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ORIGINAL ARTICLE

Comparison of two different surgical techniques in the treatment of Fournier's Gangrene

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Abstract

Fournier's gangrene is a rapidly progressive, fatal, necrotizing fasciitis of the perineum and penoscrotal region which requires rapid intervention. This retrospective study compares the surgical outcomes of the fasciocutaneous flap and the embedding of the testicles into the thigh skin, applied for the reconstruction of penoscrotal defects after surgical debridement due to Fournier's gangrene, in the light of the literature. A total of 110 patients treated for Fournier's gangrene at Çanakkale Onsekiz Mart University, Faculty of Medicine, Department of Urology, Urology Clinic between 2009 and 2021 were evaluated retrospectively. Among these, 82 patients treated with fasciocutaneous flap and embedding of the testicles into the thigh skin for the reconstruction of penoscrotal defects were included in the study. For these two wound closure methods, the cases were compared in age, hospital stay after debridement, hospital stay after wound closure, size of the debrided area, and postoperative complication parameters. There was no significant difference between the two groups in terms of age, comorbidity (hypertension, diabetes mellitus, etc.), and hospital stay after debridement. However, the length of hospital stay after wound closure and the size of the debrided area were significantly higher in patients with fasciocutaneous flap compared to the method in which the testis was embedded in the thigh. The fasciocutaneous flap application, which we apply for defects larger than 50% of the scrotum or extending beyond the scrotum, is a method that can be preferred by experienced surgeons for wound closure after Fournier gangrene debridement, considering patient comfort, since it does not create tension and blood supply to the testis is more comfortable. However, it would be more appropriate for the clinician to make a profit-loss calculation due to both the length of the operation and its more complex nature and the prolongation of the hospital stay after wound closure.

Keywords: Fournier's gangrene, debridement, fasciocutaneous flap

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Introduction

Although Fournier's gangrene (FG) was first coined by Jean Alfred Fournier in 1883 as a syndrome with perineal necrosis in males, it was first described by Baurienne in 1764 [1]. Wilson was the first scientist to describe necrosis of the fascia as necrotizing fasciitis [2]. Fournier's gangrene is a rapidly progressive, fatal, necrotizing fasciitis of the perineum and penoscrotal region (which may also involve the rectum) (Fig. 1) [3].

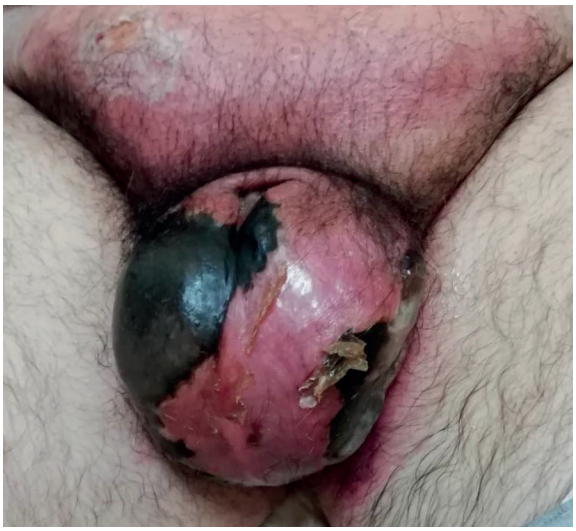

Figure 1. Fournier's gangrene before operation.

FG has incidence rate of approximately 1.6 per 100,000 males [4]. Joseph Jones, a military surgeon, first described the mortality rate of 2642 soldiers affected by FG in the civil war as 46% in 1871 [5]. In 2000, Eke compiled 1726 cases and reported a mortality rate of 16% [6]. Indeed, some studies have reported case fatality ratios reaching 66% [7,8].

Understanding how FG spreads from the deep fascia of the urogenital and anogenital region to the abdomen and chest requires a look at its anatomy. Although the infection originates from the skin, urethra or rectum, the formation of thrombosis in the small subcutaneous vessels in the later stages and the anaerobic factors also contribute to infection [9,10]. This initially painful condition turns into a locally hypoesthetic and even anesthetic condition with the infarction of nerve cells [11]. This infectious state may progress and cause soft tissue destruction and sepsis at a rate of 2-3 cm/hour [12]. The initial protection of the superficial layers and skin from infection, and the spread of necrosis along the fascial planes, may cause the disease to be underestimated by inspection and lead to delayed diagnosis. The spermatic fascia and vascular network, which are independent of the vascular supply of the urogenital region and come from the retroperitoneum, often protect the testicles from infectious involvement. Likewise, the deep Buck's fascia surrounding the urethra and corpora cavernosa prevents the spread of FG.

