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Management of scrotal soft tissue defects in patients with Fournier's gangrene

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Abstract

Introduction: Fournier's gangrene is a necrotizing fasciitis caused by mixed aerobic and anaerobic bacteria resulting in loss of skin and subcutaneous tissue in the perineal area. Various techniques have been described for the reconstruction which we intend to study and thereby propose a reconstructive algorithm.

Methods: From June 2018 to October 2019, twenty patients aged between 35–80 years with Fournier's gangrene were posted for reconstruction of scrotal soft tissue defect. Depending on the size of the defect and amount of tissue loss, patients underwent various procedures for reconstruction which included primary closure, advancement flaps and fasciocutaneous flaps. Patients were followed up post-operatively for 3 months.

Results: All patients posted for reconstruction had a single stage, stable, and well-vascularized soft tissue coverage in scrotal defect cases without significant major complication. Seven patients underwent secondary closure, six patients underwent advancement flaps, five patients underwent medial thigh flaps with two patients undergoing SSG in addition to advancement flap. Patients were assessed based on restoring anatomy, cosmetic function and psychological satisfaction. There was good functional as well as acceptable cosmetic outcome in the patients without any significant complications.

Conclusion: Most reconstructive techniques provide reliable coverage. In defects confined to lesser than 50% of scrotum, local advancement flap reconstruction is the ideal tension free closure. Medial thigh flap is recommended for defects larger than 50% of the scrotum.

Keywords: Management, Fournier's gangrene, necrotizing

1. Introduction

Fournier's gangrene, it is considered a disastrous clinical condition [1]. It's a necrotizing fasciitis caused by mixed aerobic and anaerobic bacteria resulting in loss of skin and subcutaneous tissue in the perineal area. Commonly seen in patients with diabetes mellitus, impaired immunity, alcoholism, inflammatory anorectal diseases, urinary incontinence, and overall debilitating diseases [2]. The necrosis involves the scrotum and does not include the testes and/or spermatic cords. However, the exposure of the testis can cause severe functional, aesthetic and psychological harm to the patient. It requires early diagnosis and aggressive debridement to remove all dead tissues. Various techniques have been described for the reconstruction of these defects such as primary closure, split thickness skin grafts, muscle flaps and fasciocutaneous flaps. We intend to study the various methods used for closure and thereby propose a reconstructive algorithm.

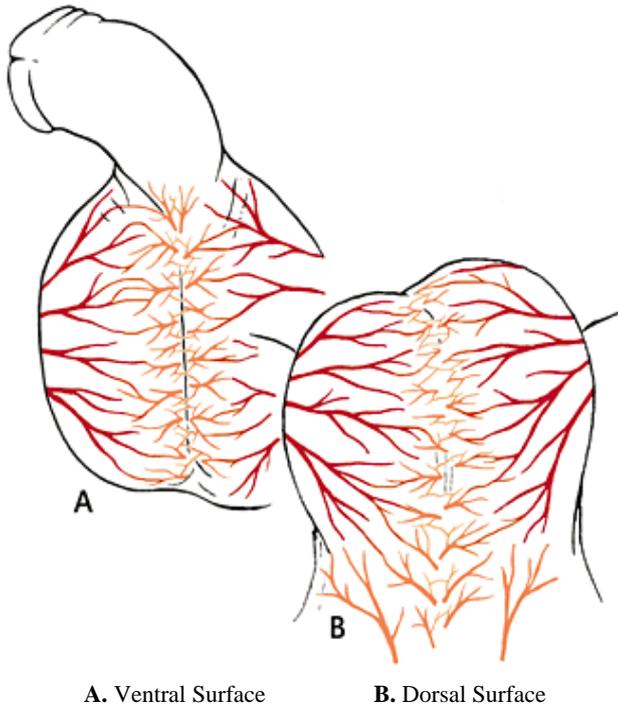
1.1 Anatomical basis for scrotal reconstruction

The *internal pudendal artery* is a terminal branch of the anterior division of the internal iliac and is the blood supply of the perineum. It passes subcutaneously to a triangular area formed by ischial tuberosity, urethral opening, and the anus. It continues as the posterior scrotal artery which divides into two to three branches supplying the scrotum.

