

Retrospective outcome analysis of one-stage penile urethroplasty using a flap or graft in a homogeneous series of patients

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Study Type – Therapy (case series)
Level of Evidence 4

OBJECTIVE

To compare the results of a one-stage penile flap or graft urethroplasty.

PATIENTS AND METHODS

Sixty-three patients had a penile urethroplasty using one-stage techniques; 18 (29%) had a one-stage flap urethroplasty and 45 (71%) a one-stage urethroplasty using skin (23) or oral mucosal (22) grafts.

The clinical outcome was considered a failure when any instrumentation was needed after surgery.

RESULTS

The mean follow-up was 55 months; of the 63 procedures, 48 (76%) were successful and 15 (24%) failures. Of 18 patients who had a one-stage flap urethroplasty, 12 (67%) were successful and six (33%) were failures; of the 45 who had one-stage graft urethroplasty, 36 (80%) were successful and nine (20%) were failures; of 23 penile skin grafts, 18 (78%) were successful and five (22%) were failures; and

of 22 oral mucosal grafts, 18 (82%) were successful and four (18%) were failures.

CONCLUSIONS

The use of grafts for one-stage penile urethroplasty gave a higher success rate (80%) than flaps (67%). The difference in the success rate between oral mucosal grafts (82%) and skin grafts (78%) was not clinically significant.

KEYWORDS

penile skin, oral mucosa, urethroplasty, flap, graft

INTRODUCTION

In June 1968, the American urologist Orandi presented a new surgical technique for the repair urethral strictures at the 24th Annual Meeting of the BAUS; this new one-stage urethroplasty technique, using the principles of pedicled skin grafting, was published in the same year [1]. Orandi probably never imagined that this simple article, consisting of only two pages of text and one page of figures, would represent the beginning of modern reconstructive urethral surgery using the one-stage flap technique. Orandi's technique has been one of the most popular used worldwide for repairing urethral strictures. Over time, Quartey [2], McAninch [3] and Jordan and Stack [4] popularized a new and original one-stage flap urethroplasty, based on Orandi's original suggestions. In 1953, Presman and Greenfield [5] first reported the use of preputial skin as a full-thickness free graft in the treatment of urethral stricture. In 1963, Devine *et al.* [6] popularized the use of free-skin grafts to repair urethral strictures. In 1994 Snodgrass

[7] first described the tubularized incised-plate urethroplasty for distal hypospadias repair. A notable development of Snodgrass' technique appeared in 1999, when Hayes and Malone [8], in patients with a failed hypospadias repair, suggested laying an oral mucosal graft into Snodgrass' midline incision of the urethral plate. In 2001, Asopa *et al.* [9] described a similar technique for repairing anterior urethral strictures, thus beginning a new era in reconstructive urethral surgery using free-graft techniques. Controversy over the best means of reconstructing the penile urethra has been renewed, and in recent years free grafts have been revisited, with fewer surgeons using genital flaps [10–14]. Rarely do current reports provide studies comparing the graft to the flap, making it hard to determine the optimum [11,14].

The purpose of the present study was to retrospectively evaluate the outcome in patients who had a one-stage penile flap or graft urethroplasty, comparing the results of these different surgical techniques and the results of using skin or oral mucosal grafts.

PATIENTS AND METHODS

We reviewed the charts of 63 patients (mean age 51 years, range 15–78) who had a penile urethroplasty using different one-stage techniques (Table 1). Patients with lichen sclerosus or failed hypospadias repair were excluded. All data on these 63 patients are fully available at <http://www.urethralcentre.it>. The preoperative evaluation included a clinical history, physical examination, urine culture, residual urine measurement, uroflowmetry and retrograde and voiding cysto-urethrography. Since 1998 all patients have been assessed with urethral ultrasonography. The causes of the strictures are listed in Table 1, with the distribution of stricture length. In 37 patients (59%) the strictures were in the middle shaft of the penis, starting >3 cm from the external urinary meatus with no involvement of the navicularis tract; in 26 (41%) the stricture involved the distal tract of the penile urethra and the navicularis tract, including the external urinary meatus. Fifty-one patients (81%) had received previous treatments (Table 1); 18 (29%) had had a one-

stage dartos fascial flap with skin-island urethroplasty and 45 (71%) a one-stage urethroplasty using penile skin (23) or oral mucosal (22) grafts (Table 1). All surgical procedures were performed by the same urologist (G.B.).