In majority of the cases, conditions that impair the resistance of the general body and immune system or comorbidities that facilitate infection can be detected in the history and during clinical follow-up [3]. Yet, the underlying cause could not be determined in 20% of the cases.

Although the cases are polymicrobial, the most common microorganism is *Escherichia coli.* (48%) Following this, Morua et al. reported that *Enterococcus faecalis* was involved in 28% of the cases [13]. Staphylococcus and Pseudomonas predominate in most of the remaining cases. Treatment requires cleaning of the necrotic tissue with aggressive surgical intervention. Antibiotherapy, on the other hand, requires broad-spectrum antibiotics with good anaerobic activity, especially against Staphylococcus and Pseudomonas species [14].

FG may give clinical findings similar to milder infections with erythema and cellulitis. The stage of this infection should be evaluated together with the general condition of the patient. However, in case of pain disproportionate to the findings in the examination, necrotizing fasciitis should come to mind [15]. Cellulitis and erysipelas may present with well-defined areas of erythema or inflammation, whereas necrotizing fasciitis is characterized by erythema with limited borders. In the differential diagnosis of FG, many diseases such as polyarteritis nodosa, strangulated hernia, scrotal or ischiorectal abscess, balanitis, pyoderma gangrenosum, warfarin necrosis and ecthyma gangrenosum may come to mind [16].

The foul-smelling "dishwater" pus that may be encountered during surgical debridement is indicative of tissue necrosis and characterizes

necrotizing fasciitis. If FG is not intervened quickly enough, it can cause the infection to spread rapidly and even cause death with developing multi-organ failure. Conducting mortality research in FG, Yan et al. It has been shown that early treatment reduces mortality [17,18]. 1463 cases were analyzed in the review of the cases between 1980-2003 by Goh et al [15]. Pain, redness and swelling were the most common clinical findings seen in more than 70% of cases. Crepitation seen in later stages can be seen as a result of exotoxins of anaerobic infections causing tissue necrosis.

The most specific imaging modality for determining the extent of infection is computed tomography (CT), which allows surgical teams to plan debridement accordingly [19]. When other imaging modalities are insufficient to determine the extent of infection, magnetic resonance imaging (MRI) is used [20]. Although MRI can aid in the diagnosis, its utility is limited due to the rapid progression of FG and should not be used to postpone surgical interventions [20].

Scrotal skin loss after FG debridement can be more than 50%. Many reconstructive techniques have been described for the preservation of testicular functions and a good aesthetic result. The size and direction of the defect are critical for the technique to be used. At this point, most clinicians plan the appropriate surgery based on scrotal skin loss.

The choice of anesthesia technique is also important in FG. General anesthesia is preferred to control physiological homeostasis [21]. Koitabashi et al., recommended avoiding spinal anesthesia in the presence of lumbar subcutaneous gas [22].

After the operation, in addition to the traditional sterile wet dressing, other methods such as hyperbaric oxygen, growth agents, unprocessed honey, and vacuum dressing technology can be applied [23].

This retrospective study compares the surgical outcomes of the fasciocutaneous flap and the embedding of the testicles into the thigh skin, applied for the reconstruction of penoscrotal defects after surgical debridement due to Fournier's gangrene, in the light of the literature.

Materials and Methods

A total of 110 patients treated for Fournier's gangrene at Çanakkale Onsekiz Mart University, Faculty of Medicine, Department of Urology, Urology Clinic between 2009 and 2021 were evaluated retrospectively. Among these, 82 patients treated with fasciocutaneous flap and embedding of the testicles into the thigh skin for the reconstruction of penoscrotal defects were included in the study. For these two wound closure methods, the cases were compared in age, hospital stay after debridement, hospital stay after wound closure, size of the debrided area, and postoperative complication parameters.

