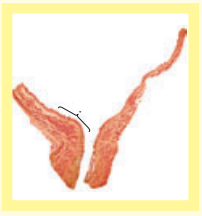
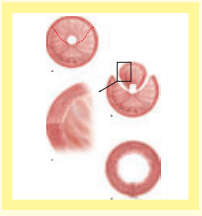
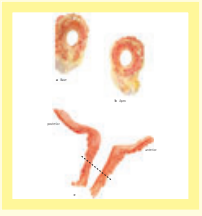
Surgery Illustrated







Surgical Atlas

Anterior detrusor flap in urogenital sinus repair

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INTRODUCTION

Persistent urogenital sinus, alone or associated with congenital adrenal hyperplasia, presents a surgical challenge to achieve urinary and fecal continence, together with adequate genital reconstruction. The longer the common sinus, the more difficult the repair. More detailed background information is given in [1–13].

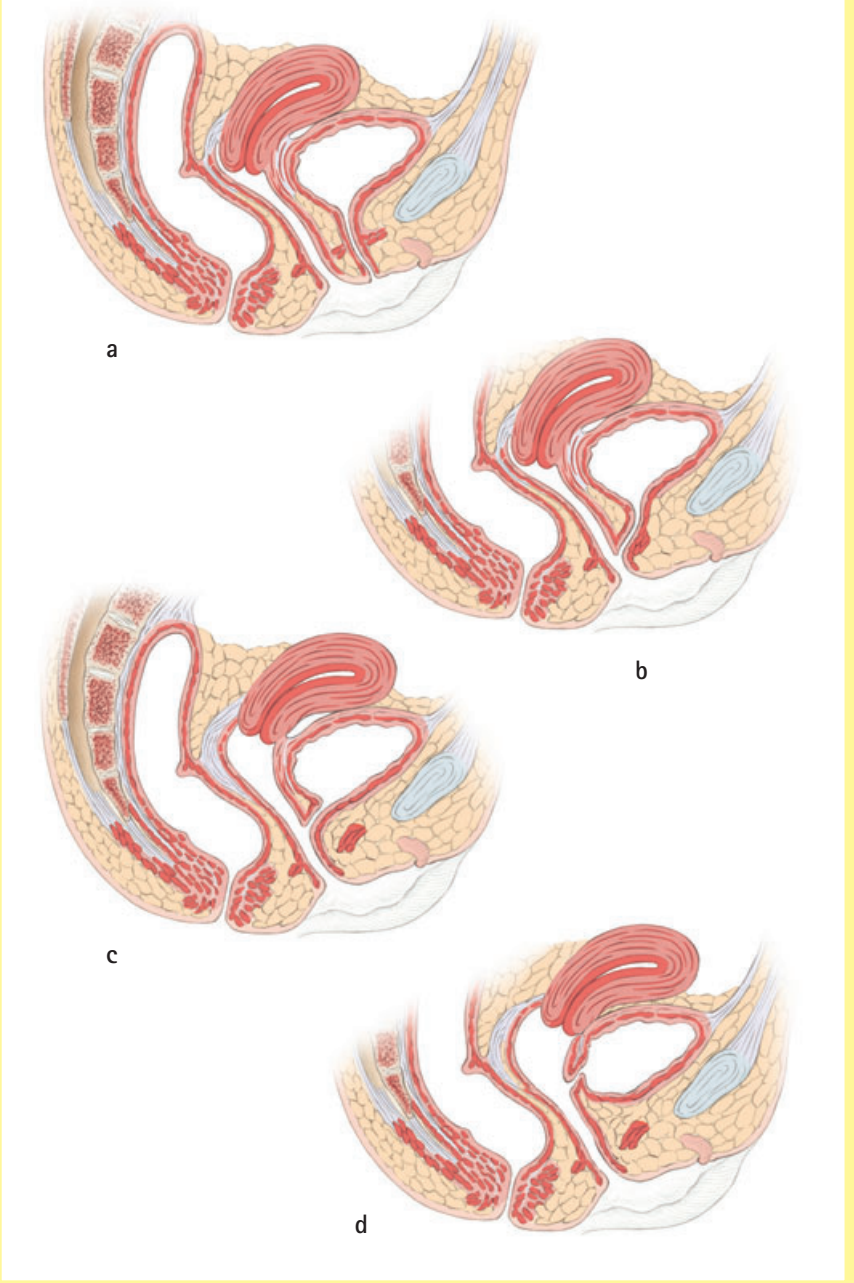


Figure 1

A short common sinus (low confluence; Fig. 1B) can be easily repaired with a simple posterior cut-back of the common sinus and the addition of an inverted U-shaped perineal skin flap to open the vaginal vestibule and help to bring the urethral opening to the surface.

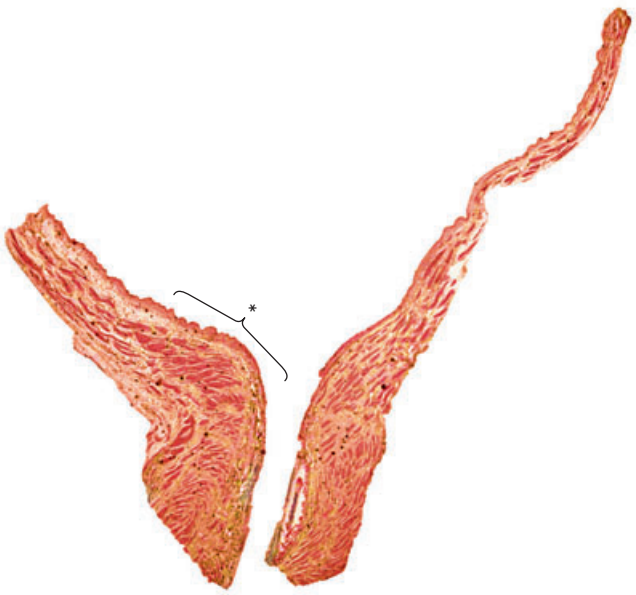
With a longer common sinus (but <3 cm), termed a mid-confluence (Fig. 1C), total urogenital sinus mobilization allows the urethra and vagina to descend, achieving separate openings of the urethra and the vaginal canal. The vaginal vestibule can be widened by adding an inverted U-shaped posterior flap. The whole procedure can be performed perineally. The common sinus could be excised, or better, opened and added to the vaginal vestibule.

