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Original Article

Is a *pedicular flap* coupled to the *double turnover flaps urethroplasty* suitable for urethral–perineal reconstruction? Considerations about a relapsing urethral–cutaneous fistula condition

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ABSTRACT

Background: This study highlights the effectiveness, in one surgical stage, of two combined local techniques for perineal fistula repair in a patient with spinal cord injury: the "Turn over flaps urethroplasty" and the "Pedicular fasciocutaneous flap" from the inferior gluteal fold. Unlike the traditional *Perforator flap*, we harvested a *Pedicular flap*; by definition, this is a flap with a narrow diffuse microvascular supply aimed in our case at shielding the neourethra and substituting the remaining scarred perineum. **Method:** The urethroplasty technique adopted, the 'Double turn over flaps urethroplasty', has been based on sculpting two opposing local cutaneous flaps circumscribing the fistulous cutaneous openings. Eventually, the neourethra continuity has been re-established by turning over both flaps and making them meet medially. The dimension and thickness of the "Pedicular fasciocutaneous flap", have been considered to prevent any damage to the urethroplasty and at the same time to replace all the debrided scarred perineal tissue. **Results:** The follow-up confirmed a well-consolidated supple perineal area and a competent neourethra. **Conclusions:** The "Pedicular

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flap" is by definition a random vascular flap nourished through a narrow pedicle, not based on a single perforator but only on a diffuse, spread micro-perforators. When associated with the double "*Turn over flaps urethroplasty*", it represents a possible alternative to achieve satisfactory results for those physical and psychological challenges encountered in the treatment of recurrent urethral fistula of the perineum in a patient with spinal cord injury.

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Introduction

Different medical conditions trigger perineal reconstruction, including malignancies, injuries, burns, infections, congenital anomalies, radiation damage, urethral calculi and gynaecological issues.¹⁻⁵ One particular context is the patient with spinal cord injury. In this background, the recurrent urethral fistula of the perineum after past failed surgical attempts aimed at re-establishing the lumen continuity, was causing a wide scarred superficial perineal tissue. Several techniques have been described in the literature to manage the perineal soft tissue reconstruction in a urethral fistula setting; these include flaps of proximity designed as fasciocutaneous, musculocutaneous, perforator flaps as well as distant flaps moved to the perineum.⁶⁻⁸ By themselves, they are useless unless associated with a proper technique for urethral lumenrestoration. This clinical case describes in a single-stage procedure, the *Turn over flaps urethroplasty* associated with the *Pedicle fasciocutaneous flap* of the inferior gluteal fold.

Clinical background

The clinical setting is represented by a 35-year-old male who was paraplegic for 13 years. He had a T4 complete post-traumatic spinal cord injury but was otherwise in good health. His records reported several attempts to fix a recurrent cutaneous fistula of the perineum caused by repeated unsuccessful catheterisations. At the consultation, the patient underwent both colostomy and suprapubic cystostomy. These were the last surgical attempts to favour spontaneous indirect closure of the perineal skin ulcer. Locally, the perineum appeared widely scarred with a fistulous tract and two orifices 3 cm apart. The catheterisation of both cutaneous openings had revealed a free communication, anteriorly to the urethra penis and posteriorly with the bulbous urethra and the bladder. A cystoscopy as well as an ante and retrograde cystourethrogram confirmed the patency of both urethral tracts just interrupted at the perineum. Eventually, magnetic resonance imaging (Philips Ingenia, Philips Medical System PC Best- Netherlands) in the T2 weighted images fat suppression ([Figure 1a](#)) visualised an abnormal path to the perineal skin coming from the two arms of the interrupted urethra. Urinary suprapubic diversion was not sufficient to fully exclude urine leakage from the bladder to the skin. Noteworthy are the clinical records confirming a relentless condition of suppuration as well as a self-evacuating abscess contributing to and causing the severely scarred perineal reaction. *Technique*: The plastic surgery timeline for major urologic surgery was performed as an unscheduled reconstruction procedure without the diagnostic phase for a colour Doppler scanning of the perineum. *Urologic Time*: The patient was placed in a lithotomy position; the perineal skin was incised as an ellipse 5 cm in length. It encompassed with its extremes both orifices of the fistula. After isolating the sides of the ellipse, they have been turned over ([Figure 2, Left](#)). Finally, both cutaneous flaps were sutured to each other ventrally and in line with the middle unscathed perpendicular long axis of the ellipse. This first surgical step was aimed at re-establishing the urethral continuity. In particular, the dome of the neourethra resulted from the middle part of the rhombic perineal skin not being undermined.