The *external pudendal artery* arises from the medial side of the femoral artery and divides into the superficial and deep branches. It sends cutaneous branches that supply the skin of the femoral triangle and travels medially. It terminates inferiorly below symphysis pubis to supply the skin of the scrotum anteriorly.

The *cutaneous branches of the obturator artery* arborize medially near the origin of gracilis muscle. It gives cutaneous branches that supply the skin of the middle third of the scrotum. Anastomoses occur between the branches of the internal pudendal, the external pudendal and the obturator arteries.

So, the pudendal thigh flap can be raised over the three vascular territories of the three arteries.



1.2 Vascular territories

Branches from inferior external pudendal artery (in red)
branches from septal arteries (in orange)



Fig 2: Showing scrotal defect <50% exposing

Medial Thigh Flap

The medial thigh flap is based on Septo-cutaneous branch of femoral artery. The axis of the flap is a line joining the apex of the femoral triangle and the medial femoral condyle. The skin territory of the flap extends from the inferior aspect of the femoral triangle to the junction of the middle and distal thirds of the medial thigh.

Geometry of The Flap

Proximal Extent: Marked by a line 5cm parallel to the line joining pubic tubercle to ischial ramus, which determines the most proximal point for rotation of the flap.

2. Methods

2.1 Patient Selection

From June 2018 to October 2019, twenty patients with Fournier's gangrene were posted for reconstruction of scrotal soft tissue defect. The patients aged between 35–80 years suffering from Fournier's gangrene in the perineal area were admitted. Common predisposing factors were diabetes mellitus, chronic renal failure, and lack of personal hygiene. Depending on the size of the defect and amount of tissue loss, patients underwent various procedures for reconstruction which included primary closure and local flaps. Patients were followed up post-operatively for 3 months.

2.2 Preoperative Evaluation

1. Personal information such as age and gender
2. History of presenting complaints including onset of symptoms, course of disease, and duration of symptoms
3. Past medical and surgical history, to rule out immunocompromised state.
4. Routine preoperative investigations.
5. Optimising the patient's general condition.

2.3 Procedure

Scrotal Advancement Flap

The first step was the surgical freshening of the wound and the removal of any granulation tissues. If both testes were involved, they were sutured together. If less than 50% of the scrotum was lost, a scrotal advancement flap was made. The flap was elevated in a plane close to the tunica vaginalis to protect the main vessels and the wound was closed primarily.



Fig 2: Image post local advancement flap
Left sided testes

Distal Extent: The flap should narrow sharply towards the semitendinous muscle insertion along the medial femoral condyle. Maximum length of the flap is 25cm.

Anterior Border: Line joining pubic tubercle and semitendinous insertion.

Posterior Border: The lateral edge of adductor longus and the medial edge of rectus femoris.

All patients were operated under spinal anaesthesia. The axis of the flap was a line joining apex of femoral triangle to the medial femoral condyle. The dominant pedicle was located at the apex

of the femoral triangle around 6-8 cm below the inguinal ligament. The width of the flap ranged from 7 to 10 cm, whereas the length ranged from 15 to 25 cm. Dissection was done distally to proximal in the subfascial distal plane over the muscle. After harvesting, flap was rotated to cover the testicular and perineal area and creating a scrotum with tension-free closure. The donor sites were managed by direct closure.

Case 1:



Fig 3: Scrotal defect >50% exposing



Fig 4: Marking the dimensions of the medial thigh flap bilateral testes



Fig 5: Elevating flaps bilaterally: Right sided scrotal skin with underlying dartos is raised as a flap and advanced medially. Left sided medial thigh fasciocutaneous flap is raised and approximated medially.



Fig 6: After the flaps are elevated and medialised, the raw area in medial thigh approximated using secondary sutures.

Case 2



Fig 7: Showing bilateral scrotal defect with perineal defect.



Fig 8: Left sided scrotal advancement flap raised



Fig 9: Scrotal defect closed by advancement and perineal wound approximated by secondary suturing.

2.4 Postoperative Care

All patients had to restrict their movements in bed for 3 days. Antibiotics were continued for 10 days postoperatively. Drain was removed on third and sutures were removed on tenth post operative day. Patients were followed up for 3 months.

3. Results

All patients posted for reconstruction had a single stage, stable, and well-vascularized soft tissue coverage in scrotal defect cases without significant major complication.