The real challenge is the longer common sinus (>3 cm, high confluence; Fig. 1D), where total urogenital sinus mobilization is not enough to bring the urethral and vaginal openings to the perineum. The tendency is to leave the common sinus as a continuation of the urethra and to mobilize the vaginal canal free from the urinary tract, bringing it down to the perineum in a separate opening. However, this never achieves a satisfactory cosmetic appearance of the vaginal vestibule, and this surgery is extremely risky: separating the vagina from the urogenital sinus and urinary tract is the most difficult aspect and can result in injury to the urethra, bladder base or vagina.

The length of the urethra proximal to the common sinus is critical for total urogenital sinus mobilization. When the urethra is short, the risk of incontinence is very high. Thus, a surgical decision to use the common sinus as a continuation of the urethra and mobilize the vagina alone to the perineum is never easy and always risky.

We take a different approach; in our experience the longer the common sinus the shorter the urethra. In patients with a high confluence with a long common sinus, the urethra is usually quite short. In all such situations, we advocate leaving the common sinus as a continuation of the vaginal canal, which alleviates the need for any risky vaginal dissection or total sinus mobilization. Repair of the vaginal vestibule becomes extremely simple with an excellent cosmetic appearance.

In brief, the short urethra is identified and then dissected from the common sinus through a suprapubic approach. Then an anterior bladder flap, 2.5 cm square, is turned into a tube and added to the short urethral stump, providing both an adequate sphincteric mechanism and the length necessary to reach the vaginal vestibule without tension. The vaginal vestibule can easily be expanded and reconstructed with a posterior inverted U-shaped flap, as is commonly done with the repair of short common sinus.



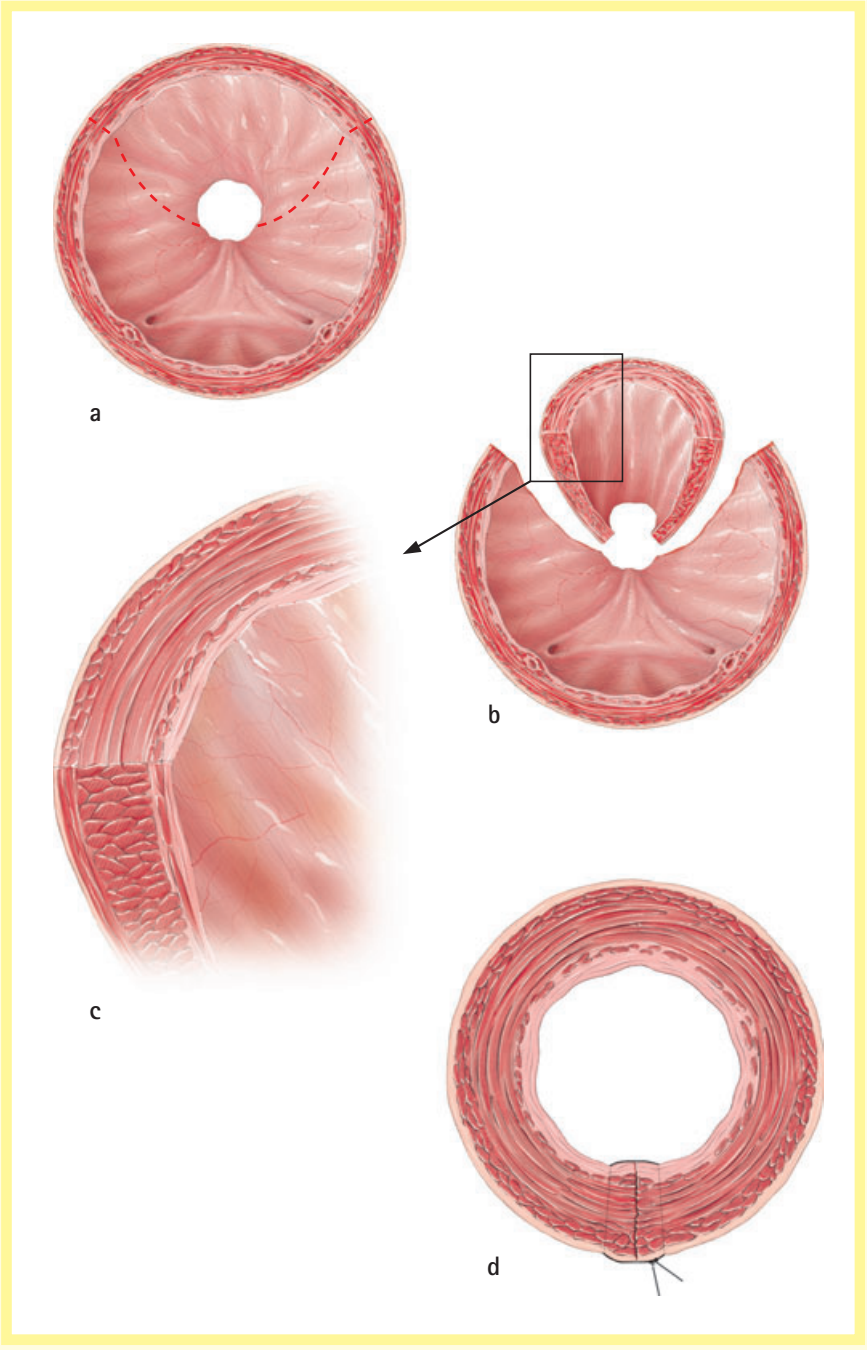
ANATOMICAL CONSIDERATIONS

Figure 2

Ventral condensation of middle circular fibres. The anatomical structure of the vesical wall around the internal meatus lends itself readily to the construction of a sphincteric unit. The segment of the anterior bladder wall just above the internal meatus has an outer longitudinal coat, a middle coat of heavily condensed circular fibres, and a weak inner longitudinal coat.