The patient is placed supine for strictures in the distal part of the penis, and in the simple lithotomy position for strictures involving the proximal part of the penis. The patient's lower legs are carefully placed in Allen stirrups with sequential inflatable compression sleeves, and the lower extremities are then suspended by the patient's feet within the boots of the stirrups. Proper positioning ensures that there is no pressure on any aspect of the calf muscles and no inward boot rotation, to avoid peroneal nerve injury. The skin of the suprapubic region, penis, scrotum and perineum is shaved and this region is prepared and draped appropriately. The oral mucosal graft is harvested according to the standard technique. Methylene blue is injected into the urethra to better define the urethral mucosa.

For the one-stage dartos fascial flap with skin-island urethroplasty, a suture is placed in the glans to stretch the penis and to control for flap elevation. Two different procedures were used according to the stricture location. (i) In seven patients with strictures involving the distal tract of the penile urethra and the navicularis tract, including the external urinary meatus, a longitudinal strip of penile skin was marked on the ventral surface of the penis (Fig. 1a). The glans and the penile urethra were longitudinally opened (Fig. 1b). The dartos fascia was carefully dissected from the superficial lamina of Buck's fascia and from the foreskin (Fig. 1c). Thus, a longitudinal skin island based on dartos fascial flap was obtained (Fig. 1c). The left side of the skin island was moved and sutured to the left side of the urethral mucosal plate (Fig. 1d). A Foley 14 F silicone grooved catheter was inserted and the skin flap rotated to cover the urethral plate, and sutured to the right side of the urethral plate (Fig. 1e). The corpus spongiosum was closed over the skin flap (Fig. 1f). The glans and penile skin were sutured along the midline (Fig. 1g). (ii) In 11 patients with strictures in the middle shaft of the penis, starting >3 cm from the external urinary meatus, with no involvement of the navicularis tract, the distal extent of the stenosis was identified by inserting a 14 F catheter with a round tip up

Variable	N (%)	Success rate, n (%) or n/N
Age, years		
15-49	28 (44)	22 (79)
50-69	28 (44)	20 (71)
>70	7 (12)	6/7
Cause		
Unknown	19 (30)	12 (63)
Catheter	21 (33)	15 (71)
Trauma	4 (6)	4/4
Instrumentation	17 (27)	15/17
Infection	1 (2)	1/1
Radiotherapy	1 (2)	1/1
Length, cm		
1-2	2 (3)	2/2
2-3	8 (13)	6/8
3-4	10 (16)	5/10
4-5	16 (25)	13/16
5-6	14 (22)	11/14
>6	13 (21)	11/13
Previous treatment		
Urethrotomy	11 (18)	10/11
Dilatation	8 (13)	6/8
Urethroplasty	3 (5)	2/3
Multiple	30 (48)	21 (70)
None	11 (18)	9/11
Urethroplasty technique (substitute material) {mean follow-up, months}		
Flap (penile skin)	18	12 (67) {57}
Graft (penile skin)	23	18 (78) {37.8}
Graft (oral mucosa)	22	18 (82) {57}

TABLE 1

The success rate, by patient age, cause of stricture, stricture length, previous treatment and surgical technique