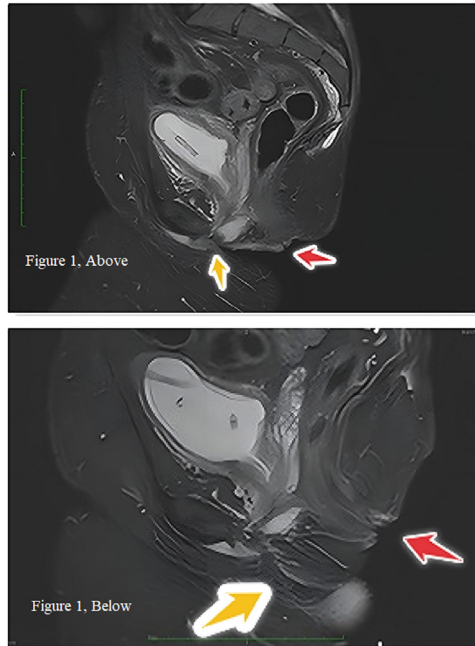


Figure 1. (Above) MRI, (Magnetic Resonance Imaging) T2 weighted fat sat images, preoperative study, sagittal view; it is apparent the cutaneous-urethral fistula, (Yellow arrow); red arrow shows the anus; (Below) MRI, same comparative images, follow-up of 120 days, well-consolidated flap now replacing the debrided scarred tissue and effectively supporting the repaired urethra (Yellow arrow).