Figure 3

The middle anterior segment is limited to 2–2.5 cm just above the internal meatus (Fig. 3A). When this segment is raised as a 2 cm square flap (Figs 3B & 3C) and fashioned into a tube (Fig. 3D), the tube contains the heavy circular coat with delicate longitudinal fibres on either side (Figs 3C & 3D).



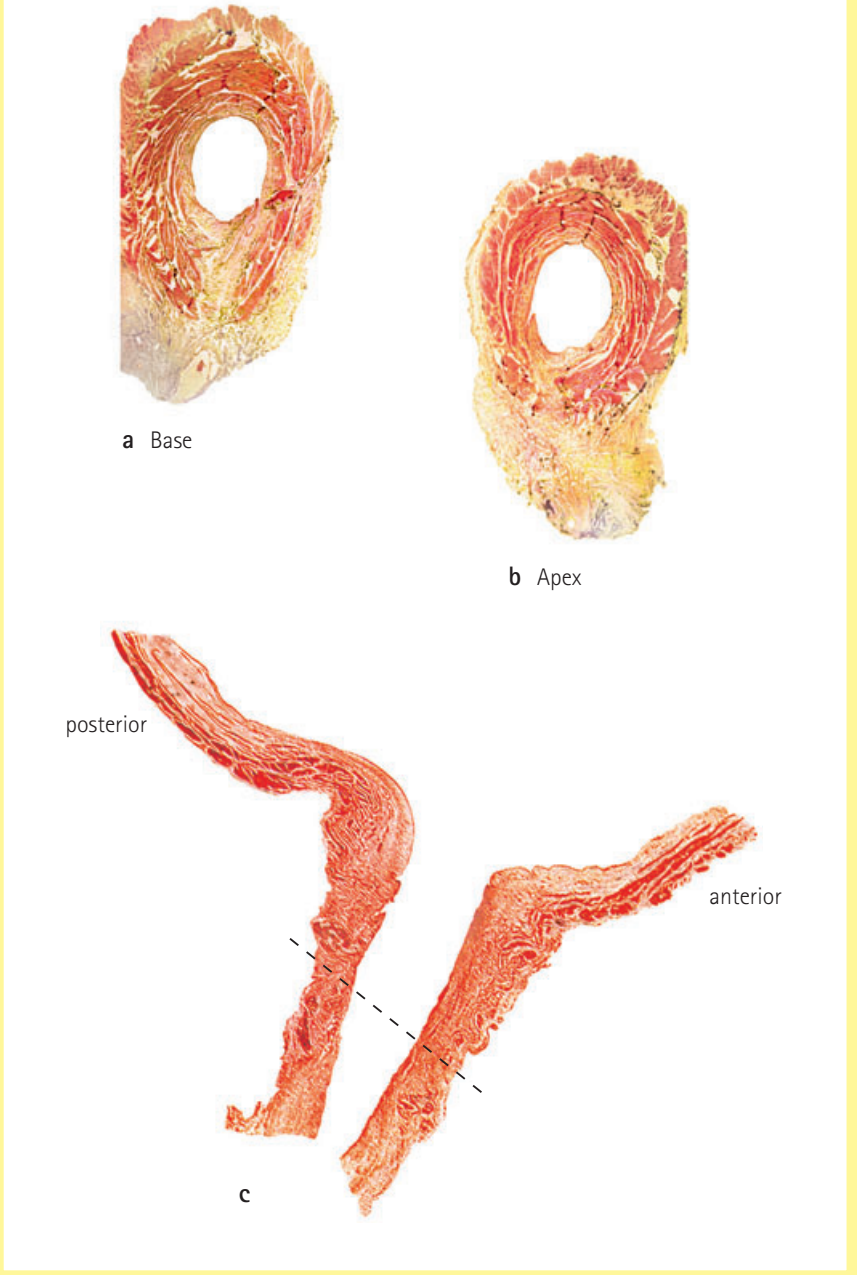
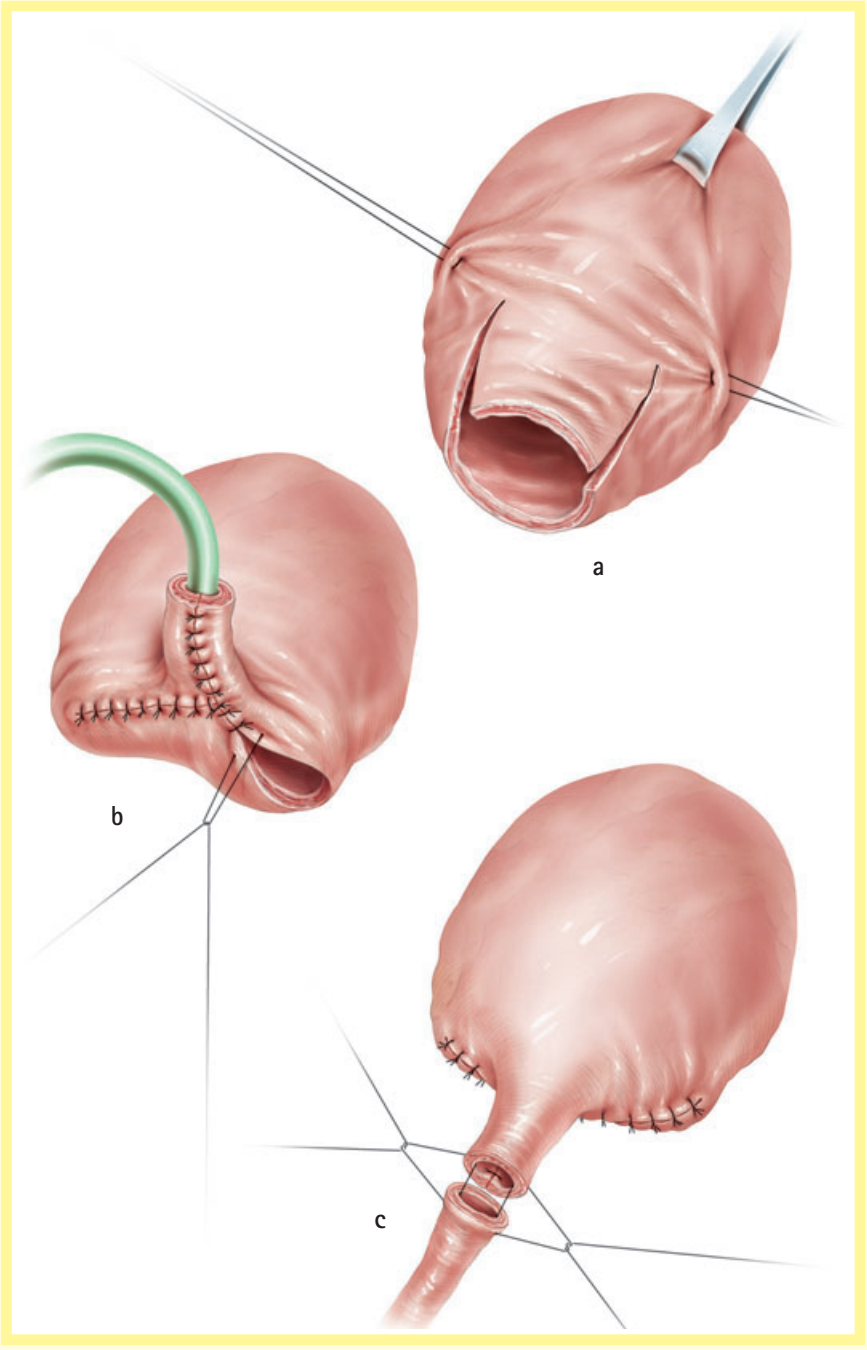