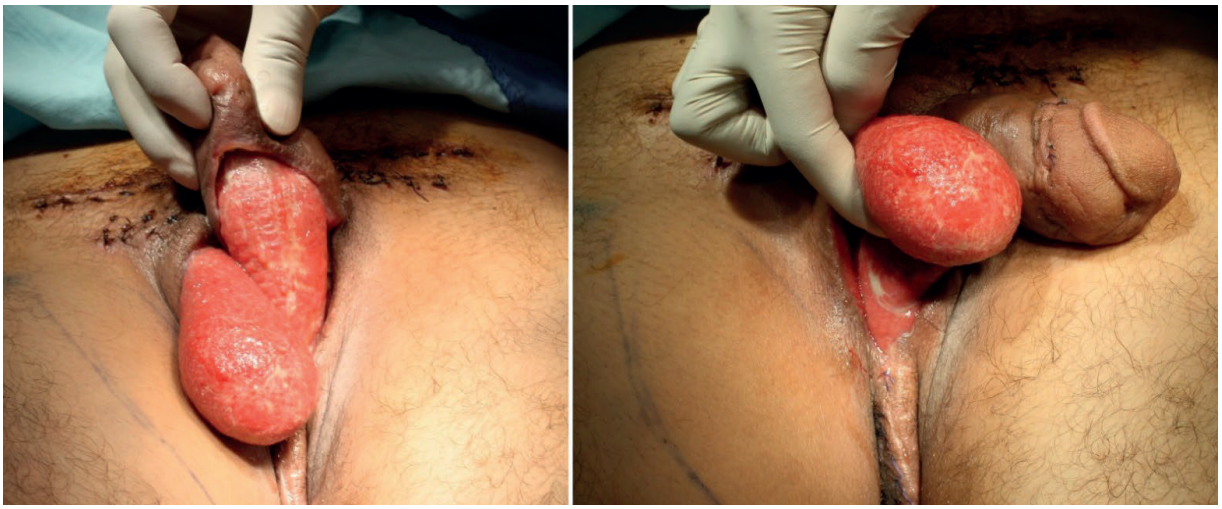

Figure 2. Granulation tissue after debridement.

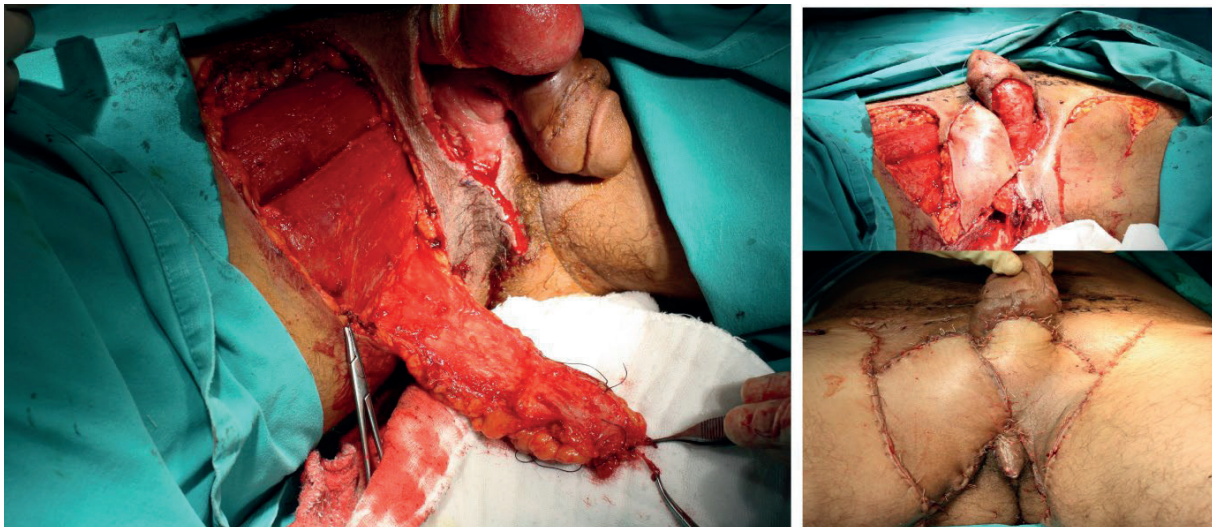

Figure 3. Fasciocutaneous flap method.

Figure 4. Embedding the testicle in the thigh method.