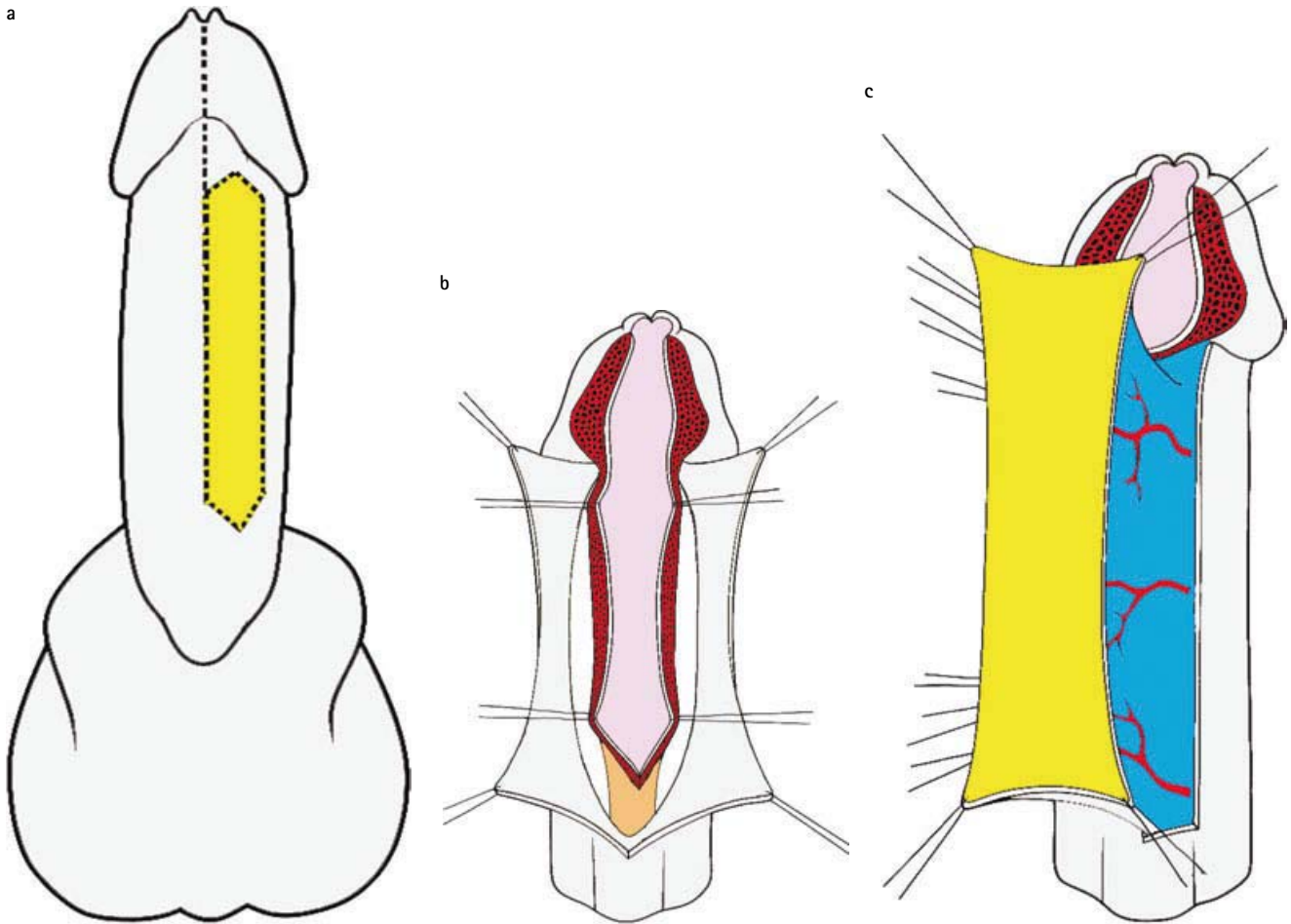
to the point of resistance. A midline incision was made and a longitudinal island of penile skin marked on the ventral surface of the penile skin (Fig. 2a). The urethra was dissected from the corpora cavernosa and rotated to fully expose the dorsal urethral surface (Fig. 2b). The urethra was opened and the urethral stricture exposed by extending the urethrotomy distally and proximally (Fig. 2c). Once the entire stricture had been incised, distal and proximal calibration of the urethra was mandatory for identifying any residual narrowing. The dartos fascia was carefully dissected from the superficial lamina of Buck's fascia and from the foreskin. Thus, a longitudinal island of penile skin, based on the dartos fascial flap, was obtained and moved over the corpora cavernosa (Fig. 2d). The two apices of the urethrotomy were fixed to the two apices of the skin island flap (Fig. 2e). The left side of the urethral plate was sutured to the left side of the skin island flap. A Foley 14 F silicone grooved catheter was inserted and the urethral plate rotated to cover and be sutured to the right side of the skin island

(Fig. 2f). At the end of the procedure, the skin flap was completely covered by the urethra (Fig. 2g). The midline incision was closed (Fig. 2h).

For the one-stage graft urethroplasty, the penile urethra was exposed (Fig. 3a) and the strictured tract fully opened by a ventral midline incision (Fig. 3b). The urethral mucosal plate was longitudinally incised along the midline down to the albuginea of the corpora and the wings of the urethral plate laterally mobilized to create a wide bed for the graft location (Fig. 3c). The graft (penile skin or oral mucosa) was sutured and quilted onto the bed of the dorsal urethrotomy using interrupted 6-0 polyglactin sutures (Fig. 3d). The urethra was tubularized up to the glans over a Foley 14 F grooved silicone catheter (Fig. 3e). The glans and the penile skin were closed (Fig. 3f).

Patients were discharged from the hospital 3 days after surgery and had voiding cysto-urethrography 2 weeks later. The clinical

FIG. 1. (a) A longitudinal strip of ventral penile skin is marked. (b) The navicularis and penile urethra are opened. (c) The dartos fascia is dissected from Buck's fascia and skin. (d) The left side of the skin flap is sutured to the urethral plate. (e) The skin flap is rotated to cover the urethral plate. (f) The corpus spongiosum is closed over the flap. (g) The glans and penile skin are closed.



outcome was considered a failure when any instrumentation was needed after surgery, including dilatation. Uroflowmetry and urine culture were repeated every 4 months in the first year and annually thereafter. When there were symptoms of decreased force of stream and uroflowmetry gave a rate of <14 mL/s the urethrography, urethral ultrasonography and urethroscopy were repeated.