Figure 4

Cross section of sphincteric segment: A, at the base of the tube; B, at its apex. All muscle fibres are apparent in the tube. Note also the site of the suture line of the tube in the midline posterior. C, A sagittal section through the base of the bladder, reconstructed sphincter segment and part of the urethra. Note the abundant musculature in the sphincteric segment, which is mainly circular. Note also the smooth healing between the tube and the urethra (dotted line) and lack of musculature in the urethra distal to the tube. The new urethrovesical relationship is closely similar to a normal arrangement.

Figure 5

Surgical experimental model for testing the procedure; A, The 2.5 cm square flap is raised; B, it is then formed into a tube around a catheter; C, the bladder outlet is reconstructed by bringing the apex of the trigone to the base of the tube. Finally, the reconstructed tube is anastomosed to the distal end of the urethra.



With the length achieved by raising an anterior bladder flap and turning it into a tube, the urethra can reach the vaginal vestibule while leaving the common sinus in continuity with the vaginal canal.

This approach simplifies the surgical correction of a high urogenital sinus by eliminating the risky, extensive dissection to bring the vaginal canal to the perineum. With a posterior inverted U-shaped perineal flap, the vaginal vestibule can be opened up by incising the common sinus posteriorly.

SURGICAL STEPS

After endoscopic examination of the common sinus and identifying the urethral opening, a catheter is placed under vision into the bladder. Through a low transverse abdominal incision, the anterior bladder is exposed.