The patients were discharged on POD-3 after drain removal, to be followed up on OPD basis.

Six patients underwent secondary suturing out of which two cases of had wound dehiscence without any underlying collection, managed conservatively.

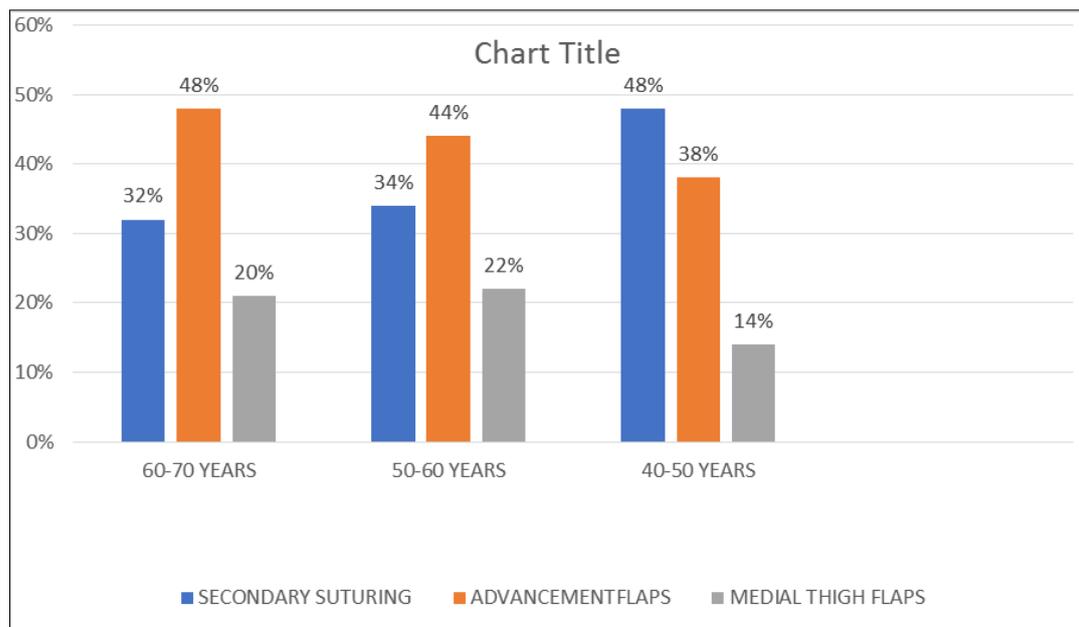
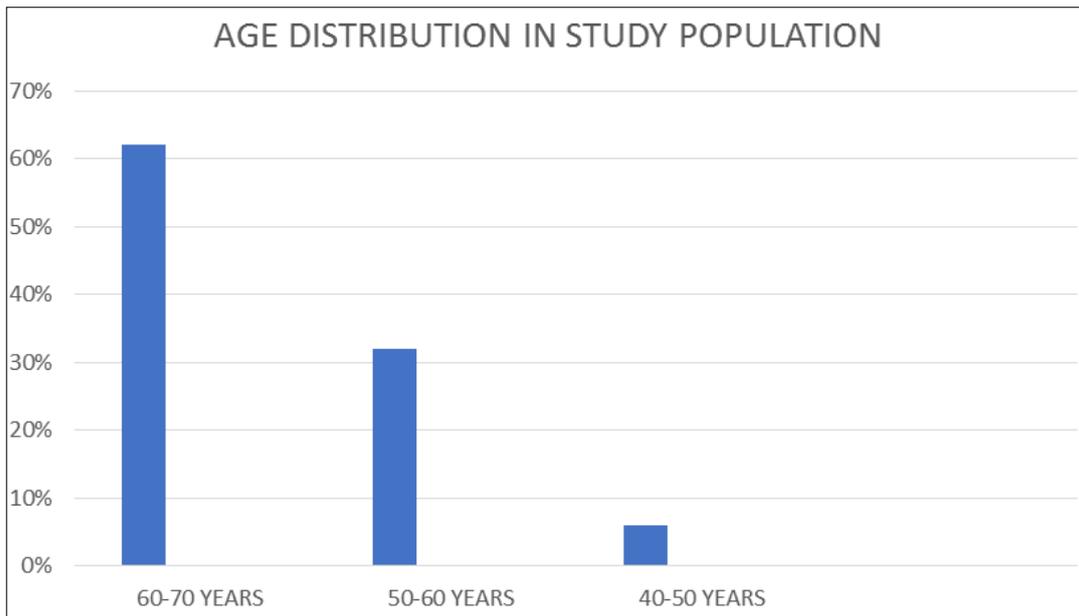
Seven patients underwent local advancement flap, with no complications during 3 month follow up period.