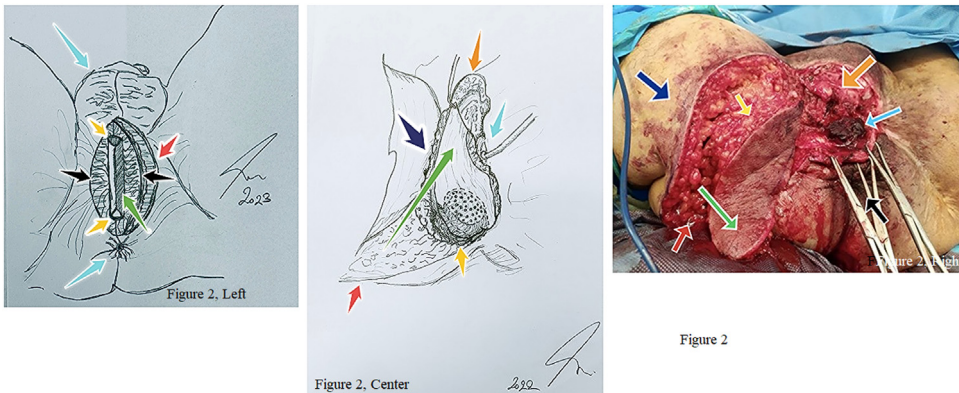


Figure 2. (Left) Schematic diagram, not in scale, shows the patient in lithotomy position, the two openings of the urethra-cutaneous fistula of the perineum (Yellow arrows); urethral tract to reconstruct (3 cm long) (Green arrow); two cutaneous turn over flaps (Black arrows), undermined, opposing each other, encompassing the two openings of the fistula and hinged on that median not undermined tract of skin, which will be part of the neourethra; (Red arrow) Origin of left turn over flap for the neourethra, (Orange arrows) scrotum and anal sphincter. (Centre) Schematic diagram shows the pedicle flap vascularity; namely the hypothesis of the mechanism based on the concept of microperforator arborisation system. The patient is in a lithotomy position. The fasciocutaneous pedicular flap is isolated on its pivot and already rotated to the final destination (streamed green arrow); (Right) picture *in vivo* of the patient, the fasciocutaneous flap is not yet rotated (Solid green arrow). Red arrow, origin of the flap from the inferior gluteal area. Blue arrow, right thigh. Yellow arrow, pedicle of the fasciocutaneous flap. Orange arrow, debrided perineal area. Streamed sky-blue arrow in the sketch, urethral catheter inserted in the fistulous breach. Solid sky-blue arrow, urethroplasty masked by Surgicel -TABOTAMP®, (J & J International, European Logistics Centre Leonardo). Green arrow, distal end of the fasciocutaneous flap not yet rotated.

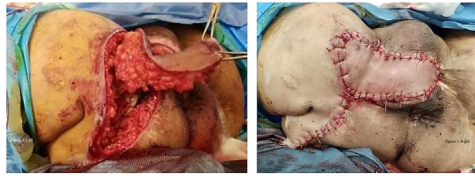


Figure 3. (Left) Patient in lithotomy position; isolated pedicular fasciocutaneous flap, medial-inner rotation of the flap from the inferior gluteal fold on the debrided area; (Right) the flap is sewn on the urethroplasty and completely replaces the perineal scarred soft tissue.

On the contrary, the undermined sides, hinged, flipped and sewn caudally, made the skin surface lie inside and form the lumen. This manoeuvre completed the skin tubulisation of the neourethra while the subcutaneous tissue remained outside (Figure 2, Centre). *Reconstruction of the Perineum:* After a wide debridement of the remaining scarred perineum (Figure 3, Left), due to the versatility of its characteristics, an inferior fasciocutaneous gluteal fold flap was chosen and tailored to replace the entire perineal scarred tissue as well as to give a proper support to the neourethra reconstruction (Figure 3, Right). It was privileged to have the option of a longitudinal fascial flap, 22 cm × 9 cm, partially encompassing the yet untouched inferior gluteal fold (Figure 3, Left). It has been accurately reckoned to cover in excess of the debrided perineal area. The dissection of the lozenge started distally and subfascially. The subfascial isolation of the flap was as good as complete, but a minor proximal-medial-random root, mostly circular, with a diameter/width of 6 cm and a perimeter/circumference of approximately 19 cm. This represented the unique connection left between the flap and the deep perineal-pudendal vascular source. After isolating the flap, it was rotated proximally and anticlockwise for more than 90°. This allowed the flap to assume a horizontal position, cover the naked debrided perineal area and buttress the neourethra (Figure 3- Right). In due course, the new position of the flap covered the entire rhomboid perineal soft tissue block, extending from the radix of the scrotum to the anus and from one ischial tuberosity to the opposite one. The transposed flap has been anchored to the adjacent tissues using a long-lasting resorbable material (Ethicon-Vicryl 0, Johnson & Johnson International) in skin-to-skin, full-thickness transfixing sutures. No drains have been left in place except the bladder-neourethral catheter and the suprapubic cystostomy. The regimen of antibiotics has targeted the usual pathogens, hence the intravenous administration of Ceftriaxone 2 g/day, for 15 days. This regimen was replaced by an oral, third generation cephalosporin, Cefixime, 400 mg, once a day, for 15 more days. However, the choice of each antibiotic was tailored according to a preoperative and postoperative antimicrobial testing. The scheduled routine for the patient's bladder voiding organised in the inpatient setting was, as for the postop, to maintain the urinary catheter in place for 15 days while at the same time keeping open the episcistostomy as long as the 30th postoperative day.

For the outpatient setting, the routine changed as follows: on the 35th postoperative day, the intermittent catheterisation was resumed keeping closed the suprapubic cystostomy. At last, on the 45th postoperative day, the episcistostomy was removed.