RESULTS

The overall mean follow-up was 50.6 months; it was 57 months for flap urethroplasty, 37.8 months for penile skin urethroplasty and 57 months for oral mucosal grafts. Of the 63 patients, 48 (76%) had a successful outcome and 15 (24%) were failures. The success rate

with patient age, cause of stricture, stricture length, previous treatment and stricture site and urethroplasty technique are listed in Table 1.

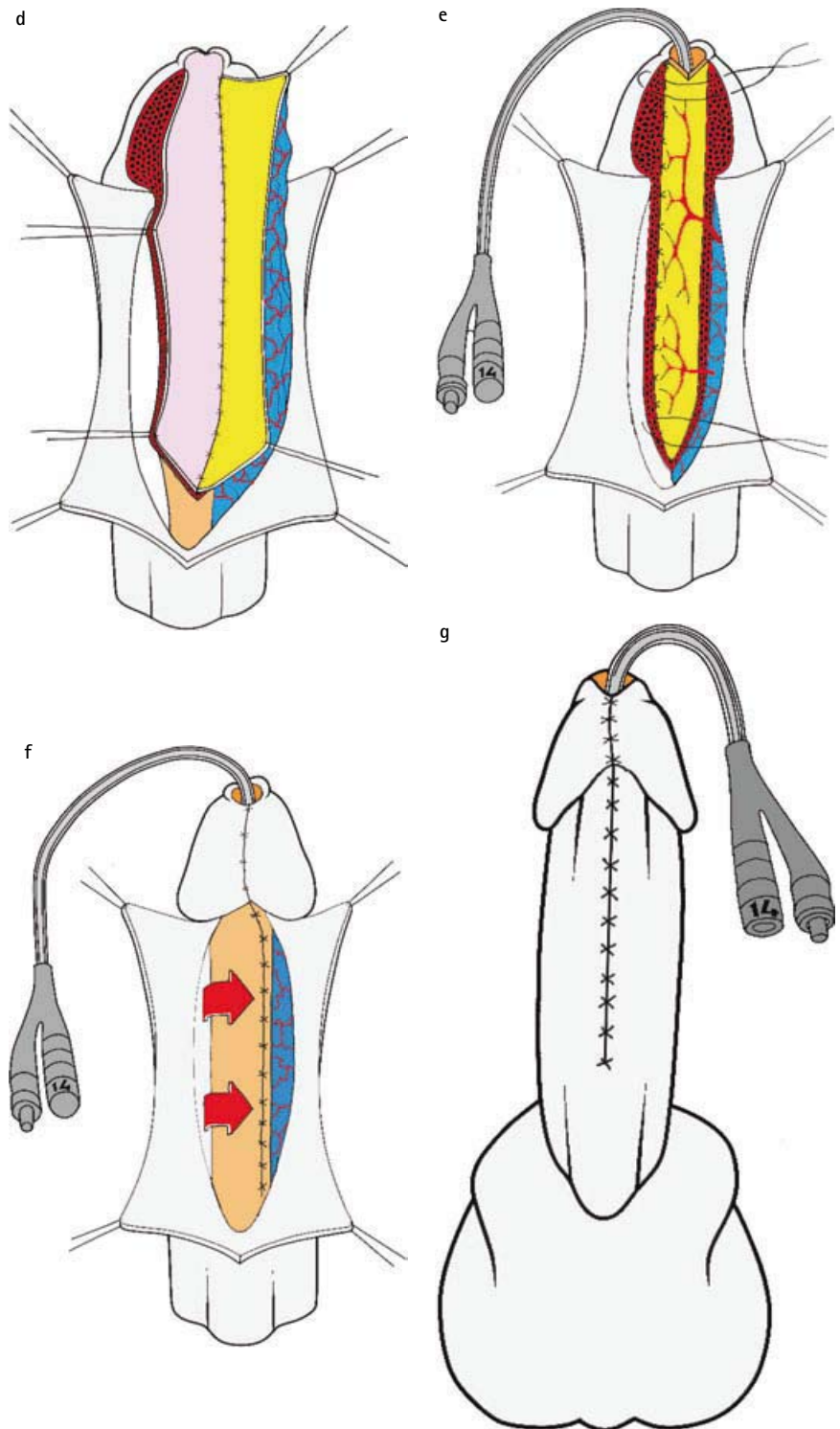
Of the 18 patients who had a one-stage dartos fascial flap with skin island urethroplasty, 12 (67%) were successful and six (33%) failures (Table 1). In seven patients with strictures involving the distal tract of the penile urethra and the navicularis tract including the external urinary meatus (Fig. 1a–g), four were successful and three were failures. In 11 patients with strictures in the middle shaft of the penis starting >3 cm from the external urinary meatus with no involvement of the navicularis tract (Fig. 2a–h), eight were successful and three were failures. Of 45 patients who had a one-stage

