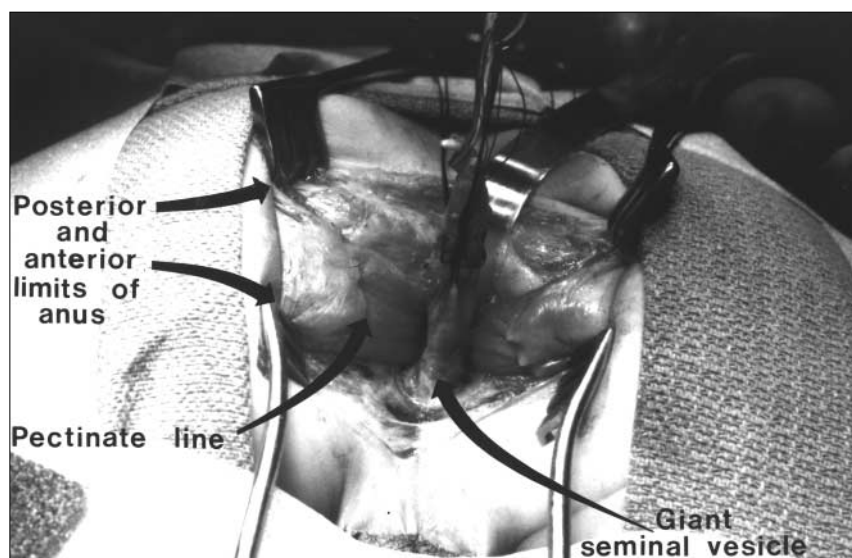
These types of operations have been reported in the past [37, 41, 44.] Some have described using a posterior sagittal approach in which the rectum is not divided, but rather mobilized and retracted laterally [65–68.] An endoscopic treatment has also been reported [69]. Two of our patients had failed attempted endoscopic treatment prior to our operation. Both patients operated on for rhabdomyosarcoma are alive and free of tumor 4 years after those operations. Bowel control is normal. Urinary control is normal in the patient in whom the urethra was preserved.

**Table 4** PSTA approach for posterior urethral masses

|                                     |                                 |
|-------------------------------------|---------------------------------|
| Patients, n                         | 9                               |
| Age, mean (range)                   | 8.6 years<br>(1 month–40 years) |
| Giant infected seminal vesicles, n  | 7                               |
| Rhabdomyosarcoma of the prostate, n | 2                               |

#### Diverting colostomy

Early in this series, we used a protective colostomy in all patients. The colostomy was usually constructed at the same time as the main procedure. One or two months after the definitive repair, the colostomy was closed. Subsequently, and mainly because of pressure from patients and their fami-



**Fig. 7** Operative field of a transanorectal approach used to resect a giant, infected seminal vesicle

lies, we compromised and decided to attempt these operations without a protective colostomy. However, in order to prevent complications, the patients undergo a complete bowel prep with Go-Lytely. A central line is placed at the time of the operation, and the patients were given nothing by mouth for 10 days, receiving parenteral nutrition. Using this protocol, most patients have done very well. Three patients with Hirschsprung's disease developed postoperative rectocutaneous fistulae, and two patients suffered from a superficial wound infection that healed without further complications.

## Discussion

Two other authors [57, 58] have used this approach to treat patients with Hirschsprung's disease. They were happy with the exposure, but both were preliminary experiences and they have not reported on the long-term follow-up. The posterior sagittal approach appears to be ideal for the treatment of presacral masses.

In the adult surgical literature, rectal tumors have been one of the main indications for the use of the posterior approach [1–10, 12, 14, 15, 19–22, 24, 26, 27, 31, 33, 34, 36, 42, 45–48].

The use of posterior sagittal approach for this problem requires further study and evaluation. Our short series does not have statistical significance, but the two early recurrences are obviously concerning. The approach may be a useful technique for the palliation of patients in which an abdominal-perineal resection is not possible.

Technically, the operation is straightforward and provides excellent exposure for acquired rectogenito-urinary fistulae. The risk of recurrence is clearly very high because of the effects of radiation therapy. The posterior approach has been used extensively for the treatment of this condition

[10, 11, 13, 14, 17, 20, 22, 23, 25–27, 29, 49, 50]. A larger experience with this type of operation for idiopathic rectal prolapse has been published by others [59, 60]. This congenital defect is defined as an abnormal junction of the vagina and urethra, forming a common channel that opens externally as a single orifice located where the urethral opening should be. These patients are born with a normal rectum and may or may not have adrenal hyperplasia [32].

