

Original Research Article

A clinical study of management of Fournier's gangrene in a rural hospital

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ABSTRACT

Background: Fournier's gangrene is a potentially life threatening synergistic necrotising fascitis of external genitalia and perineal tissues. It commonly affects young men but can also affect women and children. The use of broad spectrum antibiotics and serial wound debridement is the main stay of treatment. The reconstruction of soft tissue defect following the debridement is a challenging task. The purpose of this study is to evaluate the surgical reconstruction methods of soft tissue defects due to Fournier's gangrene.

Methods: This was a prospective study conducted in Adichunchanagiri Institute of Medical Sciences from January 2015 to December 2017. All patients with necrotizing fascitis of external genitalia and perineum, irrespective of age and gender, were included. Parameters such as age, gender, aetiology, predisposing factors, clinical features, defect location, type of bacterial flora, sort of reconstructive procedure used, and duration of hospital stay, post-operative pain, patient satisfaction and mortality, if any, were studied. The choice of reconstructive procedure was based on severity of defect, availability of local tissue and patient preference.

Results: Out of 31 cases included in the study, 30 patients underwent reconstructive procedures. The age range was 4 to 74 years (mean 38.5). The commonest presentation was pain, scrotal swelling and fever. The most common aetiology was urogenital diseases. 10 patients were treated by split-thickness skin graft, 5 by secondary suturing, 2 by unilateral superomedial thigh flap, 4 by bilateral superomedial thigh flap, 5 by tensor fascia lata flap, 2 by medial thigh V-Y advancement flap, 2 with perineal artery flap and one case healed by secondary intention.

Conclusions: This study suggests that earlier presentation, with early diagnosis and intervention with prompt debridement and appropriate, appropriate antibiotics are the main stays of treatment. The resulting soft tissue defects following wound debridement required surgical reconstruction, except in one case, thus decreasing morbidity, hospital stay and early return of patients to regular life.

Keywords: Debridement, Flap, Fournier's gangrene, Reconstruction, Split skin grafting

INTRODUCTION

Fournier's gangrene is a potentially life threatening, synergistic necrotising fascitis of external genitalia and perineal tissues. This fulminant disease frequently affects young men but can also affect women and children. Baurienne, in 1764, first described this condition which

rapidly progressed to cause gangrene of the external genitalia in men. In 1883, Jean Alfred Fournier, a French venerologist described three characteristics of this clinical condition; abrupt onset of scrotal pain and swelling in otherwise young healthy man, with rapid progression to gangrene of skin and subcutaneous tissues, with absence of definitive cause.¹ In majority of cases, foci of infection

are colorectal (30-50%), urogenital (20-40%) and cutaneous trauma (20%).² Other associated comorbid conditions like diabetes mellitus, alcoholism, extremes of age, malnutrition, malignancy, chronic steroid use, and cytotoxic drugs have been documented.¹ It is a synergistic polymicrobial infection of both aerobic and anaerobic bacteriae. The infection spreads through tissue planes along Colle's fascia, Dartos fascia and Scarpa's fascia, causing microthrombosis of subcutaneous arterioles leading to gangrene of skin and subcutaneous tissues and cause severe endotoxemia with development of multiorgan insufficiency. Frequently it can spread rapidly to abdominal wall also.³

Patients present with pain, swelling of scrotum, fever and systemic toxicity. Cellulitis crepitus, eschar, foul smelling odour, gangrene of skin and subcutaneous tissue can also be noted. The testes are spared due to independent blood supply from testicular artery. There is marked systemic toxicity out of proportions to local signs.⁴

Risk factors include diabetes mellitus, trauma, recent surgery, immunosuppression, IV drug use, HIV infection, systemic lupus erythematosus and morbid obesity.⁵

Diagnosis of Fournier's gangrene is mainly clinical, with dramatic out of proportion general condition of the patient with respect to presenting local disease extent.

Fournier's Gangrene Severity Index [FGSI] was instituted by Laor et al as a prognostic index to determine the severity and prognosis of Fournier gangrene patients and was endorsed by Yeniyol and Tuncer.⁶⁻⁹ Temperature, heart rate, respiratory rate, serum sodium and potassium, serum creatinine, serum bicarbonate, haematocrit and white blood cell count are the parameters of this index.

Early treatment includes fluid resuscitation, antibiotic therapy with third generation cephalosporins, aminoglycosides and metronidazole, monitoring for appearance of gangrenous patches, serial wound debridement, urinary and faecal diversions followed by reconstructive procedures.¹

If patient is in sepsis or its sequelae, aggressive treatment to stabilize hemodynamically should be priority. Early surgical debridement if delayed will have negative impact on prognosis of the patient.

Hyperbaric oxygen therapy, Negative pressure wound therapy all will aid surgical debridement but not replace it. High mortality is reported in most studies and is due to severe sepsis, coagulopathy, acute kidney failure, diabetic ketoacidosis and multiple organ failure.¹⁰ As shown by Temiz M, timing of surgery plays a very important role in decreasing morbidity, mortality and hospital stay while ensuing early return to patient's routine life.¹¹

METHODS

This was a prospective study conducted in Adichunchanagiri Institute of Medical Sciences, from January 2015 to December 2017. All the patients with Fournier's gangrene were included irrespective of age and sex, to study the age and sex incidence, aetiology, predisposing factors, clinical features, defect location, type of bacterial flora, sort of reconstructive procedure used and mortality, if any. Also, post-operative pain, duration of hospital stay and patient satisfaction with surgical outcome after definitive reconstructive procedure was included in the study. On admission, patients were started on empirical broad-spectrum antibiotics and later changed to specific antibiotics based on culture reports. Supportive treatment for pain and fever was given as the need arose. Patients in sepsis or its sequelae were aggressively treated in intensive care unit. Surgical debridement was prioritized with timely intervention sometimes requiring multiple sittings to obtain disease free healthy defects. The choice of reconstructive procedure was based on the severity & location of the defect, availability of local tissue for defect closure, general condition of the patient and patient preference. Reconstructive procedure was tailored. No prejudice was made on the type of procedure to be used for reconstruction and was tailored for individual cases. Reconstructive methods used in this study were as follows:

Secondary suturing

Post debridement if defects were small, remaining scrotum was raised and sutured secondarily (Figure 1).