graft urethroplasty (Fig. 3a–f), 36 (80%) were successful and nine (20%) were failures. In 19 patients with strictures involving the distal tract of the penile urethra and the navicularis tract, including the external urinary meatus, 16 (84%) were successful and three (16%) were failures. In 26 patients with strictures in the middle shaft of the penis starting >3 cm from the external urinary meatus with no involvement of the navicularis tract, 19 (73%) were successful and six (27%) were failures. The success rate with different substitute materials are also shown Table 1. The 15 failures were treated using the procedures listed in Table 2; of the 15 failures, 14 had a satisfactory final outcome and one had a definitive perineal urethrostomy because the patient refused further surgery on the penile shaft.

DISCUSSION

In 1972, Orandi [15] published a 4-year follow-up of 21 patients who had a one-stage flap urethroplasty, reporting that one patient had a recurrent stricture and in two hair grew and stones formed in the urethra. In previous reports the success rate of the pedicled skin flap and free grafts are virtually identical [11,14]. Moreover, many studies fail to accurately report the follow-up criteria, and the location of the stricture (penile or bulbar) is rarely specified [11]. Moreover, many studies group together the different kinds of free grafts, e.g. penile skin, bladder mucosa and oral mucosa [11], and commonly include urethroplasties using different substitution grafts and varying techniques (penile or scrotal flaps, oral mucosa graft, genital or extragenital skin grafts) in their evaluation of the results [11]. Recently, some authors reported the results of a randomized prospective study comparing these two different techniques, including patients with penile (nine) and bulbar (16) or penobulbar (30) urethral strictures [14]. It is incorrect to compare, even in a randomized prospective trial, the outcome of any kind of urethroplasty used in the repair of so many different kinds of strictures. All urologists who are involved in reconstructive urethral surgery know well that the use of one-stage flap or graft procedures for penile urethroplasty is differs markedly from the use of these procedures in the bulbar urethroplasty, as far as surgical steps, complication rates and final outcome are concerned. For these reasons, the final evaluation of the results reported in the randomised prospective trial are confusing and should not be considered credible [14]. The cause of the urethral stricture is also variable, e.g. trauma, inflammation, hypospadias-epispadias failure or lichen sclerosus. Location and length are also important factors in determining the complexity of the repair. To evaluate the true incidence of deterioration of a urethral repair it is necessary to compare the same repair technique using the same substitution material with urethral strictures of similar location and causes. For these reasons we excluded, from the present study, patients with urethral strictures associated with complex immunological disorders (lichen sclerosus) or with complex anatomical and pathological status of the penile components and urethral tissues (failed hypospadias-epispadias repair). Moreover, in the present study we included only patients with penile

FIG. 1. Continued.