Results

The patient healed uneventfully except for a minor dehiscence of the wound on the left ischial tuberosity. The skin flap dehiscence was managed conservatively and successfully. Early postoperative ultrasound scanning, and handheld acoustic Doppler flowmetry (Esaote my lab 9 xp) of the proximal flap area corresponding to the subcutaneous-fascial connection, ruled out either any significant vessel or a true perforator. After a follow-up of 120 days no recurrence of perineal leakage was found or referred to by the patient; superficially, the perineum looked and felt supple as well (Figure 1 -Below). The reconstructed bulbar neourethra portion was confirmed to have a length of 3 cm measured from the proximal to distal fistulous openings. Characteristics of the fasciocutaneous flap: The donor site surface dimension needed to cover the recipient perineal area has been reckoned to be 198 cm² (22 cm × 9 cm). The pivot area of the flap not undermined and thus left intact, placed on the su-



Figure 4. (Left) Patient in a lithotomy position, preoperative scarred perineal area in the sub-scrotal zone; it is present the cutaneous breach of the urethral-perineal fistula; (Right) Follow-up, 120 days after surgery, well-consolidated rotated fasciocutaneous flap on the reconstituted perineal area.

peromedial flap corner, had a surface of approximately 28 cm^2 [$(3 \text{ cm})^2 \times 3.14$]; The undissected subcutaneous vascular area of the flap has been converted to percentage by taking into account the ratio between the total surface area of the flap and that part spared as point of vascular link to the deep muscular plane. This corresponds to approximately 15% of the flap that remained connected to the fascial-subfascial anatomical compartment. The lower pole of the flap was rotated by more than 90° . Admittedly, its caudal-perpendicular axis was first oriented vertically, after the procedure, it showed a horizontal-supero-medial vector. At 120 days of follow-up (Figure 4, Left, Right), the presence of a consolidated healed local area was confirmed both clinically and radiologically (Figures 1 and 2). In short, the perineal leakage of urine, the subcutaneous fluid collection and the general symptoms had disappeared.

Discussion

The anatomical and pathological consequences caused by the unrelenting cutaneous perineal urethral fistula in a patient with spinal cord injury is more than a potential issue.⁹ Among other complications, there is the postoperative recurrence of the fistula after the bulbar urethral fixing as well as the general and specific complications that the chronic urine leakage locally prompts.^{10,11} Even in those patients forced to maintain a permanent urine diversion in a neurological bladder, it is apparent that one surgical approach could not be effective. A definitive solution can neither be represented just by the urethra debridement and reconstruction nor to simply burying the debrided and interrupted perineal urethra under a well vascularised flap¹² on the ground that the scar formed around the indwelling permanent catheter be a guide for the reconstitution of the lost, short urethra. Admittedly, taking into account this observation, confirmed by the past surgical attempts on the patient, the technique undertaken was based this time on an associated surgery. After a wide perineal and urethral debridement, the bulbar urethral continuity was obtained by making converge ventrally two local skin flaps while the whole anatomical superficial area was replaced with a new perineal covering. For the perineal soft tissue reconstruction, we sculpted a fasciocutaneous flap not preliminary scanned with ultrasound for the presence of perforator vessels. Actually, a gluteal fasciocutaneous flap was isolated randomly taking into account the anatomical area involved, known as a district of high vascular density.¹³ Most notably, the follow-up confirmed the absence of any significant perforator and consequently, we hypothesised to have based the flap on the 'micro-perforators vascular supply system'.¹⁴ This quite new theory maintains that in intense vascularised anatomical areas, it is possible to carve and leave a narrow connection from the deep muscular compartment to the isolated flap, with no major perforators as a nourishing source. The mechanism for the survival of the flap would be rooted in the diffused network of microperforators present in the unique axis of tissue connecting the fascia of the flap to the muscle plane. Admittedly, the total vascular area/system resulting from the sum of each individual lumen of the microperforator would compare well with the vascular area/lumen of the single perforator of the traditional perforator flap. Should this kind of flap be rotated on its pedicle; however, it would maintain the resilience, as this clinical case confirms, to survive, to buttress the exposed bulbar neourethra and eventually replace the perineum. This seems a