The study was approved by the Social and Humanity Sciences Ethical Committee of Canakkale Onsekiz Mart University Medical Faculty with the number 2011-KAEK-27/2021-E.2100003815.

Surgical Techniques

Fasiocutaneous flap: Following the healing of the patient's wound site, the operation was started together with the urology and plastic surgery clinics by positioning the legs in abduction. The defect edges in the penoscrotal region were debrided. First, the right transverse fasciocutaneous flap was prepared in accordance with the drawing made before, and it was raised on the vascular handle and brought to the right penoscrotal area by turning it over the pedicle to the site that exposed the testis. This flap closed the defect on the right side. Then, the same flap was prepared from the left side in the same way, and the left side defect was completely closed. (Fig. 2,3)

Embedding the testis in the thigh: Following the healing of the wound site, the incision lines in the suprapubic, scrotal, inguinal and perineal regions were debrided by placing a Foley catheter under sterile conditions in the lithotomy position. The membranous portions were excised. Granulation was observed on the tissues. With blunt dissection, pockets were created in the subcutaneous region of both thighs where the testicles could sit comfortably. After placing 2 hemovac drains in the lodge and 1 under the skin and controlling the bleeding, the layers were closed in the anatomical plane, and the operation was completed. (Fig. 4)

A total of 110 patients treated for Fournier's gangrene at Çanakkale Onsekiz Mart University, Faculty of Medicine, Department of Urology, Urology Clinic between 2009 and 2021 were evaluated retrospectively. Among these, 82 patients treated with fasciocutaneous flap and embedding of the testicles into the thigh skin for the reconstruction of penoscrotal defects were included in the study. For these two wound closure methods, the cases were compared in age, hospital stay after debridement, hospital stay after wound closure, size of the debrided area, and postoperative complication parameters. (Table 1)

The Chi-square test and Mann-Whitney U-test were used to compare categorical data between groups. Results with a p value of <0.05 were considered significant.

All 82 patients were male. The method chosen for the reconstruction of penoscrotal defects was fasciocutaneous flaps in 15 (18%) patients and embedding the testicles into the thigh in 67 (82%) patients. Of our patients, 40 (48%) had Type 2 Diabetes Mellitus (Type 2 DM), and 27 (67.5%) of these Type 2 DM patients had uncontrolled blood sugar. Vascular disease (hypertension, peripheral artery disease, coronary artery disease) was present in 50 (60%) patients. Comorbidities were similar in both groups. The mean age of the patients with fasciocutaneous flap and with testicle embedding in the thigh were 53 (±9.7)

Table 1. Comparison of fasciocutaneous flap and embedding the testicle in the thigh methods.

	Fasciocutaneous flap	Embedding the testicle in the thigh
Number	15 (18%)	67 (82%)
Age	53 ± 9.7	57 ± 8.2
Duration of hospitalization after debridement	12.1 ± 2.4	12.8 ± 2.3
Duration of hospitalization after wound closure	13.5 ± 2.7	2.4 ± 1.7
Size of debrided area (cm^2)	78 ± 17.9	35 ± 14.1

and 57 (± 8.2), respectively. After debridement, the patients who underwent fasciocutaneous flap surgery stayed in the hospital for 12.1 (±2.4) days, while those who underwent testicle embedding surgery remained in the hospital for 12.8 (±2.3). The groups had no significant difference in age, comorbidity, and length of hospital stay after debridement. However, the length of hospital stay after the reconstruction of penoscrotal defects was significantly longer in patients with fasciocutaneous flap (13.5±2.7) compared to the method in which the testicles were embedded in the thigh skin (2.4±1.7). The size of the debrided area was also significantly larger in patients with a fasciocutaneous flap (78±17.9 cm^2) compared to those with testicle embedding into the thigh skin (35±14.1 cm^2).

Discussion

Fournier's gangrene is a rapidly progressive, fatal, necrotizing fasciitis of the perineum and penoscrotal region (which may also involve the rectum) which requires rapid intervention [3]. Some studies have reported case fatality ratios reaching 66% [7,8]. Although the infection originates from the skin, urethra or rectum, the formation of thrombosis in the small subcutaneous vessels in the later stages and the anaerobic factors also contribute to infection [9,10]. This initially painful condition turns into a locally hypoesthetic and even anesthetic condition with the infarction of nerve cells [11].