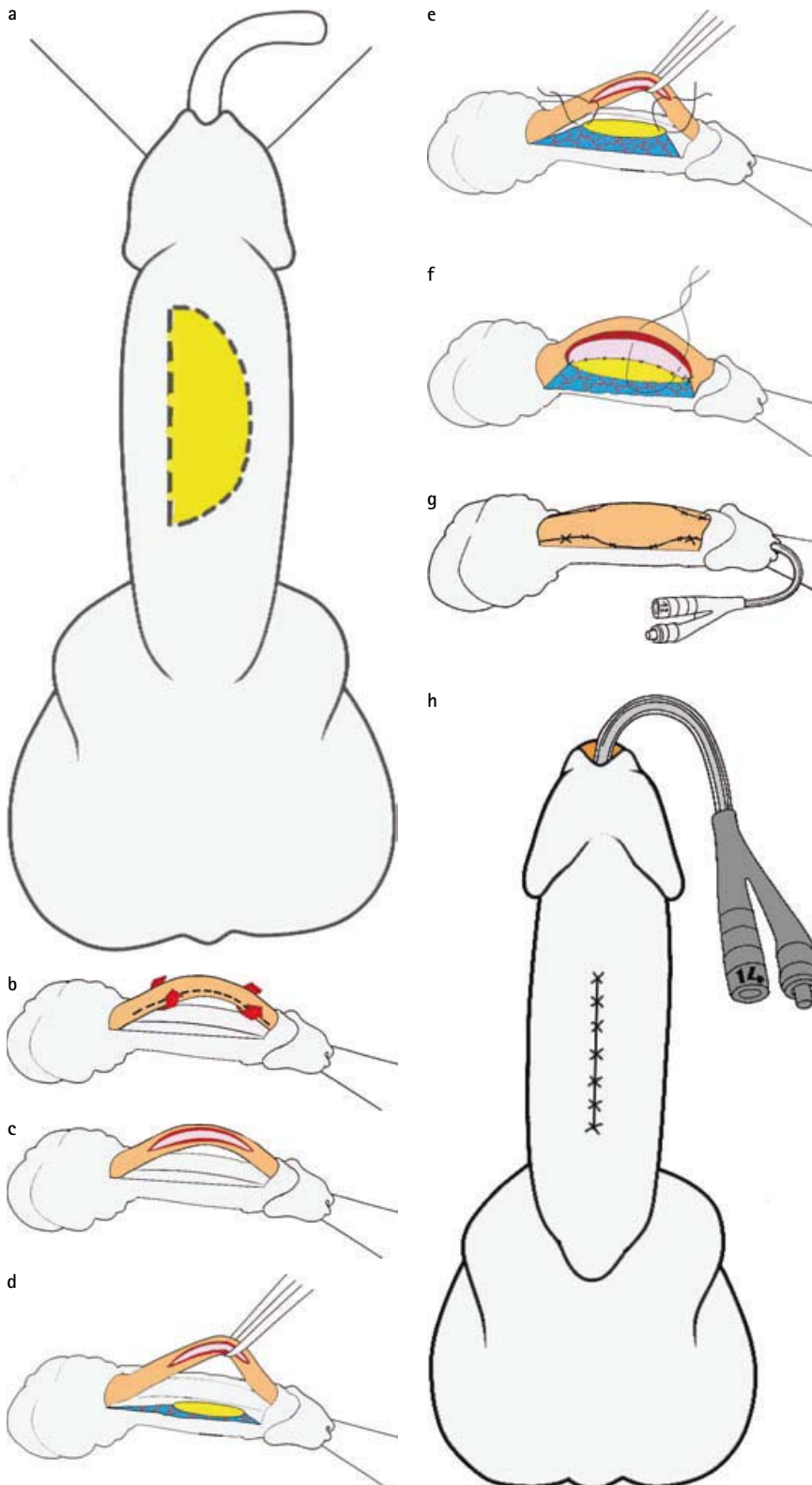


urethral strictures that did not involve or extend into the bulbar tract.

In the present series the overall success rate of the free graft was 80%, while the oral

mucosal graft had a higher success rate (82%) than the skin graft (78%). The overall success rate of the pedicled skin flap was 67%, but Orandi's technique, selected for patients with strictures in the middle shaft of the penis, had

FIG. 2. (a) A longitudinal strip of ventral penile skin is marked. (b) The urethra is rotated 180° and the dorsal urethral surface is exposed. (c) The urethra is opened. (d) The skin flap is obtained from the dartos fascia. (e) The distal and proximal apices of the flap are sutured to the apices of the urethrotomy. (f) The urethra is rotated to cover the flap. (g) The flap is covered by the urethra. (h) The penile skin is sutured.