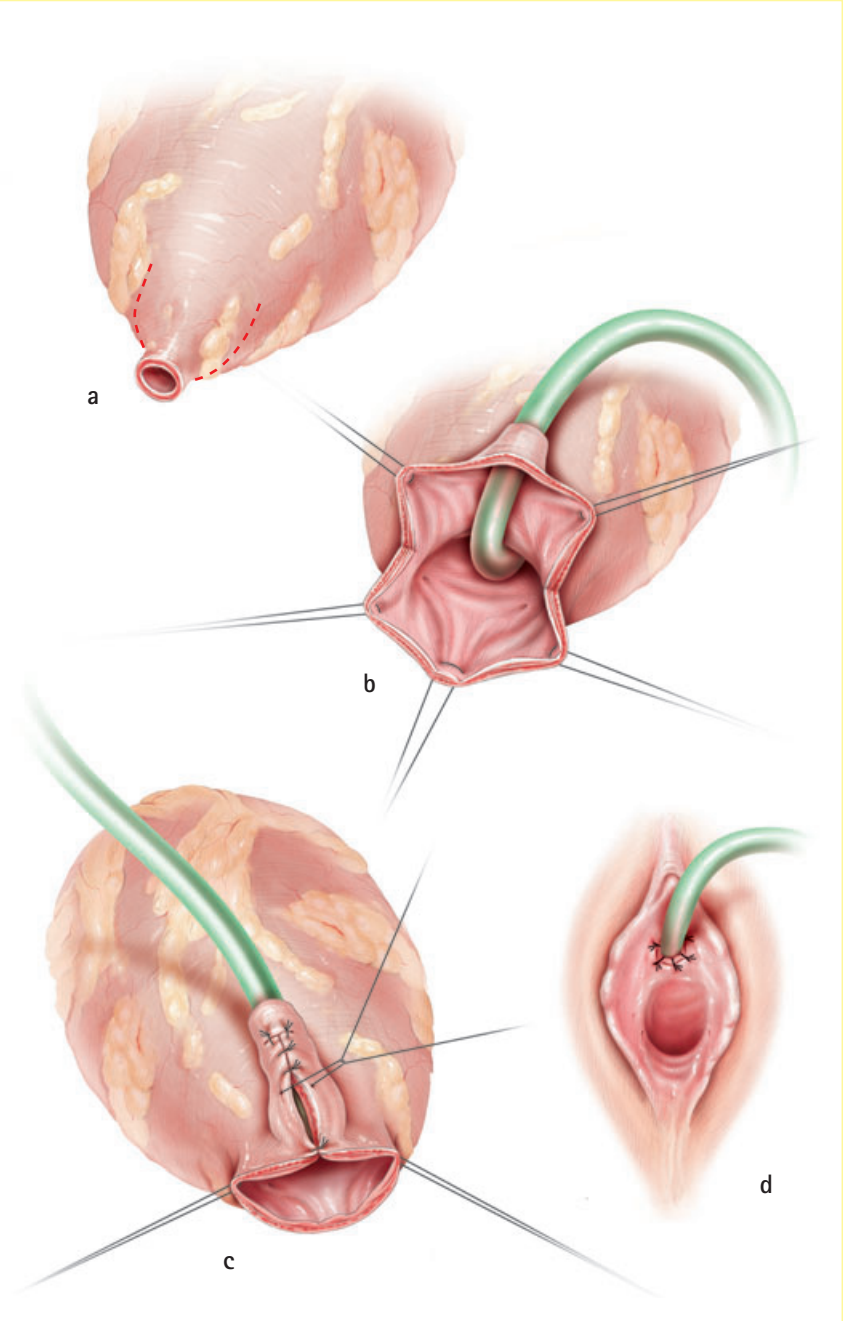


Figure 6

The urethra is carefully dissected and transected at its point of junction with the common sinus (Fig. 6A), with closure of the urethral opening in the sinus. After limited mobilization of the bladder base, the bladder is filled to moderate distension. The level of the internal meatus is identified (again with the help of the urethral catheter). A 2.5 cm square flap is marked by stay sutures, and two parallel incisions on the anterior bladder wall are taken to delineate the sides of the flap. The posterior bladder wall, precisely at the level of the internal meatus and apex of the trigone, is cut transversely from the 6 o'clock up to the 3 o'clock position on one side and to the 9 o'clock position on the other (Fig. 6B). This results in a square bladder flap continuous at its base with the anterior bladder wall, and at its distal end with the intact short urethral stump. Around a 10–12 F Foley catheter, the flap is turned into a tube with interrupted polyglycolic acid sutures (Fig. 6C). The apex of the trigone is then sutured to the base of the tube and bladder closure completed on either side. The urethral length is now adequate to reach the vaginal vestibule.

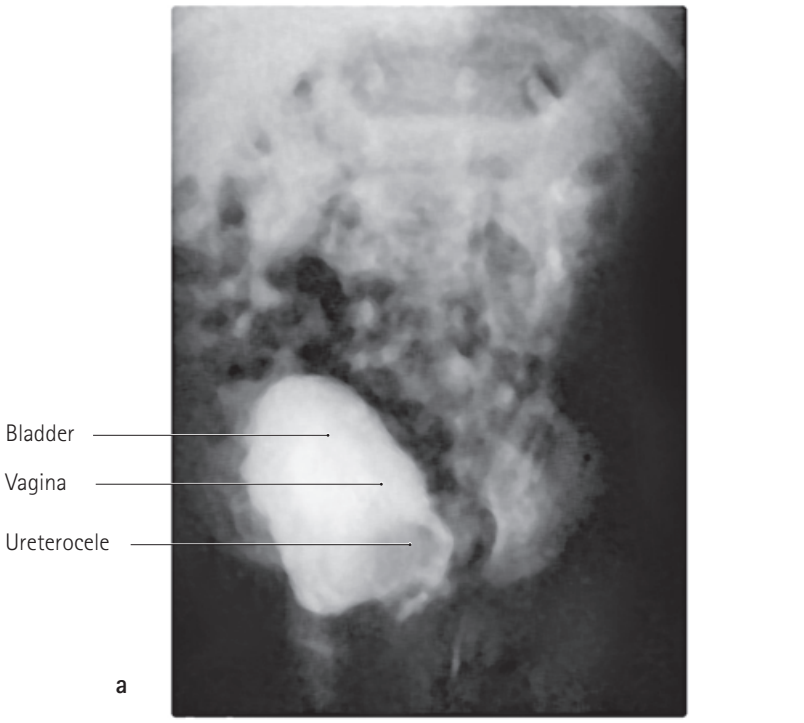
Through a small incision ventral to the opening of the common sinus, the distal end of the urethral stump is brought out and sutured to the vaginal vestibule (Fig. 6D). A posterior narrow perineal skin flap is usually needed to expand the vaginal vestibule after a midline posterior slit of the dorsal portion of the common sinus.

DIFFICULT CASES

The same principle can be applied to the reconstruction of more complicated congenital anomalies that might be encountered with persistent urogenital sinus.

Figure 7

These show a patient with a high confluence and a long common sinus. This condition was complicated by the presence of a giant ureterocele draining a dysplastic right kidney, extending into the short urethra and prolapsing into the common sinus. The patient also had a bicornous uterus with a rudimentary left side associated with a streak ovary. A, IVU when the patient was 6 weeks old showed no visualization of the right kidney, a left kidney within normal limits and a large irregular filling defect in the bladder base. B, An enlarged view of lateral cystogram and vaginogram shows an anteriorly displaced bladder, distended posterior vaginal cavity and large defect between them, caused by the giant ureterocele. Note the short urethra opening into a long urogenital sinus. Through a suprapubic exposure, the ureterocele was excised. After reconstructing the attenuated bladder base and trigonal area, the left ureter was advanced.