Demographics indicate male predominance. Of the 25 million patients in the US State Inpatient Database, only 39 (2%) of 1641 patients operated on for FG were women. In our study, all patients were male.

Conditions that impair the resistance of the general body and immune system or comorbidities that facilitate infection can be detected in the history and during clinical follow-up in most cases [3]. Yet, the underlying cause could not be determined in 20% of the cases. Co-morbidities are present on the basis of FG development in up to 88% of patients [23,24]. The most common of these is diabetes (27-60%) [15,16]. In addition, obesity, hypertension, peripheral vascular disease and alcoholism can be considered as risk factors for FG development. In our study, 40 (48%) of our patients had Type 2 Diabetes Mellitus (Type 2 DM), and 27 (67.5%) of these Type 2 DM patients had uncontrolled blood sugar. Vascular disease (hypertension, peripheral artery disease, coronary artery disease) was present in 50 (60%) patients. Both groups had similar comorbidities.

The use of multiple antibiotics is recommended in the treatment of FG; because FG is a polymicrobial infection involving anaerobes. Appropriate treatment is metronidazole for anaerobes, penicillin for streptococci, and third generation cephalosporins for gram-negatives [26]. Despite prolonging wound healing, wide resection (including the surgical margin with good tissue) is recommended by some surgeons [25]. In order to completely clear the necrosis, it is recommended to finish the debridement at a level where the skin cannot be easily separated from the subcutaneous tissue [27].

Granulation tissue develops after the treatment of Fournier's gangrene, indicating that the appropriate time has come for reconstruction surgery. Scrotal skin loss after FG debridement can be more than 50%. Many reconstructive techniques have been described for the preservation of testicular functions and a good aesthetic result. It is important that the surgical method is reconstructive in order to shorten the hospital stay and to support the patient cosmetically and psychologically. The size and direction of the defect are critical for the technique to be used. At this point, most clinicians plan the appropriate surgery based on scrotal skin loss.

When we evaluated grafting techniques such as transposition into a subcutaneous pocket with vascularized pedicles of the testis and spermatic cord, and tissue expansion techniques (such as the pedicled gracilis flap), Horta et al., showed that some kind of reconstructive surgery was needed in 67% of the patients [28,29]. They concluded that a scrotal loss less than 50% could be closed with a primary/scrotal skin flap according to the tension, or the testis could be buried under the skin of the thigh by stretching the scrotal skin [30,31]. However, skin grafting or flap reconstruction has been recommended for defects greater than 50% of the scrotum or

extending beyond the scrotum [32].

Testicular gas (produced by bacteria) detected by imaging methods can almost be associated with orchiectomy [33]. It was observed that the mortality risk decreased by 70% in patients requiring orchiectomy.

Considering the disadvantages of wide excision of necrotic tissue, Watanabe et al., showed successful results in follow-up with multiple subcutaneous Penrose drains in addition to limited excision [34]. Adequate nutritional status or energy intake is also necessary during the treatment process [35].

In this retrospective study, we compared the surgical outcomes of the fasciocutaneous flap and the embedding of the testicles into the thigh skin, applied for the reconstruction of penoscrotal defects after surgical debridement due to Fournier's gangrene in 82 patients at Çanakkale Onsekiz Mart University, Faculty of Medicine, Department of Urology, between 2009-2021, in the light of the literature.

There was no significant difference between the two groups in terms of age, comorbidity hypertension, diabetes mellitus, etc.), and the length of hospital stay after debridement. However, the length of hospital stay after wound closure and the size of the debrided area were significantly higher in patients with a fasciocutaneous flap compared to those with embedding of the testicles into the thigh.

Conclusion

The fasciocutaneous flap application, which we apply for defects larger than 50% of the scrotum or extending beyond the scrotum, is a method that can be preferred by experienced surgeons for wound closure after Fournier gangrene debridement, considering patient comfort, since it does not create tension and blood supply to the testis is more comfortable. However, it would be more appropriate for the clinician to make a profit-loss calculation due to both the length of the operation and its more complex nature and the prolongation of the hospital stay after wound closure.

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The authors declare that they do not have any financial or commercial interests about the research.

Conflict of interest

No potential conflict of interest was reported by the authors.