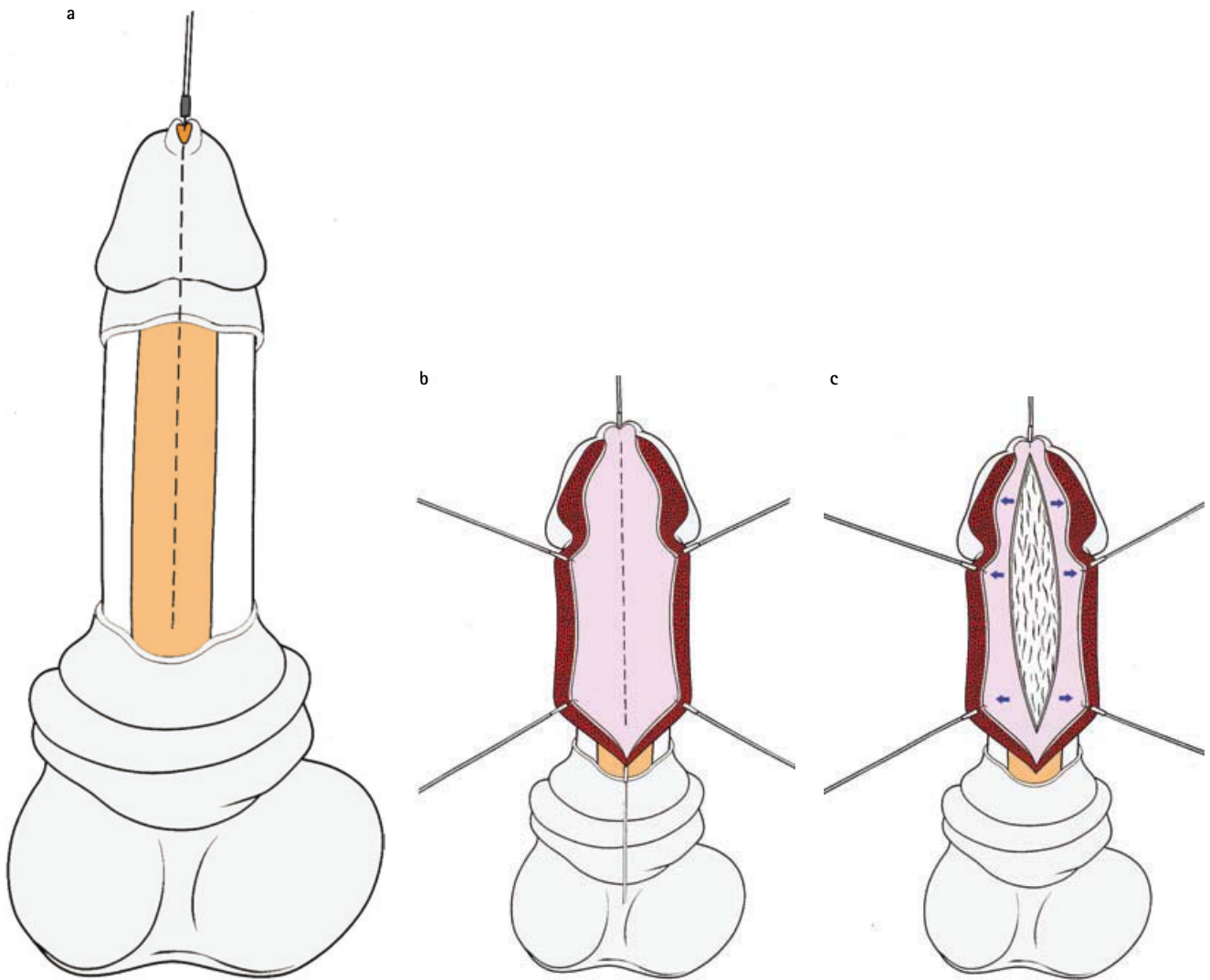


a higher success rate (eight of 11). Surprisingly, the strictures involving the navicularis tract and meatus, where the risk of stricture recurrence is very high, had a higher success rate (77%) than strictures in the middle shaft of the penis (75%). We reviewed these results according to the factors reported as influencing the success rate of any kind of urethroplasty: patient age, stricture cause, length and previous treatments. Our results showed that patient age had no effect on the success rate, suggesting that one-stage penile urethroplasty should not be withheld from patients on the basis of age, as patients aged >70 years had a higher success rate (six of seven) than younger patients (79% or 71%; Table 1). Evaluating the success rate of urethroplasty according to the cause of the stricture showed that the only strictures with a low success rate (63%) were those with an unknown cause, but this was a relatively large group of patients (19; Table 1). The success rate of urethroplasty according to stricture length is controversial, as both short strictures were repaired successfully, but of 13 strictures >6 cm, 11 were successfully repaired, and of 10 that were 3–4 cm, only five were successful (Table 1).

The success rate was nine of 11 in patients who had not had a previous treatment, whereas in patients who had a previous urethroplasty, the success rate was lower (two of three), but in those treated with urethrotomy it was not as low (10 of 11) as be expected (Table 1).

At present we are uncertain in which patients the use of the pedicled flap has a better chance of success over the free graft, as the thin penile corpus spongiosum and the dartos fascia do not ensure sufficient graft support in all patients. Identification and use of criteria to more carefully select the most appropriate procedure for the patient might clarify whether a free graft is preferable to the penile flap, according to the characteristics of the vascular and mechanical tissues used to support the original urethral mucosal plate. The choice of surgical technique (flap vs graft) was made according to the status of the original urethral plate and penile corpus spongiosum tissue. Basically, in patients with a wide, soft urethral plate and no fibrous spongiosum tissue, we prefer to use a graft. Instead, in patient with a narrow, rigid urethral plate and fibrous spongiosum tissue, we prefer to use a flap. Probably another

FIG. 3. (a) The penile urethra is exposed. (b) The urethra is opened. (c) The urethral plate is incised along the midline. (d) The graft is sutured to the urethral plate. (e) The urethra is closed. (f) The glans and penile skin are closed.