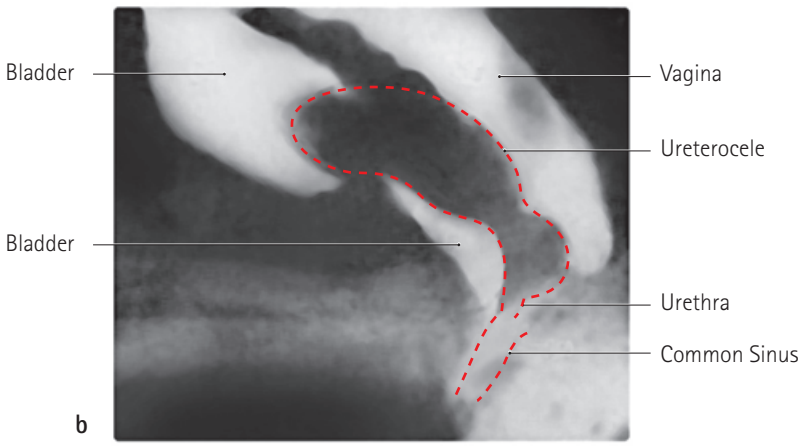
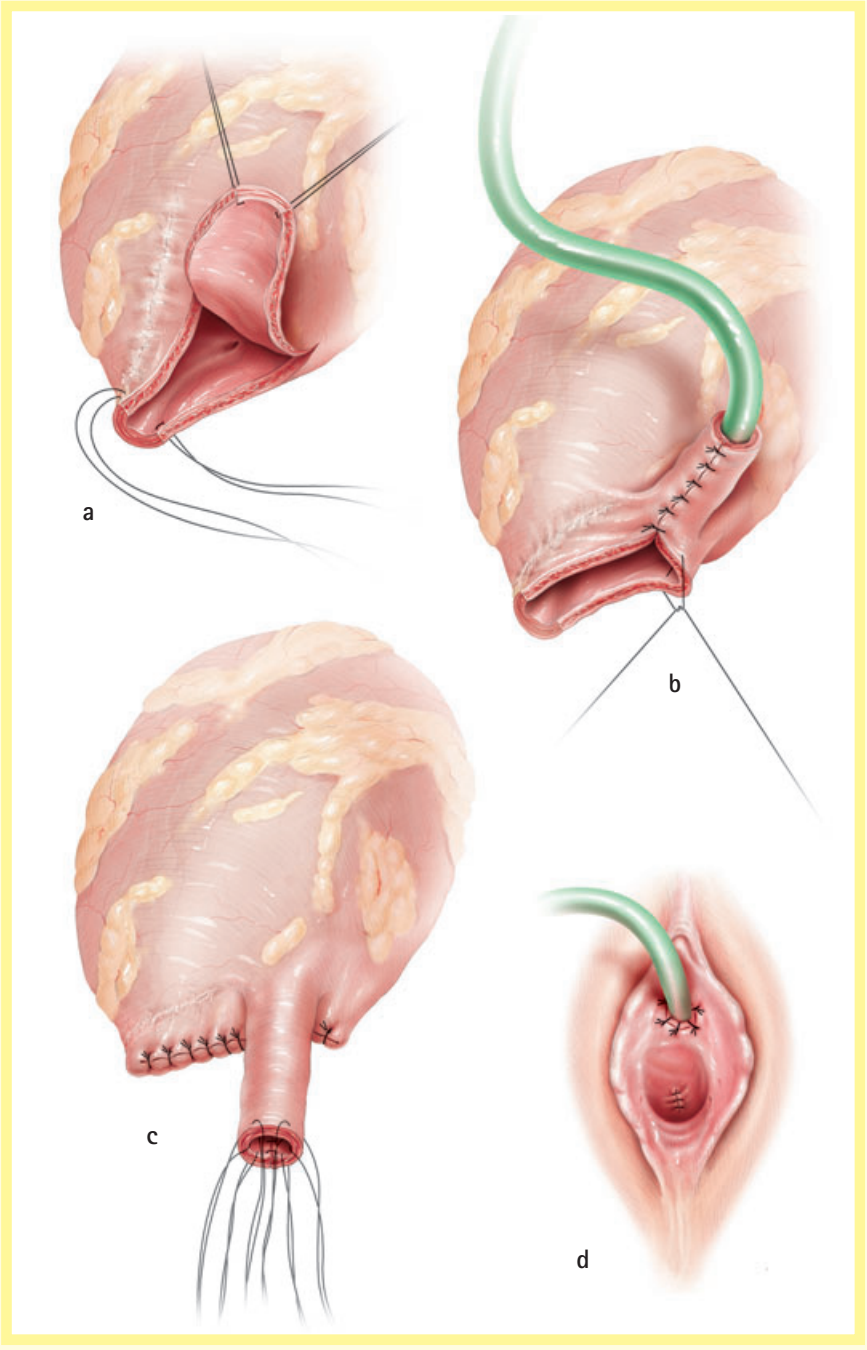


Figure 8

At age 5 years old a definitive urethral reconstruction was done. Because of the midline scar in the anterior bladder wall from the previous surgery, the flap was developed from the bladder wall to the left of it. The anatomical arrangement shows the dysplastic right kidney ending in a giant ureterocele that partly prolapsed into the short urethra, opening into the long persistent urogenital sinus, leading to a single opening in the vaginal vestibule.

Figure 9

The square flap (Fig. 9A) was then fashioned into a tube around a 10 F Foley catheter (Fig. 9B) and brought out to the vaginal vestibule via a stab wound incision anterior to the common sinus. The square bladder flap was developed to the left side of the midline (Fig. 9A) because of the previous cystostomy scar. The urethral tube was reconstructed from the bladder flap and anastomosed to the vaginal vestibule. Suprapubic and Foley catheter drainage was maintained for 3 weeks. At first the patient had little urinary control, but by 9 months after surgery she had regained complete control, voiding every 2–2.5 h with a good full stream and only minimal stress incontinence with a full bladder.



