Reconstruction with bilateral posteromedial thigh (PMT) flaps after Fournier's gangrene

Ann. Ital. Chir., 2022 93, 3: 339-343
pii: S0003469X22037204

Paolo Marchica*, Alex Pontini*, Fabio Vianello***, Bruno Azzena**

**Clinic of Plastic Surgery, University of Padua; Padua, Italy*
***Burns and Plastic Surgery Unit, University of Padua, Padua, Italy*
****Department of Urology, Presidio Ospedaliero di Gorizia-Monfalcone, Gorizia, Italy*

Reconstruction with bilateral posteromedial thigh (PMT) flaps after Fournier's gangrene

Fournier gangrene (FG) is a deadliest condition affecting genitoperineal area in predisposed patients. A late diagnosis, thus a delayed surgical treatment, leads often to death. LRINEC score and CT scan can help in suspect, despite definitive diagnosis needs surgical exploration and histological findings. Furthermore, FG determines wide defects of genitoperineal area, thus reconstructive surgery is pivotal to restore form and function of the affected patient.
Aim of this article is to discuss the use of posteromedial thigh (PMT) fasciocutaneous flap in FG reconstruction, based on authors' personal experience. A case report of a 63-year-old obese and diabetic man is presented. Two PMT flaps (10 x 17cm^2) were harvested to cover a complete scrotal defect (20 x 40cm^2), while penis integuments defect was treated with a two-staged surgery (dermal substitute application and skin graft). Follow-up at 4 months showed a successful outcome of PMT flaps reconstruction, with preservation of testes vitality, despite one of the flaps developed distal necrosis that was treated with further debridement and skin graft. The authors experience is followed by the decision-making process based on a literature review that led to the choice to use PMT flaps to achieve reconstruction. Furthermore, alternative flaps to treat FG, each of them with pros and cons, are discussed, despite there is not a gold standard treatment and every option must be tailored to the patient.

KEY WORDS: Fournier gangrene, Genital reconstruction, Infection, Necrotizing fasciitis, Posteromedial thigh flap, Perineum reconstruction

Background

Fournier gangrene (FG) is a necrotizing fasciitis of the perineum [1], caused by a fulminant infection whose source may be identified in 95% of cases [2]. Urogenital or colo-rectal diseases, abdominal and pelvic abscesses represent the trigger of the infection in patients with predisposing conditions (diabetes, alcoholism, smoking, AIDS, etc.) and a male predominance is proven [3]. 5% of etiological factors remains idiopathic, despite penile trauma resulting from oral sex and urogenital unrecognized infections are advocated as causative agents [4].

Gram positive and negative bacteria are responsible of the FG by causing a cellulitis, then the infection deepens involving dermal and subcutaneous arteries. Subsequent thrombosis leads to a necrotizing process and the infection spreads through the fascial layers affecting multiple adjacent sites. E. coli presents a 60% isolation rate, thus resulting the most common responsible agent [5]. The LRINEC score [6] is a useful tool for suspecting FG, though the definitive diagnosis is dependent from surgical exploration and histological findings [7]. Gubitosi et al. [8] used Fournier Gangrene Severity Index (FGSI), developed by Laor in 1995[9], as a predictive parameter of outcomes. FGSI indicates the degree of metabolic aberration and deviation from homeostasis and provides an objective and simple prognostic method. The FG may evolve in sepsis and septic shock, with a mortality rate of 40%[10].
Different methods of reconstruction of perineal and genital defects have been widely described in literature but, to date, there is no a gold standard treatment. Skin grafting provides poor results, while flaps surgery improves

Pervenuto in Redazione Settembre 2021. Accettato per la pubblicazione Novembre 2021
Correspondence to: Paolo Marchica, MD, Clinic of Plastic Surgery, University of Padua, Via Nicolò Giustiniani 2, Padua (PD) 35128, Italy (e-mail: paolomarchica91@gmail.com)

the outcome [11]. The posteromedial thigh (PMT) flap is a fasciocutaneous flap based of the perforator vessels nourishing the skin of the posteromedial aspect of the thigh. Hupkens provided a mapping of the perforator vessels supplying the posterior thigh region and he found a wide range of perforators suitable for flaps, of which the Profunda Femoris Artery (PFA) represents the main source vessel (61.7%) [12].