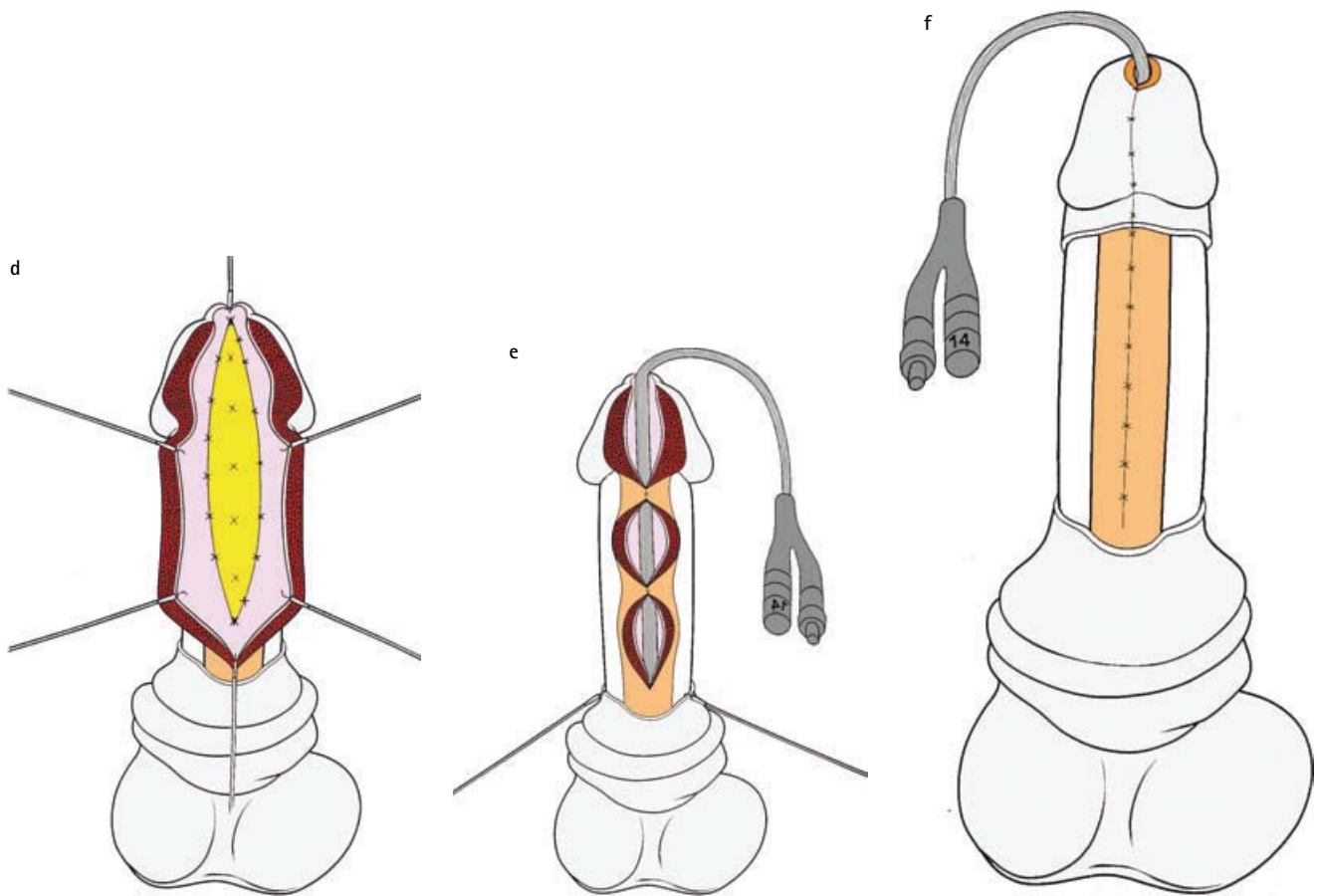


important factor influencing the choice of the surgical technique was the surgical background and training. Unfortunately, we have not had the opportunity for training in plastic and reconstructive surgery techniques, and we are not fully confident in the tissue-transfer procedures. Our experience in the use of free grafts for bulbar urethroplasty has greatly matured, thus over time we have transferred this expertise to penile urethral surgery, preferring to use the graft rather than the flap. In patients with penile urethral strictures not related to lichen sclerosus or failed hypospadias repair, the success rate of one-stage urethroplasty using the pedicled

Primary urethroplasty (n patients)	Repair after failure (n)
Flap (6)	Fistula closure End-to-end anastomosis Two-stage repair (3)
Oral mucosal graft (4)	Perineal urethrostomy Urethrotomy Meatotomy Flap
Skin graft (5)	Oral graft Urethrotomy End-to-end anastomosis Two flap (2) Two-stage repair

TABLE 2
The surgical treatments of the 15 failures

FIG. 3. Continued.



flap or graft was 67–82%. Oral mucosa seems to be a little better than skin graft material, but the difference is so small that it does not justify the use of oral mucosa as a first choice. The choice of surgical technique (graft vs flap) was based primarily on the condition of the urethra during surgery, but the surgical background and training of the surgeon also conditioned the selection of the procedure.

CONFLICT OF INTEREST

None declared.

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