step forward in the ladder offered to the surgeon to choose to simplify complex, combined procedures like the one here described. As to concern the urologic phase of the surgery deemed to be essential for a balanced and successful outcome, there are a variety of options available to restore the continuity of the urethral defect; they span from the end-to-end anastomosis, the buccal mucosal graft and flaps to cite just a few.^{15,16} We ruled out from the beginning both the primary anastomotic urethroplasty because it had already been attempted and also any grafting because of the length of the bulbar urethra to reconstruct. Notwithstanding the awareness of the frequent complications due to skin flaps urethroplasty such as recurrent stricture, troublesome postvoid dribbling and diverticulum formation,¹⁷ we relied on two parallel ‘turn over local flaps’ to substitute the lost urethral segment. The technique entailed carving bilaterally, at the sides of the path of the lacking urethral tract, two cutaneous flaps, even if on scarred skin. They encompassed both openings of the urethral fistula and have been sewed to each other medially and caudally. The movement dug the perineal skin, tabularised it and let it become the inner new layer of the reconstituted bulbar urethra (Figure 2-Left, -Centre). By so doing, the subcutaneous sides of the urethral flaps ended up exposed and needed to be sheltered. The literature confirms that a well vascularised flap covering the urethroplasty reduces the rate of the fistula at least in hypospadias; on that basis, we added a fasciocutaneous flap to the first procedure.¹⁸ The fasciocutaneous flap was based on the so-called pedicular area (PA) and the ubiquitous micro-perforators theory¹⁹ and has satisfied two surgical purposes, respectively, to buttress the urethroplasty and to substitute the scarred perineum. To summarise, the mechanism at the base of the random vascularisation of the pedicle flap we used, known as the pedicle hub or PA consists of a ubiquitous microperforators system arborizing the pedicle and representing the source, which nourishes the entire flap. This kind of flap, as Gómez et al¹⁴ described, could allow subfascial isolation of it to up to 90% of its total area. Provided that this connection is no less than 10 cm² and positioned in regions of highest vascular density, it would allegedly, according to the aforementioned author,¹⁴ well compare with the single vascular vessel characteristic of the traditional perforator flap.²⁰

Limitations

This study has several limitations. This is a case report and as such is meant just to introduce an idea to work out a complex local condition in a wearing general physical background as the paraplegic patient is; there has been no preoperative colour Doppler assessment of what would have become the unique vascular connection, the pedicle of the fasciocutaneous flap. We carried out the US colour Doppler only in the follow-up. It is because of this that we could retrospectively confirm to rule out any significant perforator in the pivot of the flap and hypothesised the presence of the pedicular hub mechanism.

Conclusions

Although the findings of this study show obvious limitations due to the unexpected strategy adopted and the inherent observational nature of the clinical setting, some elements emerge; Adding two skin flaps to reconstitute the continuity of the urethral lumen, to a rotated *pedicular* local flap is able to successfully recreate a long-lasting urethral conduit wall, effectively protected by a new concept of thick, thriving, nourishing *pedicular* locoregional flap. The final results are an effective urethroplasty, the reinforcement of it and the substitution of the scarred soft perineal tissue. Seemingly, both techniques, simultaneously performed, can be offered as an option to achieve satisfactory results in a complex condition like this. Admittedly, future studies seem to be warranted to further confirm and evaluate the applicability and efficacy of this combined approach.

Declaration of Competing Interest

For each and any Authors of the article there are no author disclosures or conflicts of interest to declare.

Disclosures

There was no financial support for this study. The authors of this manuscript have no financial (or other) conflicts of interest to declare in relation to the content of this article.

Ethical compliance

Studies involving human participants were in accordance with the ethical standards of the institution, (ASL Roma 2, O.U.-Human Resources-Ethical Committee -Prot. 108338/6.6.2023), and however, with the 1964 Helsinki Declaration and its later amendments of comparable ethical standards

The participant has signed the informed consent form and voluntarily participated in our study.

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