Figure 5a shows a diagram of a urogenital sinus. In those cases of a very short common channel, where the junction of the vagina and the urethra is located very close to the perineal skin, almost any technique can be used to repair this problem. However we believe that, for those patients in whom the vagina joins the urethra at a distance of 2 cm or more from the perineum, the transanorectal approach is the best.

This approach has been reported in the past [32, 39]. Some authors [62–64] have used an approach in which only the anterior aspect of the anal sphincter and the anterior rectal wall were opened. This has been termed ASTRA (anterior sagittal transanorectal approach). There is no question that a limited incision can be enough to repair many of these defects. However, one must keep in mind that we are dealing with a spectrum of defects and, therefore, one must be prepared to deal with more complex anomalies that require greater exposure.

Our series reinforces the fact that the transanorectal approach does not interfere with bowel control in patients with post-traumatic acquired urethra strictures or atresias. A similar experience has been published by others [38]. The decision to proceed with or without a colostomy must be based on the individual circumstances of each case. That decision should be based on the surgeon's degree of experience and the patient's disease process and overall condition. In any case, we always obtain consent for a colostomy prior to the definitive operation. A surgeon should not hesitate to divert if the preparation has been inadequate or the repair is compromised by marginal blood supply.

The posterior sagittal approach appears to be a useful alternative for the treatment of pelvic conditions when they are difficult to reach through the abdomen or through the perineum. We believe that both of the variations of the technique discussed in this paper should be part of the armamentarium of general surgeons, colorectal surgeons and urologists. We highly recommend this approach for patients with Hirschsprung's disease who previously underwent repair and require re-operation for complications. We think that this is also the ideal way to approach presacral masses. The surgical treatment of rectal tumors is much more controversial and our experience is not large enough to draw final conclusions. However, it certainly is an alternative to be considered in certain circumstances. The transanorectal approach has emerged as an important technical alternative for the surgical care of conditions such as posterior urethral cystic masses, malignant tumors of the posterior urethra, post-traumatic acquired urethral strictures and atresias and congenital urogenital sinuses. The fear that division of the sphincters will lead to fecal incontinence does not appear to be well founded, as long as a midline approach is used, and a meticulous repair is accomplished.

