

Closure of the Scrotal Defect Due to Fournier's Gangrene with Relieved Contracted Scrotal Flaps by Scoring Incisions: Descriptive Research

Fournier Gangrenine Bağlı Skrotal Defektlerin Skrolama İnsizyonu ile Rahatlatılarak Skrotal Fleplerle Kapatılması: Tanımlayıcı Araştırma

¹Anvar AHMEDOV^a, ²Burak ÖZKAN^b, ³Mehmet SEVİM^c

^aClinic of Plastic, Reconstructive and Aesthetic Surgery, Başakşehir Çam and Sakura City Hospital, İstanbul, Türkiye

^bDepartment of Plastic, Reconstructive and Aesthetic Surgery, Başkent University Faculty of Medicine, Ankara, Türkiye

^cDepartment of Urology, Kütahya Health Sciences University Faculty of Medicine, Kütahya, Türkiye

ABSTRACT Objective: Fournier's gangrene is an insidious disease that occurs in the scrotal, perianal, and genital regions where aerobic and anaerobic bacteria form micro thromboses, causing tissue necrosis and extending to the fascia and spreading to the trunk and extremities. This disease, which is more common in male patients, patients with diabetes mellitus, immunocompromised patients, and those undergoing surgical procedures has high morbidity and mortality. We present the scoring incision of scrotal flaps that we apply in our clinic and the approximation suture technique with appropriate tension. **Material and Methods:** A study was conducted between January 2016 and July 2021; patients whose primary surgical debridement procedures were terminated after Fournier's gangrene were hospitalized in our clinic to close their defects. The study examined data such as mean age, defect size and localization, accompanying diseases, reproducing microorganisms, duration of surgery, duration of hospitalization, the healing time of wounds, and complications. **Results:** The mean age of the patients was 61.1 years, and the most common comorbidities were diabetes mellitus and respiratory tract disease. Beta-hemolytic streptococci were the most prolific microorganism. The defects were closed in 4-7 weeks in all patients. **Conclusion:** In scrotum defects that occur after Fournier's gangrene, the approximating suture technique performed at appropriate tension after the release of the contractures of scrotal flaps with scoring incision provides good stretching of the scrotal flaps and closure of the wounds at appropriate times.

ÖZET Amaç: Fournier gangreni, skrotal, perianal ve genital bölgelerde aerobik ve anaerobik bakterilerin mikro tromboz oluşturarak doku nekrozuna neden olması sonrası fasiyaya uzanarak gövde ve ekstremitelere yayılan sinsi bir hastalıktır. Erkek hastalarda, diyabet hastalarında, bağışıklığı baskılanmış hastalarda ve cerrahi işlem geçirenlerde daha sık görülen bu hastalık aynı zamanda yüksek morbidite ve mortaliteye sahiptir. Bu çalışmada, kliniğimizde uyguladığımız skrotal fleplerin skrolama kesisini ve uygun gerginlikte yaklaşım dikiş tekniğini sunmak amaçlanmıştır. **Gereç ve Yöntemler:** Fournier gangreni sonrası primer cerrahi debridman işlemleri sonlandırılan hastalar defektlerinin kapatılması için kliniğimize yatırılan hastalar Ocak 2016-Temmuz 2021 tarihleri arasında retrospektif olarak tarandı. Çalışmada; ortalama yaş, defekt boyutu ve lokalizasyonu, eşlik eden hastalıklar, üreyen mikroorganizmalar, ameliyat süresi, hastanede yatış süresi, yaraların iyileşme süresi ve komplikasyonlar gibi veriler incelendi. **Bulgular:** Hastaların ortalama yaşı 61,1 yıl olup, en sık eşlik eden hastalıklar diyabet mellitus ve solunum yolu hastalığıdır. Beta-hemolitik streptokoklar en çok üreyen mikroorganizmalardır. Tüm hastalarda 4-7 haftada defektler kapatılmıştır. **Sonuç:** Fournier gangreni sonrası oluşan skrotum defektlerinde skrotal fleplerin kontraktürleri skrolama insizyonu ile gevşetildikten sonra uygun gerginlikte yapılan yaklaşım suture tekniğiyle skrotal fleplerin iyi bir şekilde esnetmekte ve yaraların uygun zamanlarda kapatılmasına olanak sağlamaktadır.