References

1. Fournier JA. Gangrene foudroyante de la verge. MedPract. 1883;4:589-97.
2. Baurienne H. Sur une plaie contuse qui s'est terminee par le sphacele de la scrotum. J Med Chir Pharm. 1764;20:251-6
3. Wilson B. Necrotizing fasciitis. Am Surg. 1952;18:416-31.
4. Bugra D, Bozfakioglu Y, Buyukuncu Y, Bulut T. Gangrène de Fournier. Etude analytique de six cas [Fournier's gangrene. Analytic study of 6 cases]. J Chir (Paris). 1990;127(2):115-6.
5. Joury A, Mahendra A, Alshehri M, Downing A: Extensive necrotizing fasciitis from Fournier's gangrene. Urol Case Rep. 2019;26:100943. doi: 10.1016/j.eucr.2019.10094.
6. Jones J. Investigation upon nature, causes and treatment of hospital gangrene as it prevailed in the confederate armies 1861-1865. New York, NY: US Sanitary Commission; 1871.
7. Eke N. Fournier's gangrene: a review of 1726 cases. Br J Surg. 2000;87(6):718-28. doi: 10.1046/j.1365-2168.2000.01497.x.
8. Pizzorno R, Bonnini F, Donelli R, Stubinskl M. Hyperbaric oxygen therapy in the treatment of Fournier's disease in 11 male patients. J Urol. 1997;158:837-40. doi: 10.1097/00005392-199709000-00039.
9. Öztürk O, Bircan K, Şahin H, Korkmaz K, İslim F. Fournier gangreni: Skrotum ve perinenin nekrotizan yumuşak doku infeksiyonu (in Turkish). Dicle Tıp Dergisi 1994:21;137-40.
10. Paty R, Smith AD. Gangrene and Fournier's gangrene. Urol Clin North Am. 1992;19(1):149-62.
11. Aşci R, Sarikaya S, Büyükalpelli R, Yilmaz AF, Yildiz S. Fournier's gangrene: risk assessment and enzymatic debridement with lyophilized collagenase application. Eur Urol. 1998;34(5):411-8. doi: 10.1159/000019775.
12. Rani SA, Hoon R, Najafi RR, Khosrovi B, Wang L, Debabov D. The in vitro antimicrobial

activity of wound and skin cleansers at nontoxic concentrations. Adv Skin Wound Care. 2014;27:65–9. doi: 10.1097/01.ASW.0000443255.73875.a3.