## References

1. Kraske P (1885) Zur Exstirpation hochsitzender Mastdarm krebse. *Verh Dtsch Ges Chir* 14:464–474
2. Cripps H (1907) Cancer of the rectum Its surgical treatment with an appendix of 380 cases. Jacksonian Prize essay. Churchill, London, pp 117–144
3. Weir RF (1901) An improved method of treating high-seated cancers of the rectum. *JAMA* 37:801–803
4. Bevan A (1917) Carcinoma of the rectum. Treatment by local excision. *Surg Clin Chicago* 1:1233–1239
5. David VC (1943) The management of polyps occurring in the rectum and colon. *Surgery* 14:387–394
6. Larkin MA (1959) Transsphincteric removal of rectal tumors. *Dis Colon Rectum* 2:446–451
7. Mason AY (1970) Surgical access to the rectum - a trans-sphincteric exposure. *Proc R Soc Med* 63:91–94
8. Mason AY (1972) Trans-sphincteric exposure of the rectum. *Ann R Coll Surg Engl* 51:320–331
9. Mason AY (1969) Trans-sphincteric approach to rectal lesions. *Surg Ann* 9:177–194
10. Kilpatrick FR, Mason AY (1969) Post-operative rectoprostatic fistula. *Br J Urol* 41:649–654
11. Beneventi FA, Cassebaum WH (1971) Rectal flap repair of prostatorectal fistula. *Surg Gynecol Obstet* 133:489–492
12. Oh C, Kark AE (1972) Transsphincteric approach to mid and low rectal villous adenoma: anatomic basis of surgical treatment. *Am Surg* 176:605–611
13. Dahl DS, Howard PM, Middleton RG (1974) The surgical management of rectourinary fistulas resulting from a prostatic operation: a report of 5 cases. *J Urol* 111:514–517
14. Ruedi T (1978) Transsphincteric approach to the rectum in cases of low early cancer. *Langenbecks Archiv Chirurgie* 347:609–611
15. Hofmann KT (1979) Treatment of tubulo-villous rectal adenomas. Transsphincteric approach. *MMW-Munchener Medizinische Wochenschrift* 121:1491–1492
16. Neff U, Durig M, Ruedi T (1980) Indications and results of the transsphincteric Mason approach. *Therapeutische Umschau* 37:728–733
17. Seghaier SM, Ganouni A, Jeddi M, Jegham H (1981) Treatment of prostatic-rectal fistulas by a transanorectal posterior approach. *Tunisie Medicale* 59:432–437
18. Henderson DJ, Middleton RG, Dahl DS (1981) Single stage repair of rectourinary fistula. *J Urol* 125:592–593
19. Criado FJ, Wilson TH (1981) Posterior trans-sphincteric approach for surgery of the rectum. *Dis Colon Rectum* 24:145–150
20. Westbrook KC, Lang NP, Broadwater JR, Thomson BW (1982) Posterior surgical approaches to the rectum. *Ann Surg* 195:677–683
21. Heij HA, Tan KG, van Houten H (1982) The transsphincteric approach to rectal villous adenomas. *Netherlands J Surg* 34:4–7
22. Prasad ML, Nelson R, Hambrick E, Abcarian H (1983) York Mason procedure for repair of postoperative rectoprostatic urethral fistula. *Dis Colon Rectum* 26:716–720
23. Konturri M (1985) Transsphincteric-transrectal repair of post-traumatic urethrectal fistula. Case report. *Scand J Urol Nephrol* 19:73–76
24. Klaaborg KE, Kronborg O (1985) Transsfinkterisk rektotomi ved tumorer og fistler i rectum. *Videnskab OG Praksis* 147:411–413
25. Bauer HW, Sturm W, Schmiedt E (1984) Surgical correction of rectoprostatic fistula. *Urology* 24:452–455
26. Bergman L, Solhaug JH (1986) Posterior trans-sphincteric resection for small tumours of the lower rectum. *Acta Chir Scand* 152:313–316
27. Thompson BW, Tucker WE (1987) Transsphincteric approach to lesions of the rectum. *South Med J* 80:41–43
28. Jorge E, Ballantine TVN, Joehl RJ (1987) Posterior sagittal anorectoplasty for adults. *Arch Surg* 122:987–991
29. El Ouakdi M, Guermazi H, Ayed M, Zmerli S (1988) Treatment of prostatic-rectal fistulae. Apropos of 5 cases. *J Urol* 94:389–391
30. Applebaum H, Atkinson JB (1991) The posterior sagittal approach for reconstruction of severe rectovaginal injuries. *J Pediatr Surg* 26:856–857
31. Kusunoki M, Yanagi H, Shoji Y et al (1991) Stapled anastomosis for trans-sphincteric resection of the rectum. *Surg Gyn Obstet* 173:325–326
32. Peña A, Filmer B, Bonilla E, Mendez M, Stolar C (1992) Transanorectal approach for the treatment of urogenital sinus: preliminary report. *J Pediatr Surg* 27:681–685
33. Kanemitsu T, Kojima T, Yamamoto S et al (1993) The trans-sphincteric and trans-sacral approaches for the surgical excision of rectal and presacral lesions. *Surg Today* 23:860–866
34. Qui HZ (1993) Posterior transsphincteric approach for the surgery of the rectum. *Chung-Hua Wai Ko Tsa Chih (Chinese J Surg)* 31:124–126
35. Peña A (1994) The posterior sagittal approach: implications in adult colorectal surgery. Harry E. Bacon Lectureship. *Dis Colon Rectum* 37:1–11
36. Hamdy H, Wahab AM, Fakbroo A, Mohammed A (1994) Posterior sagittal anorectoplasty in adults. *Br J Surg* 81:601–602