Out of 5 patients who underwent medial thigh flap, one patient showed wound dehiscence and one patient had limited flap necrosis, both managed conservatively.

Two patients required additional skin grafting to cover the penile soft tissue defect, out of which one patient developed graft seroma and subsequent necrosis, healed by secondary intention.

Patients were assessed based on restoration of anatomy, psychological satisfaction and preservation of testes. Good functional as well as acceptable cosmetic outcome in the patients were achieved without any significant complications.

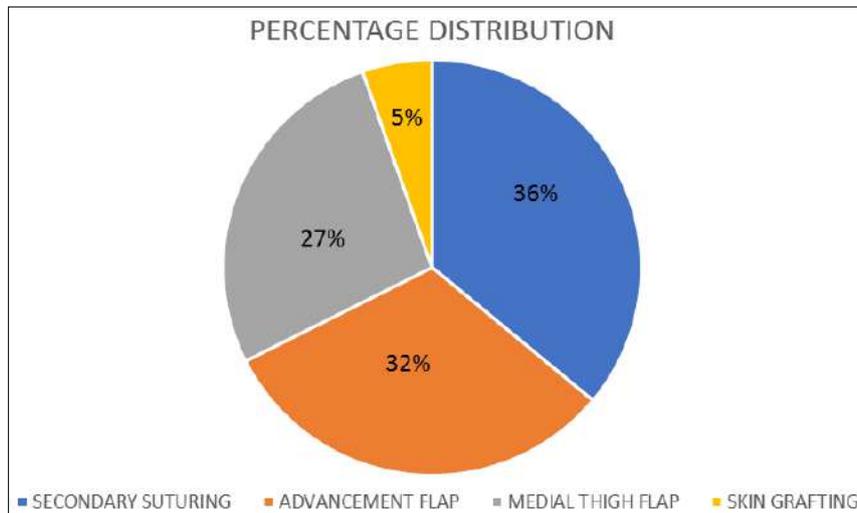
3.1 Age Distribution



Majority of the patients operated were aged between 60-70 years with mean age being 63.4 years. Amongst patients aged over 50 years, majority of them underwent scrotal advancement flaps,

however 48% of those aged below 50 years underwent secondary suturing.

3.2 Procedure Done



Amongst the study population 36% of the patients in whom tension free closure was possible, underwent secondary suturing. However, small defects which couldn't have a tension free closure underwent local advancement flaps. Large defects were closed by medial thigh flaps. In 2 cases where penile raw area was noted, split skin grafting was done to cover the penile defect with advancement flaps for the scrotal defect.

4. Discussion

In patients with Fournier's gangrene, reconstruction of scrotum is a major challenge because of functional, psychological and cosmetic reasons.

For successful reconstruction, six important points have to be kept in mind

1. Patient should have optimal general condition with healthy granulation tissue of the wound.
2. Surgical freshening of the wound prior to coverage.
3. Both testes when exposed have to be covered with bilateral local flaps to minimize tension on the flap margins.
4. Non-absorbable sutures are preferred for closure.
5. Tension free closure
6. Drains to be used to eliminate dead spaces and prevent fluid collection.

Scrotal defects are better reconstructed using local tissue because of their reliability and good matching with deficient tissues [3]. The percentage of raw area and the orientation of the defect are critical for the determination of type of flap required. The ideal procedure includes performing a one-staged reconstruction with adequate skin and subcutaneous thickness, to withstand traction and movements, with minimal consequences to the donor area, which can maintain the thermoregulation of the testicles and shows the natural ptosis of the scrotal region [4, 5]. The scrotal skin is elastic and stretchable. When less than 50% raw area, the scrotal advancement flap was a good option that was done in seven cases. It has a good skin quality and an excellent aesthetic appearance maintaining near to normal anatomy.