Case Report

A 63-Year-Old man with diabetes mellitus, obesity, neurogenic bladder due to previous spine surgery requiring clean intermittent bladder autocatheterization, developed a urinary tract infection and accessed to the emergency room presenting fever, gluteal and scrotal swelling. Raise of inflammatory markers (LRINEC score [3,8]) and CT scan findings (subcutaneous emphysema in both the gluteal regions and perineum, extended up to the lower abdominal wall) provided suspicious of necrotizing fasciitis of genitoperineal area (FG). Non-vital tissue, evil-smelling exudate, and blistering were found in correspondence of the affected areas. The patient required intensive care support because of the onset of septic shock and non-responsive fluid hypotension.

A broad-spectrum antibiotic therapy was started (vancomycin, meropenem and metronidazole) and a first debridement surgery of non-viable necrotic tissues was performed, causing a substantial defect of the perineum and genital integuments, with both the testes exposed. A temporary urinary and intestinal diversion was necessary to reduce wounds' contamination.

Multisensitive E. coli was found in microbiological samples (wound swabs and hemocultures). Hence, the antibiotic therapy was adjusted with meropenem administration. Wounds were daily treated with 0.05% sodium hypochlorite and normal saline irrigation, then dressed in 0.05% sodium hypochlorite-soaked fabric gauzes and the man received 25 days of hyperbaric oxygen therapy (HBOT). Local and general conditions improved: wound bed presented moderate exudate and moist granulating tissue while non-viable tissues were removed after surgical excision (Fig. 1), with a final defect measuring 20x40 cm^2; the patient no longer needed hemodynamic support. Besides, both testes were vital assessing by ultrasonographic evaluation.

Reconstruction with bilateral PMT flaps was planned. Requirements of the Declaration of Helsinki as well as principles of GCP were taken into consideration. A lithotomic position was required to perform preoperative markings and the following surgery. A line from the perineum to the pes anserinus was drawn, and preoperative search for PFA perforator vessels with hand-held Doppler probe revealed one perforator for each side, located along this line within 10 cm from axis of the flaps. A line from the perineum to the pes anserinus was drawn, and preoperative search for PFA perforator vessels with hand-held Doppler probe revealed one perforator for each side, located along this line within 10 cm from the groin crease. PMT flaps marking (10x17cm^2) was centered over this line, corresponding to the longitudinal axis of the flap.

Testes and penis were released from the surrounding scar tissue by the urologists' team. Under 3.5x loupes magnification, bilateral proximally based PMT fasciocutaneous flaps were harvested from the thighs, preserving the perforators, transposed and inset to reconstruct the scrotum (Fig. 2-3). A dermal substitute Integra® Dermal Regeneration Template (Integra LifeSciences, Plainsboro,

Fig. 1: Local conditions and defect extension after surgical debridement, seriate dressings and HBOT cycle, before reconstructive surgery. Abbreviations: HBOT (hyperbaric oxygen therapy).

Fig. 2: Harvesting of PMT flaps to cover testes. Abbreviations: PMT = posteromedial thigh.

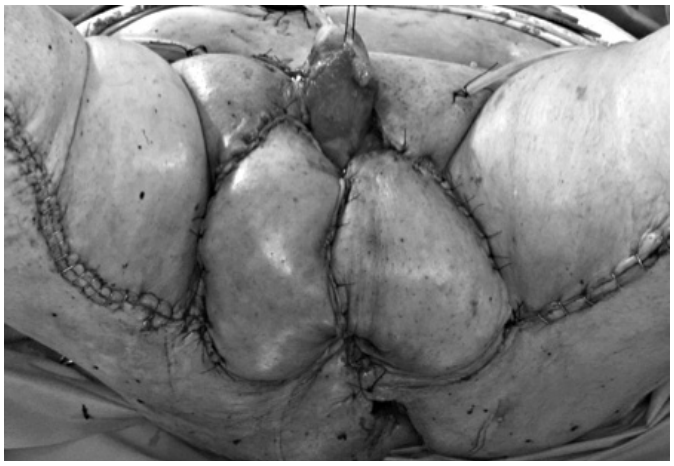

Fig. 3: Inset PMT flaps to reconstruct the scrotum. Donor sites were directly closed. Penis was released from surrounding scar tissue. Abbreviations: PMT = posteromedial thigh.