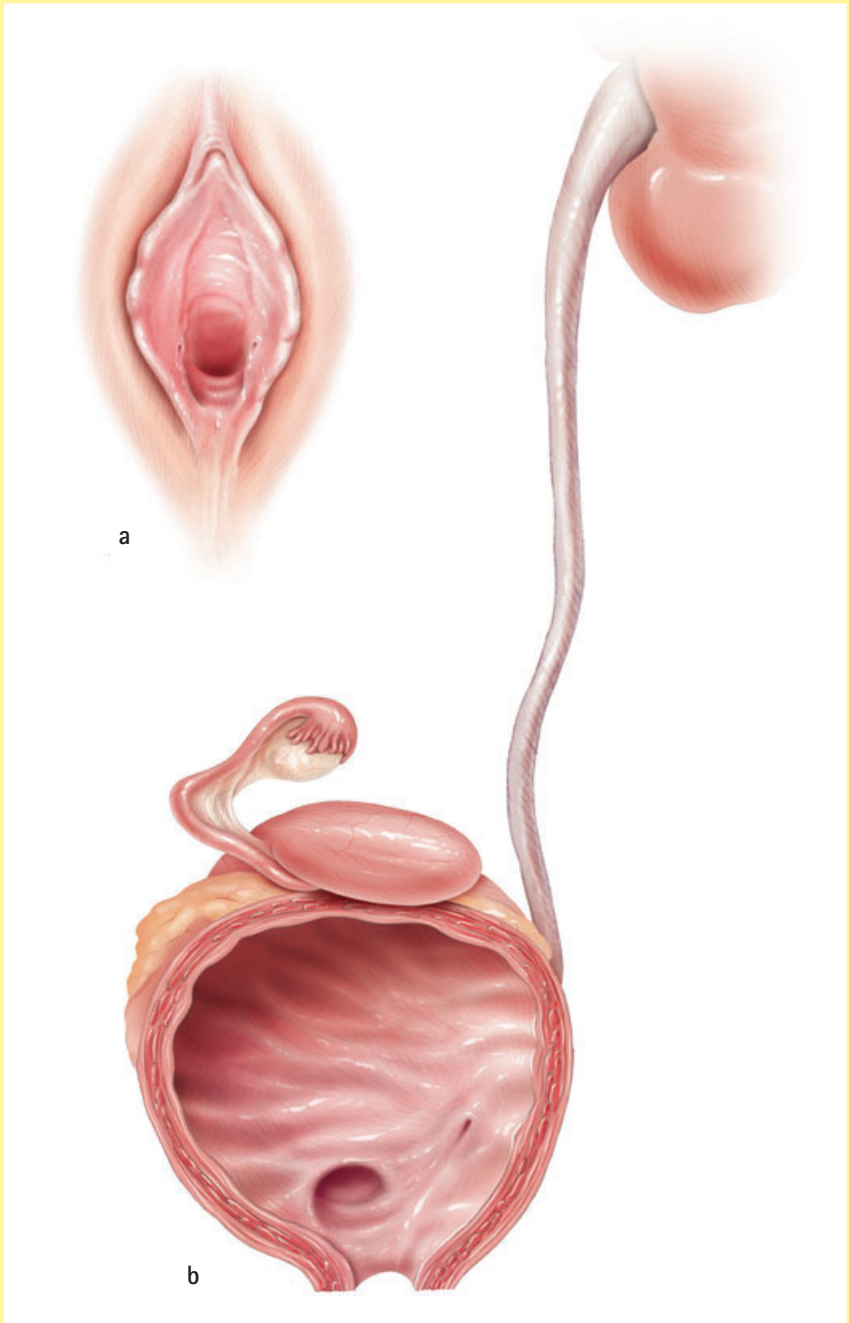
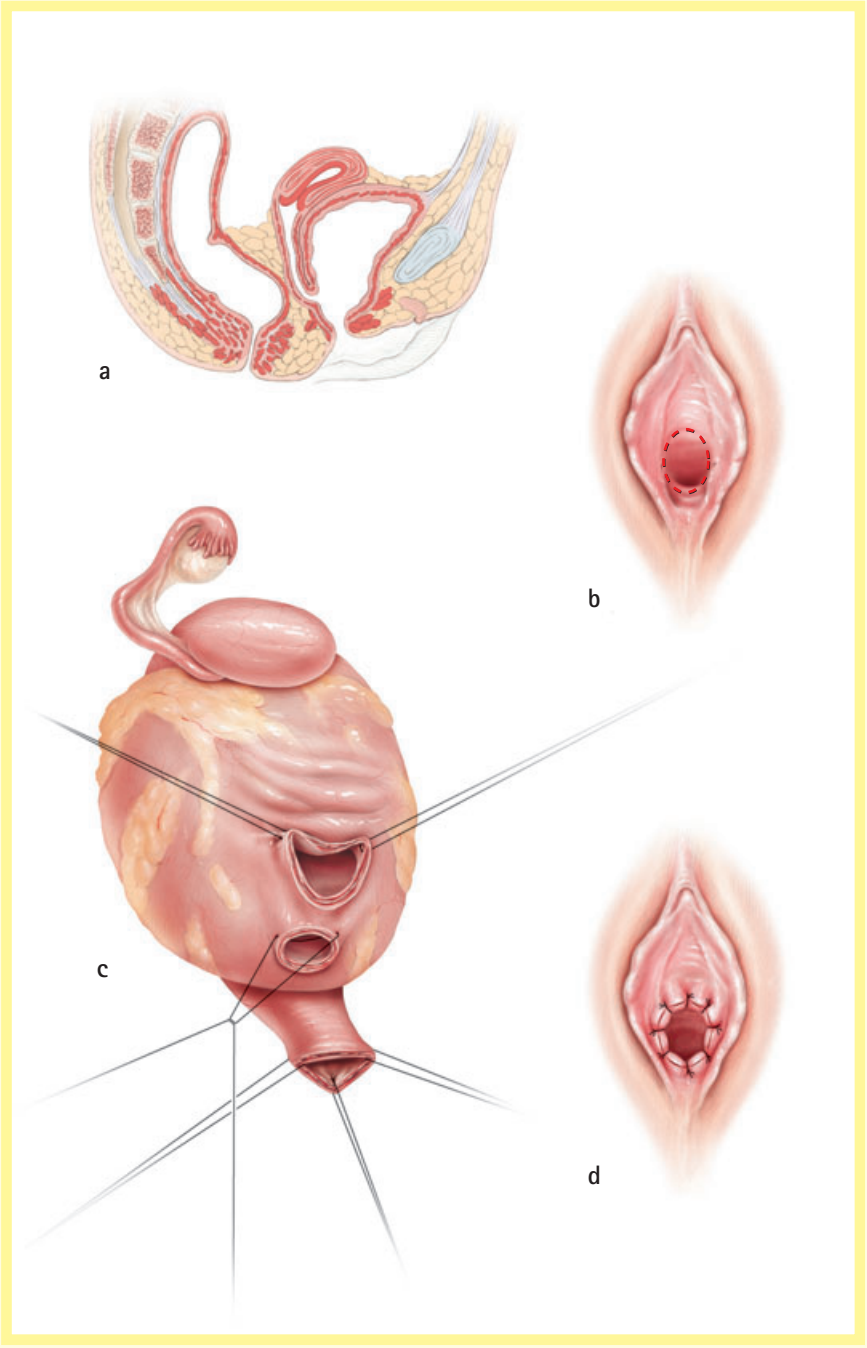


Figure 10

In another variation of these complex congenital anomalies, a 17-year-old girl had severe pain at her first attempt at sexual intercourse. She did not complain of urinary incontinence, although this had been a lifelong problem for which she wore diapers at all times. The external genitalia appeared normal, but when the labia were spread, only one large opening could be seen. This was at first taken to be the vaginal canal, but pelvic examination allowed insertion of one finger into a huge cavity that proved to be the bladder. Endoscopic examination revealed that the opening at the depth of the vaginal vestibule was actually the bladder neck. A normal left ureteric orifice and left hemitrigone were visible, but no right ureteric orifice. In its place was a puckered opening that, when catheterized and filled with dye, proved to be the vaginal canal, ending in a small uterus. It became clear that this young woman lacked a urethra and had a vaginal canal ectopically opening into the base of the bladder, as well as a left solitary kidney and lack of development of the right nephric system.