In our study, when there was complete loss of scrotal skin with exposure of bilateral testes, the pudendal thigh flap was used. In 2 cases there was complete loss of scrotal skin on one side and partial loss on the other side exposing both the testes, wherein the remnant skin on one side was advanced medially owing to scrotal skin elasticity. However pudendal thigh flap was used on

the other side, offering a complete coverage. In 3 cases there was complete loss of scrotal skin bilaterally, hence bilateral pudendal flaps were created. Pudendal thigh flap had minor complications. Small wound dehiscence (one case) and distal flap necrosis (one case) occurred. All the complications were managed conservatively without the need for revision surgery.

Burying the testis in the subcutaneous pouches in the thigh had been described earlier. This manoeuvre bears a lot of problems such as fainting attacks, testicular atrophy and sense of fullness in the thigh with unacceptable appearance [6, 7].

Skin grafts were described for coverage of the testis. Healthy granulation tissue and intact tunica vaginalis are minimal requirements for a successful take. Despite being a simple wound closure technique, the problems that beset this method are contractions, less mobility, and poor protection of the underlying testicles [8, 9].

Negative wound therapy is relatively contraindicated in this area. It showed difficulty in maintaining the sealing of the sponge due to the contour and presence of both urogenital and defecation structures [10].

The skin island of gracilis flap was used for perineal reconstruction. However, the flap has several drawbacks. It has a high incidence of necrosis, the skin is thick and the scars on the thigh are ugly in appearance. In comparison, the pudendal thigh flap is relatively easy, the donor site scar is hidden and no muscle is scarified [11].

Medial thigh flap coverage has reliable vascularity, durability, functional expendability, and proximity to the perineum and is clearly superior to the use of skin grafts or local Scrotal flaps of limited dimensions under similar circumstances [12]. Features for ideal reconstructive procedure are a single-stage procedure, good flap reliability, and appropriate flap sensation [13].

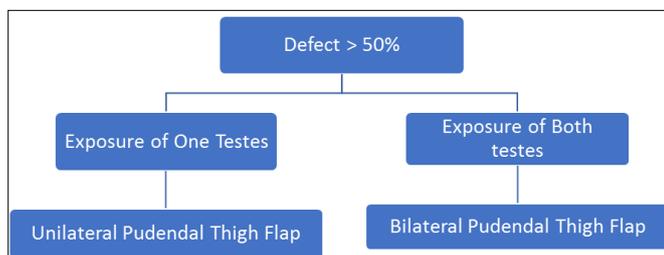
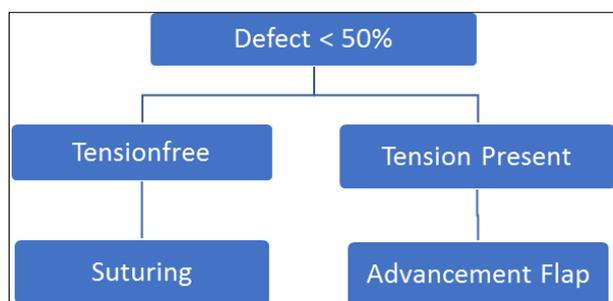
Chart 3 shows the reconstructive algorithm proposed at the end of our study.

5. Conclusion

Most of the reconstructive techniques provide reliable soft tissue coverage and an acceptable cosmetic result. In defects confined to lesser than 50% of scrotum, local advancement flap reconstruction is the ideal tension free closure. Flap reconstruction is recommended for defects larger than 50% of the scrotum.

Pudendal thigh flap has a good vascular supply, which can be used to achieve a thin contour flap. It is also a sensate flap and

has proximity to the scrotum. The donor area can be approximated by primary suturing or split skin grafting in case of large raw area, thereby leaving an inconspicuous scar. Free flaps and skin grafting to the post infective raw area does not provide a strong scaffolding and liable to necrosis and rejection. Hence, local flaps prove superior to skin grafting or free flaps. Based on our experience a guideline to approach scrotal defects was developed. Complete coverage of one testis with exposure of the other testis permits primary closure of both testes owing to the scrotal elasticity. However, partial coverage of one testis with exposure of the other testis was an indication for pudendal thigh flap.



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