13. Safioleas M, Stamatakos M, Mouzopoulos G, Diab A, Kontzoglou K, Papachristodoulou A. Fournier's gangrene: Exists and it is still lethal. Int Urol Nephrol. 2006;38:653-7. doi: 10.1007/s11255-005-2946-6.
14. Morua AG, Lopez JA, Garcia JD, Montelongo RM, Guerra LS. Fournier's gangrene: Our experience in 5 years, bibliographic review and assessment of the Fournier's gangrene severity index. Arch Esp Urol. 2009;62(7):532-40.
15. Gorbach SL. Bartlett JG, Blacklow NR. Infectious diseases. Lippincott Williams & Wilkins. 2004.
16. Goh T, Goh LG, Ang CH, Wong CH. Early diagnosis of necrotizing fasciitis. Br J Surg. 2014;101(1):e119-25. doi: 10.1002/bjs.9371.
17. Sato R, Tomioka T, Orii R, Yamada Y. Anesthetic managements of four patients with Fournier's syndrome Masui. 2008;57(3):355-7.
18. Çalışkan S, Özsoy E, Sungur M, Gözdaş HT. Fournier's gangrene: Review of 36 cases. Ulus Travma Acil Cerrahi Derg, 2019;25(5):479-83.
19. Yan Z, Gang X, Xie X, Gao Y, Li Z, Wang G. A case report and literature review: Identification of a novel AIRE gene mutation associated with Autoimmune Polyendocrine Syndrome Type 1 in East Asians. Medicine (Baltimore). 2020;99(18):e20000. doi: 10.1097/MD.0000000000020000.
20. Singh A, Ahmed K, Aydin A, Khan MS, Dasgupta P. Fournier's gangrene. A clinical review. Arch Ital Urol Androl. 20165;88(3):157-64. doi: 10.4081/aiua.2016.3.157.
21. Insua-Pereira I, Ferreira PC, Teixeira S, Barreiro D, Silva Á: Fournier's gangrene: A review of reconstructive options. Cent European J Urol. 2020;73:74-9. doi: 10.5173/ceju.2020.0060.
22. Ballard DH, Mazaheri P, Raptis CA, Lubner MG, Menias CO, Pickhardt PJ, et al. Fournier gangrene in men and women: Appearance on CT, ultrasound, and MRI and what the surgeon wants to know. Can Assoc Radiol J. 2020;71:30-9. doi: 10.1177/0846537119888396.
23. Koitabashi T, Umemura N, Takino Y. A case of Fournier's gangrene contraindicating spinal anesthesia. Anesthesiology. 2000;92(1):289-90. doi: 10.1097/00000542-200001000-00059.
24. Tucci G, Amabile D, Cadeddu F, Milito G. Fournier's gangrene wound therapy: our experience using VAC device. Langenbecks Arch Surg. 2009;394(4):759-60. doi: 10.1007/s00423-009-0486-8.
25. Aridogan IA, Izol V, Abat D, Karsli O, Bayazit Y, Satar N. Epidemiological characteristics of Fournier's gangrene: A report of 71 patients. Urol Int. 2012;89(4):457-61. doi: 10.1159/000342407.
26. Martinschek A, Evers B, Lampl L, Gerngroß H, Schmidt R, Sparwasser C. Prognostic aspects, survival rate, and predisposing risk factors in patients with Fournier's gangrene and necrotizing soft tissue infections: Evaluation of clinical outcome of 55 patients. Urol Int. 2012;89(2):173-9. doi: 10.1159/000339161.
27. Hejase MJ, Simonin JE, Bihrle R, Coogan CL. Genital Fournier's gangrene: Experience with 38 patients. Urology. 1996;47(5):734-9. doi: 10.1016/s0090-4295(96)80017-3.
28. Benizri E, Fabiani P, Migliori G, Chevallier D, Peyrottes A, Raucoules M, et al. Gangrene of the perineum. Urology. 1996;47(6):935-9. doi: 10.1016/S0090-4295(96)00058-1.
29. Atakan IH, Kaplan M, Kaya E, Aktoz T, Inci O. A life-threatening infection: Fournier's gangrene. Int Urol Nephrol. 2002;34(3):387-92. doi: 10.1023/a:1024427418743.
30. Horta R, Cerqueira M, Marques M, Ferreira P, Reis J, Amarante J. Gangrena de Fournier: De urgencia urológica hasta el departamento de cirugía plástica [Fournier's gangrene: From urological emergency to plastic surgery]. Actas Urol Esp. 2009;33(8):925-9. doi: 10.1016/s0210-4806(09)72884-0.
31. Iavazzo C, Kalmantis K, Anastasiadou V, Mantzaris G, Koumpis V, Ntziora F. Fournier's gangrene in a patient after third-degree burns: A case report. J Med Case Rep. 2009;26;3:7264. doi: 10.1186/1752-1947-3-7264.
32. 30. Tiwari IN, Seth HP, Mehdiratta KS. Reconstruction of the scrotum by thigh flaps. Plast Reconstr Surg. 1980;66(4):605–7. doi: 10.1097/00006534-198010000-00019.
33. Culp DA, Huffman WC. Temperature determination in the thigh with regard to burying the traumatically exposed testis. J Urol. 1956;76(4):436–438. doi: 10.1016/S0022-5347(17)66718-1.
34. Karian LS, Chung SY, Lee ES. Reconstruction of Defects After Fournier Gangrene: A Systematic Review. Eplasty. 2015;15:e18.
35. Atakan IH, Kaplan M, Kaya E, Aktoz T, Inci O. A life-threatening infection: Fournier's gangrene. Int Urol Nephrol. 2002;34(3):387-92. doi: 10.1023/a:1024427418743.
36. Watanabe S, Kimura F, Kyan A, Suzuki S,

Nakajima F, Hayakawa M, Nakamura H. [Clinical study on Fournier's gangrene--value of "through and through drainage"]. Nihon Hinyokika Gakkai Zasshi. 1995;86(6):1137-41. doi: 10.5980/jpnjurol1989.86.1137.

37. Malangoni MA. Necrotizing soft tissue infections: are we making any progress? Surg Infect (Larchmt). 2001;2(2):145-50. doi: 10.1089/109629601750469465.