Fig. 4: Follow-up at 4 months. PMT flaps provided a stable wound and testes coverage, with a satisfying scrotum reconstruction. Abbreviations: PMT = posteromedial thigh.

NJ) was applied on the penis to supply the missing integuments. Doppler signal was confirmed after PMT flaps transposition. However, the right PMT flap developed distal necrosis because of late venous congestion, thus a revision surgery was necessary to excise non-viable tissue, followed by a two-week cycle of negative pressure wound therapy (NPWT). A partial-thickness skin graft was used to repair the penile defect and a full-thickness skin graft was performed to cover the leftover scrotal wound. Healing was achieved with total coverage of loss of substance. Before discharging, the urinary diversion was removed, however the colostomy became permanent because of the autonomic disorder of the patient.
Follow-up at 4 months showed a stable wound coverage. The flaps survived and the testes coverage was adequate with a satisfying scrotum reconstruction (Fig. 4). The penis showed a length reduction due to scar retraction despite the use of a dermal substitute.

Discussion

FG is featured by a late diagnosis and a delayed treatment may lead the patient to death. The early diagnosis is mandatory to survival. Once the general conditions are stable, reconstructive surgery is pivotal to repair and replace the necrotic tissues.
FG reconstructive method should be addressed by the simplest and the least costly procedure because these patients present significant comorbidities and increased risk of surgical failure. No evidence to support a specific technique among the others can be found in literature. The choice should be based on the amount of the defect, that may require a primary closure, a skin graft or a flap[11]. The final decision depends on the procedure with which the surgeon is most confident to achieve the higher success rate. Flaps suitable to reconstruct the perineum are pedicled musculocutaneous and fasciocutaneous flaps. Free flaps are not a viable solution because systemic conditions may jeopardize the outcome of microsurgical anastomoses.
Muscolocutaneous flaps as gracilis flap [13] or vertical rectus abdominis muscle (VRAM) flap [14] do not require protecting small vessels, they are more resistant to infections and they are useful to fill a dead space, but they may determine a bulky and unnatural appearance[14] and a thicker coverage leading to testicular overheating with oligozoospermatism [15]. VRAM flap may lead to abdominal bulging or hernia [16] and is contraindicated when a stoma exists [17]. Gracilis muscle flap causes lesser donor site morbidity [16].
Fasciocutaneous flaps as pudendal thigh flap [13,18], Singapore flap [19], medial thigh flap [20], anterolateral (ALT) flap [13,17,20], deep inferior epigastric perforator (DIEP) flap [16], PMT flap [12,21,22], and superior gluteal artery perforator (SGAP) flap [23] do not cause any functional impairment because they do not require the muscle harvest, they result less bulky, providing a more natural appearance [13,20] and they may be sensate [18]. DIEP and ALT flap provide tissues with a long-distance pedicle and large soft tissue supply [16] and they tend to be uninvolved in infected patients [17].
Based on these elements, PMT flap is characterized by: muscle sparing without functional impairment; able to provide a thin a pliable coverage with the chance to obtain a sensate flap; a minimal donor site morbidity and a quite hidden scar on the posteromedial aspect of the thigh; richness of perforator vessels ensuring an adequate nourishment of the flaps; the proximity to the perineum warranting a close match with the original features of the native lost tissues. Hence, PMT flap should be considered a useful tool in FG reconstruction.
Noteworthy is the ability of some patients, despite extensive Fournier gangrene, to be able in reaching a com-

plete healing by secondary intention and reepithelization process [8,24]. Some authors advocate the use of infusion of platelets-derived growth factors to improve a secondary intention healing process, together with the nutritional support, proper wound care and surgical debridement [8]. Finally, HBOT has been proposed by several authors, as it may play a significant role against anaerobes and could be considered a supplementary treatment [25-29]. Despite HBOT is not fully validated in FG, we decided to use it in our case, due to the severity and extent of the disease. However, further studies are needed to provide stronger evidence as regards HBOT role in necrotizing fasciitis.

Conclusion

Our experience reported a successful outcome, despite one of the flaps suffered of partial necrosis. PMT flap should be considered as a valuable option, despite complications common to most of the techniques, that may be ascribed to poor local and systemic conditions, severe contamination, or vascular issues. However, there is not a gold standard treatment, and every option must be tailored to the patient and to its local and systemic conditions.