Keywords: Fournier's gangrene; scoring incision; scrotal flap; wound approximation

Anahtar Kelimeler: Fournier gangreni; skrolama insizyonu; skrotal flep; yara yaklaşım

Fournier's gangrene is the progressive necrosis of the urogenital region. Necrosis of the skin starts with polymicrobial infection and spreads rapidly and leads to life-threatening infection with up to 67%

death rate.¹ Urgent surgical intervention and aggressive debridement are recommended for stopping this dramatic progression.² This generally results in a tissue defect to be reconstructed. Exposed scrotal tissue

For the video of the article:



Correspondence: Burak ÖZKAN

Department of Plastic, Reconstructive and Aesthetic Surgery,
Başkent University Faculty of Medicine, Ankara, Türkiye

E-mail: drburakozkan@gmail.com



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is often encountered since the disease is predominantly seen in the male population.³ The aim of the reconstruction is to cover the scrotum with pliable skin to achieve functional and aesthetic results. Skin grafts and locoregional flaps have been widely used to reconstruct scrotal defects.^{4,5} However, these methods do not provide the optimum tissue match for reconstruction. Although the best tissue match can be achieved using like-with-like reconstruction principles, the native scrotal skin is generally not considered as a donor site for reconstruction due to the retraction and constriction formed after tissue fibrosis. Nonetheless, we aimed to use remnant scrotal skin to cover the defect over testicles to achieve better outcomes with adjacent tissue. We used scoring incisions, which is a well-known maneuver in reconstructive surgery, to increase lost tissue elasticity and overcome skin retraction due to fibrosis.⁶ In this study, we evaluate outcomes of scrotal coverage with the scoring technique after Fournier's gangrene.

MATERIAL AND METHODS

A retrospective case control study was conducted following the approval of the Kütahya University of Health Sciences Non-interventional Clinical Research Ethics Committee (date: April 15, 2021, no: 2021/07-02). The study was conducted according to Helsinki Declaration principles. Ten patients whose scrotal defects were reconstructed with the scrotal scoring technique after Fournier's gangrene between January 2016 and July 2021 were included in the study. Patient characteristics such as mean age, accompanying diseases, and tissue culture biopsies were noted. Patient

clinical data such as defect size and localization, duration of surgery, duration of hospitalization, healing time of wounds, and complications were evaluated. Defect size was determined using the scrotum midline: defects exceeding the midline were considered more than 50% in size, and defects that did not cross the midline were considered lesser than 50% in size. Primary evaluation, emergent debridement, and broad spectrum antibiotics were performed in the urology department. Wound, urine and blood cultures of the patients were examined. The treatment was continued with consideration of the antibiotic sensitivity of the cultures. With the improvement of the blood tests of the patients and the regression of the infection findings of the wounds, the patients were admitted to the plastic surgery unit for reconstruction.

SURGICAL TECHNIQUE

The surgical procedure was performed under spinal or general anesthesia in supine, frog-leg position. After cleaning the operation site, the scrotal flaps were suspended with surgical hooks and convexity was observed on the skin edges. The length and width of the contracture bands due to granulation were carefully evaluated on the inner surface of the flap. After undermining of the scrotal flaps, scoring incisions were performed at 2 cm intervals from the granulation tissue to the dermis on the inner surface of the flap with a scalpel no. 15 and/or scissors perpendicular to the desired direction of advancement of the flaps (Video, Figure 1A, Figure 1B). Hemostasis was achieved with bipolar cautery at this stage.