37. Keramidas DC, Kapouleas GP, Papandreu E (1995) The posterior sagittal approach for the excision of a prostatic utricle cyst. *Br J Urol* 76:397–398
38. Flah LM, Alpuche JC, Castro RS (1992) Repair of post-traumatic stenosis of the urethra through a posterior sagittal approach. *J Pediatr Surg* 27:1465–1470
39. Braz A (1999) Posterior sagittal transanorectal approach in patients with ambiguous genitalia: report of eight cases. *Pediatr Surg Int* 15:108–110
40. Bukowski TP, Chakrabarty A, Powell IJ et al (1995) Acquired rectourethral fistula: methods of repair. *J Urol* 153:730–733
41. Siegel JF, Brock WA, Peña A (1985) Transrectal posterior sagittal approach to prostatic utricle (mullerian duct cyst). *J Urol* 153:785–787
42. Qiu H, Tang W, Zhu Y (1995) The transsphincteric approach excision of rectal villous adenomas. *Chung-Hua Wai Ko Tsa Chih (Chinese J Surg)* 33:170–172
43. Stephenson RA, Middleton RG (1996) Repair of rectourinary fistulas using a posterior sagittal transanal transrectal (modified York-Mason) approach: an update. *J Urol* 155:1989–1991
44. Braz A (1996) Tratamiento do utrículo prostá da via de acesso transesfincte sagital posterior. *Arg*
45. Carbonell ML (1979) Lesion of rectum. Posterior proctotomy approach. *Dis Col Rectum* 22:288–289
46. Madsen HHT, Kronborg O (1987) Posterior transsphincteric rectotomy. Indications and safety. *Dis Colon Rectum* 50:939–941
47. Huber A, Hochstetter AV, Allgower M (1987) Anatomy of the pelvic floor for translevatoric-transsphincteric operations. *Am Surg* 53:247–253
48. Kopecky J, Kovarova A, Kopecka P, Klus I (1997) Trans-sphincteric resection of the rectum. *Acta Medica (Kradec Kralove) Suppl* 40:91–92
49. Fengler SA, Abcarian H (1997) The York Mason approach to repair of iatrogenic rectourinary fistulae. *Am J Surg* 173:213–217
50. al-Alie M, Kashmoula D, Saoud IJ (1997) Experience with 30 posttraumatic rectourethral fistulas: presentation of posterior transsphincteric anterior rectal wall advancement. *J Urol* 158:421–424
51. Stephens FD (1953) Imperforate rectum: a new surgical technique. *Med J Austr* 1:202–206
52. deVries PA, Peña A (1982) Posterior sagittal anorectoplasty. *J Pediatr Surg* 17:638–643
53. Peña A, deVries PA (1982) Posterior sagittal anorectoplasty: important technical considerations and new applications. *J Pediatr Surg* 17:796–811
54. Peña A (1990) Atlas of the surgical management of anorectal malformations. Springer, Berlin Heidelberg New York, pp 49–71
55. Peña A, Amroch D, Baeza C, Csury L, Rodriguez G (1993) The effects of the posterior sagittal approach on rectal function (experimental study). *J Pediatr Surg* 28:773–778
56. Frogge JM, Strand WR, Miller AK, Kaplan GW (1996) Preservation of continence after posterior sagittal surgery. *J Urol* 156:647–650
57. Hedlund H (1997) Posterior sagittal resection for rectal aganglionosis: preliminary results of a new approach. *J Pediatr Surg* 32:1717–1720
58. Niedzielski J (1999) Posterior sagittal abdominoperineal pull-through: a new approach to definitive treatment of Hirschsprung's disease - initial experience. *J Pediatr Surg* 34:572–576
59. Ashcraft KW, Amoury RA, Holder TM (1977) Levator repair and posterior suspension for rectal prolapse. *J Pediatr Surg* 12:241–245
60. Vartan AD, Colin GT (1972) Trans-sacral repair of rectal prolapse. *Am J Surg* 123:231–235
61. Peña A (1992) Total urogenital mobilization: an easier way to repair cloacas. *J Pediatr Surg* 32:263–268
62. Jenak R, Ludwikowski B and Gonzalez R (2001) Total urogenital mobilization: a modified perineal approach for feminizing genitoplasty and urogenital sinus repair. *J Urol* 165:2347–2349
63. Benedetto VD, Giovale M, Bagnara V, Cacciaguerra S, Benedetto AD (1997) The anterior sagittal transanorectal approach: a modified approach to 1-stage clitoral vaginoplasty in severely masculinized female pseudohermaphrodites - preliminary results. *J Urol* 157:330–332
64. Rossi F, DeCastro R, Ceccarelli PL, Domini R (1998) Anterior sagittal transanorectal approach to the posterior urethra in the pediatric age group. *J Urol* 160:1173–1177
65. Hunt VC (1928) Posterior excision of the seminal vesicles. *Ann Surg* 87:257–262
66. Jordan WP, Kreager SA (1966) Transcocygeal approach to the prostate and seminal vesicles. *South Med J* 59:685–687
67. Kaplan GW, Picconi JR, Schuhrke TD (1977) Posterior approach to mullerian duct and seminal vesical cysts. *Birth Defects XIII(5)*:241–245
68. Schuhrke TD, Kaplan GW (1978) Prostatic utricle cysts (mullerian duct cysts). *J Urol* 119:765–767
69. Husmann DA, Allen TD (1997) Endoscopic management of infected enlarged prostatic utricles and remnants of rectourethral fistula tracts of high imperforate anus. *J Urol* 157:1902–1906