Figure 11

Surgical reconstruction was attempted. Through a vaginal approach the bladder neck was circumscribed and dissected from its connection to the vaginal vestibule (Fig. 11A). The dissection was extended posteriorly, retrotrigonally until the vaginal canal was freed all around, and transected from the bladder wall (Fig. 11C). The bladder was mobilized freely and displaced upward, while the vaginal canal was also dissected, mobilized, and pulled downward to replace the original bladder outlet. Its opening was sutured to the vaginal vestibule in the position previously occupied by the bladder neck (Fig. 11D). Through a suprapubic exposure, the mobilized bladder was freed further and repositioned more cranially.



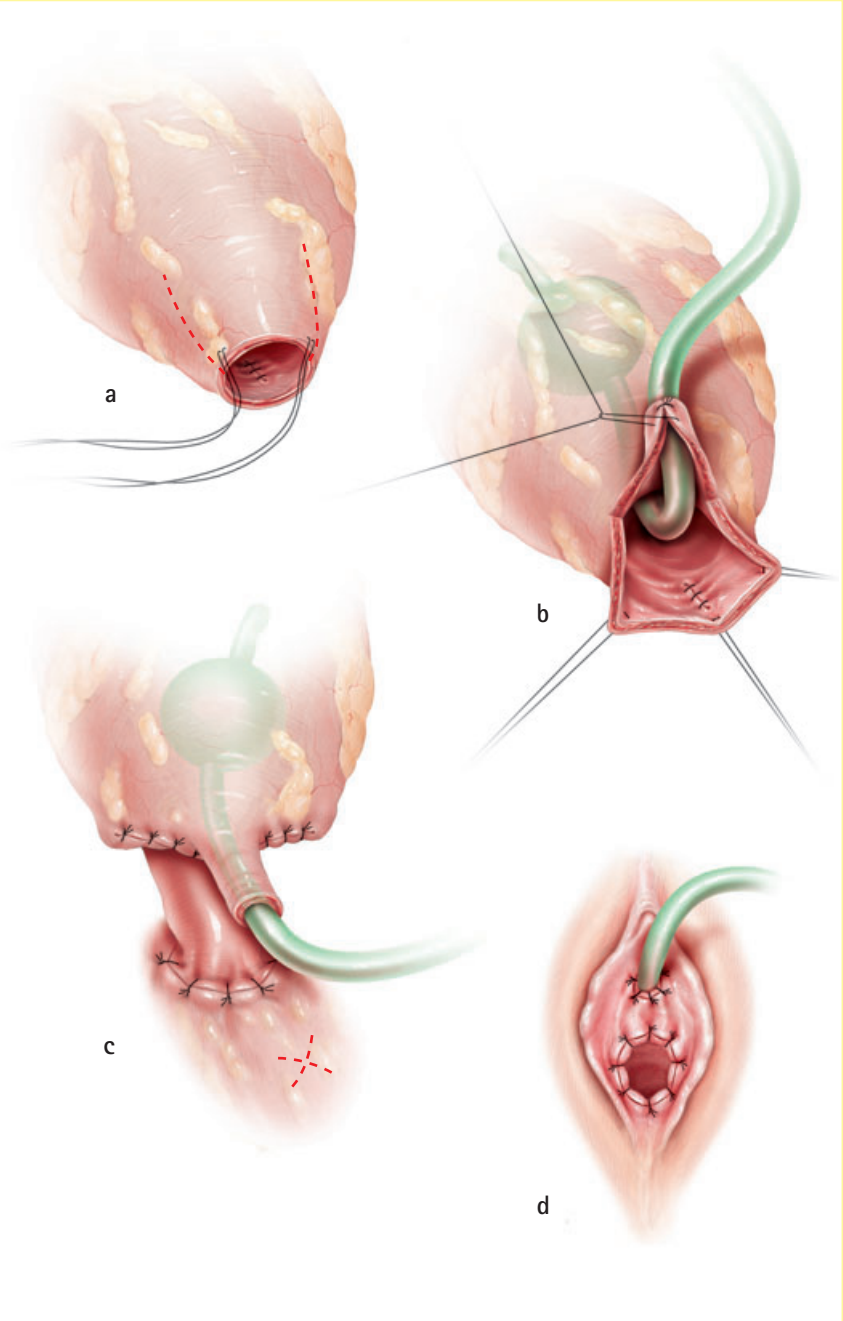


Figure 12

In accordance with the principles of the technique described above, the square flap from the anterior bladder wall, just above the internal meatus (Fig. 12A), was shaped into a tube for the reconstruction of a 2.5-cm long urethral canal (Fig. 12B). The apex of the trigone was then sutured to the base of the reconstructed tube and the bladder closure was completed (Fig. 12C). Through a stab wound incision below the pubic arch and anterior to the repositioned vaginal canal, a pathway was created in which the neourethra could lie. The end of this reconstructed tube was then sutured vaginally to the vestibule just below the clitoris (Fig. 12D). The bladder was drained through a suprapubic cystostomy and a urethral catheter.

Convalescence was uneventful. Suprapubic drainage was maintained for a total of 6 weeks because of some retraction of the external meatus, requiring dilatation. After removing the suprapubic tube, the patient was completely dry and voided with an adequate stream. When she attempted sexual activity shortly thereafter, she experienced some urinary leakage and was advised to abstain from intercourse for at least 3 months. During this time she regained urinary control and, on resuming sexual activity, had no incontinence.

This particular case exemplifies the most stringent test of the sphincteric activity of a neourethra developed from the anterior bladder wall, in that this reconstructed tube was the sole source of sphincteric function. Excretory urograms obtained after surgery showed a well-preserved upper urinary tract, and complete bladder emptying.

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