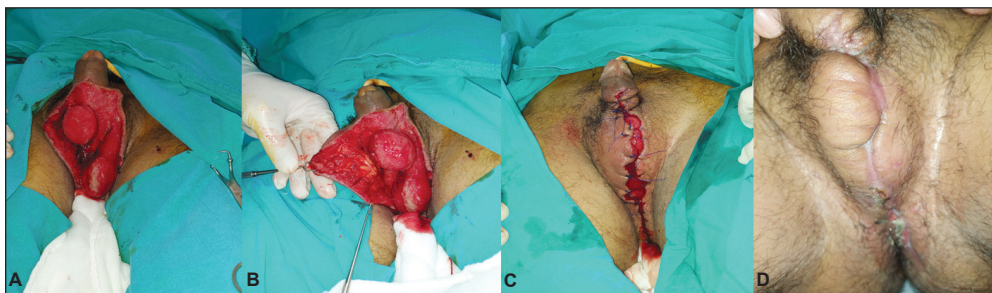


FIGURE 1: The surgical technique: **A:** Demonstration of vertical scoring incision. (See also Appendix 1); **B:** The smooth appearance of the inner surface and the cankerous appearance of the skin surface due to the contractures formed on the inner surface of the scrotal flaps after the wound granulation of the patient, scoring incisions made with scissors or nr 15 scalpel; **C:** Approximation sutures were performed in order not to diminish circulation of the scrotal flaps; **D:** Post-operative first month image of the patient.

Relaxation of the flaps was manually tested and additional scoring was performed if needed. The monofilament 2/0 sharp needle suture was passed through the two scrotum edges with a thickness of 5 mm for approximation of the flaps (Figure 1C). The flaps were suspended upwards with a total of 3 to 5 separated or mattress sutures. The testicles were adjusted to stand in the anatomical position and the slings of the flaps were tied one by one while keeping the sutures at the proper tension. Penrose drains were placed under the skin flaps and kept there for three days. After Penrose removal, the patients were allowed a sitting bath in warm water twice a day and wound care with povidone-iodine afterwards. Late post operative result of the surgical technique is typically seen as in Figure 1D.

RESULTS

The ages of the patients ranged from 28 and 95, with a mean of 61.1. Bacteremia was observed in one elderly patient. While the patient with cardiac problems was treated under intensive care conditions, he died of cardiac arrest that developed at 4 days post-op. Orchiectomy was performed in 10% of the patients. The clinical features and comorbidities of the patients are listed in Table 1. While diabetes was observed in 30% of the patients, limitation of movement was observed in 20% of the patients (spina bifida, tetraplegia). Thirty percent of the patients also had lung and lower respiratory tract disease. Blood cultures were also taken from the patients whose urine and wound cultures were taken, and from those whose fever exceeded 38 °C. Tissue biopsy cultures are shown in

TABLE 1: Demographic and clinical features of the patients.

Patient	Age	Defect size	Localization	Comorbidities	Surgery duration	Hospitalization	Complication
1	65	<50%	Scrotum + perineum	-Pancreatic cancer -Diabetes mellitus	40 min	14 days	None
2	46	<50%	Scrotum + perianal	-Spina bifida -Sacral decubitus ulcer -Anal fistula	45 min	6 days	None
3	52	<50%	Scrotum + penis	Schizophrenia	60 min	19 days	None
4	64	≤50%	Right scrotum	Right inguinal hernia	55 min	7 days	None
5	95	<50%	Scrotum + penis	-Atrial fibrillation -Cerebrovascular disease	40 min	4 days	Exitus
6	76	≤50%	Scrotum	-Tracheostomy	45 min	4 days	None
7	54	≤50%	Scrotum	-Diabetes mellitus	40 min	7 days	None

TABLE 2: Tissue biopsy cultures and antibiotic treatments.

Patients	Urine culture	Blood Culture	Tissue Biopsy	Antibiotic treatment	Debridement sessions
1	-	-	-Acinetobacter baumannii, -Enterococcus faecium,	Ampicillin/sulbactam	3
2	-	-	-Klebsiella pneumonia, -Escherichia coli	Clindamycin, Meropenem, Vancomycin	1
3	-	-	Pseudomonas aeruginosa	Metronidazole, Ciprofloxacin	3
4	-	-	Beta-hemolytic streptococci	Ciprofloxacin	2
5	-	-	Beta-hemolytic streptococci	Ampicillin/sulbactam	1
6	Klebsiella pneumonia	-	-	Meropenem	1
7	-	-	Beta-hemolytic streptococci	Meropenem	1
8	-	-Staphylococcus epidermidis, -MRKNS	-	Meropenem, Teicoplanin	1
9	-	-	Escherichia coli	Ertapenem, Ciprofloxacin	1
10	-	-	Beta-hemolytic streptococci	Ampicillin/sulbactam	1



FIGURE 2: Pre-op, per-op and post-operative images of the patient: **A:** Fournier's gangrene, scrotal defect after serial surgical debridement; **B:** Determining the tension by suspending the sutures first so that the appropriate tension is placed on both the flap and testicles, which ensures that the scrotal flaps are kept where the testicles are desired, and the sutures are tied one by one while they are suspended; **C:** Patient's first month post-operative image.