Riassunto

La gangrena di Fournier è una condizione letale che interessa l'area genitoperineale in pazienti predisposti. Una diagnosi tardiva, dunque un ritardo nel trattamento chirurgico, conduce spesso alla morte del paziente. Il LRINEC score e l'esame TC può aiutare nel sospettare tale condizione, ma la conferma diagnostica necessita l'esplorazione chirurgica e l'esame istologico. Inoltre, la gangrena di Fournier determina ampi difetti dell'area genitoperineale, dunque la chirurgia ricostruttiva è importante nel ripristino della forma e della funzione nel paziente affetto.

Lo scopo di questo articolo è discutere l'utilizzo del lembo fasciocutaneo posteromediale di coscia nella ricostruzione degli esiti della gangrena di Fournier in base all'esperienza personale degli autori. È dunque presentato un case report di un uomo di 63 anni, affetto da obesità e diabete che ha sviluppato una gangrena di Fournier in seguito ad una infezione scatenata da ripetuti autocateterismi. Due lembi posteromediali di coscia (10x17cm^2) sono stati prelevati per coprire un difetto scrotale totale (20x40 cm^2), mentre i tegumenti del pene sono stati trattati con una chirurgia a due step (sostituto dermico e successivamente innesto di cute). Il follow-up a 4 mesi ha mostrato un outcome soddisfacente della ricostruzione con lembi posteromediali di coscia, con la preservazione della vitalità dei testicoli, nonostante uno dei lembi abbia sviluppato una necrosi distale che è stata trattata con ripetuti debridement e innesto di cute successivo. La descrizione dell'esperienza degli autori è seguita dalla spiegazione dell'algoritmo decisionale del trattamento, basato su una revisione della letteratura che ha portato a scegliere i lembi posteromediali di coscia per ottenere la ricostruzione. Inoltre, altri lembi alternativi per trattare la gangrena di Fournier, sono discussi, considerando per ciascuno di essi vantaggi e svantaggi, e che non esiste ad oggi un gold standard di trattamento e ogni opzione deve essere valutata in base alle caratteristiche del singolo paziente

References

1. Fournier JA: *Gangrene foudroyante de la verge. Fulminating gangrene of the penis.* Med Prat, 1883; 4:589-96.

2. Chernyadyev SA, Ufimtseva MA, Vishnevskaya IF, et al.: *Fournier's Gangrene: Literature review and clinical cases*. Urol Int, 2018; 101(1):91-97.

3. Vyas HG, Kumar A, Bhandari V, et al.: *Prospective evaluation of risk factors for mortality in patients of Fournier's gangrene: A single center experience.* Indian J Urol, 2013; 29:161-65.

4. Obi AO: *Isolated Fournier's gangrene of the penis.* Niger J Clin Pract, 2016; 19(3):426-30.

5. Monstrey S, Ceulemans P, Roche N, et al.: *Reconstruction of male genital defects.* In: Neligan PC, Song DH. *Plastic Surgery, 3rd Edition, Volume 4: Lower Extremity, Trunk and Burns*. London, New York, Oxford, St Louis, Sydney, Toronto: Elsevier Saunders. 2013: 297-325.

6. Bozkurt O, Sen V, Demir O, et al.: *Evaluation of the utility of different scoring systems (FGSI, LRINEC and NLR) in the management of Fournier's gangrene.* Int Urol Nephrol, 2015; 47(2):243-48.

7. Lancerotto L, Tocco I, Salmaso R, et al.: *Necrotizing fasciitis: Classification, diagnosis, and management*. J Trauma Acute Care Surg. 2012; 72(3):560-66.

8. Gubitosi A, Moccia G, Ruggiero R, Docimo G, Foroni F, Esposito E, Villaccio G, Esposito A, Agresti E, Agresti M.: *Necrotizing soft tissue infections (NSTIs): literary review and description of a Fournier syndrome case*. Ann Ital Chir, 2013; 84(1):111-15.

9. Laor E, Palmer LS, Tolia BM, Reid RE, Winter HI: *Outcome prediction in patients with Fournier's gangrene.* J Urol, 1995; 154(1):89-92.