Table 2. According to the culture results, Beta-hemolytic streptococci growth occurred in 40% of the patients, followed by *Escherichia coli*, *Klebsiella pneumonia*, and other microorganism growths. Meropenem, ciprofloxacin, ampicillin/sulbactam, vancomycin, metronidazole and teicoplanin were used respectively. The patients were debrided an average of 1.4 times. In 40% of the patients, the scrotal defect was larger than 50%, and in 20% of these cases, the defect extended to the penis, in 10% to the perineum, and in 10% to the perianal region. Due to distal urethral involvement in 20% of the patients, urethral reconstruction was achieved with local flaps. In the postoperative wound follow-up of the patients, it was observed that the edema of the testicles decreased with the pressure created by the flaps, the flaps stretched to shrink the wound, and marginal wound necrosis did not develop in any flap. The patients were discharged from our clinic in an average of 9 days. It was observed that the tension of the sutures decreased and the wounds closed in an average of 4-7 weeks (Figure 2). Atrophic scar in the reapproximating line was seen in all patients in the late follow-up period (Figure 3).

DISCUSSION

Fournier's gangrene is a disease with a high mortality rate that progresses rapidly with necrotizing fasciitis in the perianal and scrotal regions, and is more common in male patients over 50 years of age.

Early diagnosis of the patient, removal of necrotic tissues with serial debridement, and initiation of broad-spectrum antibiotic therapy are indis-



FIGURE 3: An atrophic scar formation at the suture line in the late post-operative year.

putably the most important issues. The cessation of the progression of the disease and the healing of residual wounds with granulation and secondary wound contracture brings about closure of residual defects. The distribution of defect localization in our patient series was similar to the literature. Silva et al. found that 67 percent of patients with Fournier's gangrene undergo some type of reconstructive procedure, so it is important to know and experience reconstruction options.⁵ Our rate of scrotal defect was 60% and our rate of extensive defects extending to the perineum, perianal area, and penis was 40%. Carvalho et al. in their study found that the rate of scrotal defect was 65.6% and the rate of extensive defect was 34.4%.⁷ Beta-hemolytic streptococcus was the most common pathogen in 40% of the patients, and this was reported by Akilov et al. and found to be at the same rate (39.9%) in his study.⁸

Various reconstructive techniques are available for closure of the scrotal defect, and there is currently no established gold standard. These techniques are: secondary wound healing, wound approximation suturing, partial or full thickness skin grafts, local advancement flaps, scrotal flaps, testicular transposition, fasciocutaneous flaps, muscle or musculocutaneous flaps, or perforator flaps.

Secondary healing is a frequently used method in small defects. Wound contamination and infection are common in patients with urinary and fecal incontinence. It is a method that negatively affects the life comfort of the patient and requires constant care. Although it is a low-cost method, it requires long hospitalization and this has been reported as 28.9 days on average.⁷

In the process of Fournier's gangrene, tissue defect and the wound is dirty and effected, hence even when the wound appears clean, primary closure is not recommended. The existing preserved scrotum approximation suturing can be performed in patients, and it has been reported that the defects of the patients are closed within 6-9 weeks and the average hospitalization time is 11 days.⁷⁻⁹ In addition, in another study, it was reported that patient hospitalization was continued for an average of 8.6 days after reconstruction.⁹ After the transfer of our patients from the urology clinic, an average of 1.4 debridement was performed and the hospitalization lasted for an average of 9 days.