10. Yanar H, Taviloglu K, Ertekin C, et al.: *Fournier's gangrene: risk factors and strategies for management.* World J Surg, 2006; 30:1750-754.

11. Karian LS, Chung SY, Lee ES: *Reconstruction of defects after Fournier gangrene: a systematic review.* Eplasty, 2015; 15:e18. eCollection 2015.

12. Hupkens P, Ozturk E, Wittens S, et al.: *Posterior thigh perforator flaps: An anatomical study to localize and classify posterior thigh perforators.* Microsurgery, 2013; 33:376-82.

13. Chen SY, Fu JP, Chen TM, et al.: *Reconstruction of scrotal and perineal defects in Fournier's gangrene.* J Plast Reconstr Aesthet Surg, 2011; 64:528-34.

14. Tan BK, Rasheed MZ, Wu WT: *Scrotal reconstruction by testicular apposition and wrap-around skin grafting.*J Plast Reconstr Aesthet Surg, 2011; 64:944-48.

15. D'Alessio E, Rossi F, D'Alessio R: *Reconstruction in traumatic avulsion of penile and scrotal skin.* Ann Plast Surg, 1982; 9(2)120-24.

16. Zeng A, Xu J, Yan X, et al.: *Pedicled deep inferior epigastric perforator flap: An alternative method to repair groin and scrotal defects.* Ann Plast Surg, 2006; 57:285-88.

17. Zelken JA, Aldeek NF, Hsu CC, et al.: *Algorithmic approach to lower abdominal, perineal, and groin reconstruction using anterolateral thigh flaps.* Microsurgery, 2014; 36(2):104-14.

18. Karaçal N, Livaoglu M, Kutlu N, et al.: *Scrotum reconstruction with neurovascular pedicled pudendal thigh flaps.* Urology, 2007; 70:170-72.

19. Maharaj D, Naraynsingh V, Perry A, et al.: *The scrotal reconstruction using the "Singapore Sling".* Plast Reconstr Surg, 2002; 110(1):203-205.

20. Yu P, Sanger JR, Matloub HS, et al.: *Anterolateral thigh fasciocutaneous island flaps in perineoscrotal reconstruction.* Plast Reconstr Surg, 2002; 109:610-16.

21. Scaglioni MF, Chen Y, Yang JC: *Posteromedial thigh (PMT) propeller flap for perineoscrotal reconstruction: A case report.* Microsurgery, 2015; 35(7):569-72.

22. Scaglioni MF, Jimenez Carrillo LE, Kuo Y, et al.: *Pedicled posteromedial thigh (PMT) flap: A new alternative for groin defect reconstruction.* Microsurgery, 2017; 37(4):339-43.

23. Ayestaray B, Proske YM: *Perineal and posterior vaginal wall reconstruction with a superior gluteal artery dual perforator-pedicled propeller flap.* Microsurgery, 2015; 35:64-67.

24. Geraci G, Pisello F, Lupo F, Cajozzo M, Sciumè C, Modica G: *Fournier's gangrene: case report and review of recent literature.* Ann Ital Chir, 2004; 75(1):97-106; discussion 106. Italian.

25. Rizos S, Filippou DK, Condilis N, Filippou G, Trigka A, Skandalakis P, Vezakis A: *Fournier's gangrene. Immediate diagnosis and multimodality treatment is the comerstone for successful outcome.* Ann Ital Chir, 2005; 76(6):563-67.

26. Geraci G, Pisello F, Lupo F, Cajozzo M, Sciumè C, Modica G: *Fournier's gangrene: case report and review of recent literature.* Ann Ital Chir, 2004; 75(1):97-106; discussion 106. Italian.

27. Clayton MD, Fowler JE Jr, Sharifi R, Pearl RK*: Causes, presentation and survival of fifty-seven patients with necrotizing fasciitis of the male genitalia.* Surg Gynecol Obstet, 1990; 170(1):49-55.

28. Asfar SK, Baraka A, Juma T, Ma'Rafie A, Aladeen T, al Sayer H: *Necrotizing fasciitis*. Br J Surg, 1991; 78(7):838-40.

29. Singh G, Ray P, Sinha SK, Adhikary S, Khanna SK: *Bacteriology of necrotizing infections of soft tissues*. Aust NZJ Surg, 1996; 66(11):747-50.