Skin grafting plays an important role in the reconstruction of scrotal area defects. Its advantages are short operative time, simple one-stage procedure, low donor site morbidity, ability to cover large areas, and reasonable functional and cosmetic results.¹⁰⁻¹² In scrotal reconstruction, partial skin-thickness skin grafts may resemble normal scrotal skin color, shape, and thickness.^{10,12} However, this technique should only be attempted in the case of a healthy scrotal granulation wound bed. Skin grafting in penile defects does not appear to affect sexual and erectile function.¹³ The disadvantages are the risk of wound contamination, tissue maceration, and trauma. Therefore, reconstruction with split-thickness skin grafts often leads to graft loss, making them an option only

for small defects.¹ In our proposed method, since the scrotum reconstruction is performed with the patient's scrotal tissues, an original scrotal appearance that can protect against trauma is obtained and there is no donor site morbidity.

Flap reconstruction has multiple advantages over skin graft reconstruction. Flaps can provide early, single-stage sensory coverage with testicular preservation with a lower incidence of contractures.¹⁴ It has been defined as the most suitable option for extensive defects involving the scrotum and extending to the perineum, perianal and penis.¹¹ Flap procedures have disadvantages such as longer operating time and are associated with higher morbidity and limited donor sites.^{1,11,13,15} Various flap modifications have been used to cover in the literature, including local advancement flaps, scrotal flaps, and multiple musculocutaneous fasciocutaneous flaps and perforator flaps.¹⁶⁻²⁵

In our study, we aimed to use native contracted scrotal flaps for reconstruction. Chen et al. reported that the defects could be closed successfully by using the scrotal advancement flap for 11 patients with scrotal defects.¹⁵ They recommended this technique for defects covering less than half of the scrotum surface area. Although it is a simple technique, donor site morbidity is also low, and the contracted native scrotal skin should be released for approximation. Approximation was performed with intra-flap dissection and undermining to scrotal subcutaneous cleavage. This aggressive undermining increased the risk of dehiscence and flap necrosis.^{16,26} Scoring incisions are frequently used inner surface of the convexities for relasing tension and increasing the length such as scalp surgery and cartilage corrections.²⁷ Thus, we performed scoring incisions to limit undermining and increase the elasticity of the scrotal flaps. In our cases, total loss of scrotum was not observed, the largest scrotal defect was still around 50%, and in <50% of the defects, there were defects extending to the surrounding region. In all cases, the closure was performed with scoring incisions of the scrotal flaps and sutures of appropriate tension. In our proposed method, since the scrotum reconstruction is performed with the pa-

tient's scrotal tissues, we achieved an original scrotal appearance that can be protective against trauma. Our method has advantages over skin grafts and locoregional flaps in terms of superior aesthetic appearance, lesser bulk, short operative time, and minimal donor site morbidity.

CONCLUSION

After opening the contractures of the scrotal flaps with the scoring incision, which is a new surgical technique, the early approximation suturing technique at appropriate tension was found to be a very effective method in closing the defect by gradually stretching the already flexible scrotal tissue due to the cutting of the contracture bands with the scoring incision on the granulation and contracture surfaces of the scrotal flaps. This technique can be easily used in small and medium-sized defects for repairs in accordance with the originality of the scrotal area without causing donor site morbidity.

Source of Finance

During this study, no financial or spiritual support was received neither from any pharmaceutical company that has a direct connection with the research subject, nor from a company that provides or produces medical instruments and materials which may negatively affect the evaluation process of this study.

Conflict of Interest

No conflicts of interest between the authors and / or family members of the scientific and medical committee members or members of the potential conflicts of interest, counseling, expertise, working conditions, share holding and similar situations in any firm.

Authorship Contributions

Idea/Concept: Anvar Ahmedov; **Design:** Anvar Ahmedov; **Control/Supervision:** Anvar Ahmedov, Mehmet Sevim; **Data Collection and/or Processing:** Anvar Ahmedov, Mehmet Sevim; **Analysis and/or Interpretation:** Anvar Ahmedov; **Literature Review:** Burak Özkan; **Writing the Article:** Anvar Ahmedov; **Critical Review:** Mehmet Sevim; **References and Fundings:** Burak Özkan; **Materials:** Anvar Ahmedov.

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