Figure 1: Secondarily sutured case.



Figure 2: Post-surgical debridement skin grafted cases.

Split thickness skin grafting

Partial thickness skin grafts obtained from either of the thighs were used for wound coverage especially in elderly patients. Cuticell-Betadine dressing was done for donor sites (Figure 2).

Superomedial thigh flap

This fasciocutaneous flap has blood supply from deep external pudendal artery, medial circumflex femoral artery and subcutaneous branches of superficial femoral artery. Flap is elevated in subcutaneous plane until gracilis and adductor longus muscle, then elevated in subfascial plane preserving the perforators. Both unilateral (Figure 3) and bilateral (Figure 4) flaps are used depending on size of the defect.



Figure 3: Unilateral superomedial thigh flap.



Figure 4: Bilateral superomedial thigh flap.

Medial thigh V-Y advancement flap

For perineal defects, fasciocutaneous flaps from medial thigh is advanced to cover the defect in a V to Y fashion (Figure 5).



Figure 5: Medial thigh V-Y Advancement flap.

Tensor fascia lata flap

This musculocutaneous flap is based on ascending branch of lateral circumflex femoral artery. This flap was used in patients with combined groin defect along with external genitalia defects (Figure 6).



Figure 6: Tensor fascia lata flap.

Pudendal thigh flap

This sensate faciocutaneous flap is raised based on the perineal artery with pedicle at ischial tuberosity and was used mainly to cover partial scrotal defect on one side in young patients (Figure 7).



Figure 7: Pudendal thigh flap.



Figure 8: Healing by secondary intention.

All patients were operated under spinal anaesthesia, in lithotomy position. Antibiotics were instituted based on culture reports and encompassed both Gram positive and Gram-negative organisms with anaerobic cover given as needed. All patients were catheterized with some requiring suprapubic catheterization.

Post-operative pain was tabulated at regular intervals based on requirement of analgesic for relief. Pain scale

was not used in view of simplification of data. NSAIDs were the main stay for treatment of pain with opioids being used occasionally. Duration of hospital stay post definitive surgery depended on ambulation of the patient and discharged when condition was deemed fit. Patient satisfaction with reconstructive procedure was assessed at the end of 2 months after surgery. This was done using a scale ranging from 0 to 5, 0 being no satisfaction and 5 being extremely satisfied. Assessment was done with patient looking at the site directly and also from photos pre-operatively and at the end of 2 months.

Study design

Data was entered and analysed using MS excel. For data analysis descriptive statistics was used. Qualitative data are expressed as frequency and proportion. Quantitative data are expressed as mean.

RESULTS

31 patients were admitted for management of Fournier's gangrene during the study period. The age of the patients ranged from 4 to 74 years with mean age of 38.5 years. 29 of the patients were males and other 2 were females. (Figure 9).

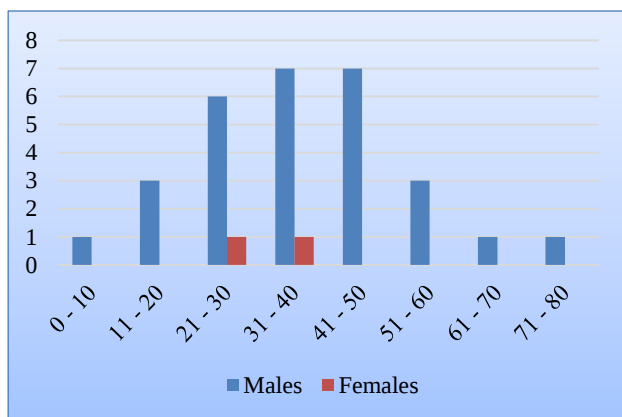


Figure 9: Age and gender distribution.

All 31 patients presented with pain, 23 of them had fever, 17 of them had scrotal swelling and 15 of them had gangrenous skin (Figure 10).

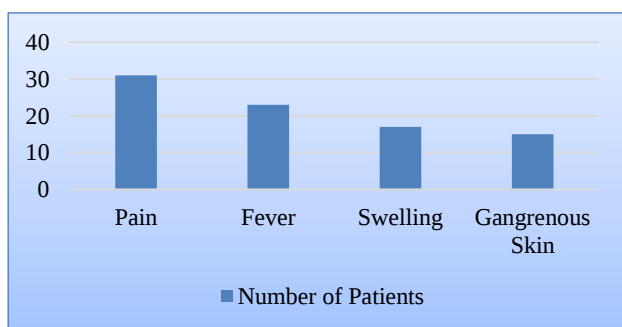


Figure 10: Presenting clinical features.

The affected region was scrotum in 27, perineum in 7, penis in 4, groin in 3, vulva in 2. Six in study group had total loss of scrotum (Figure 11).

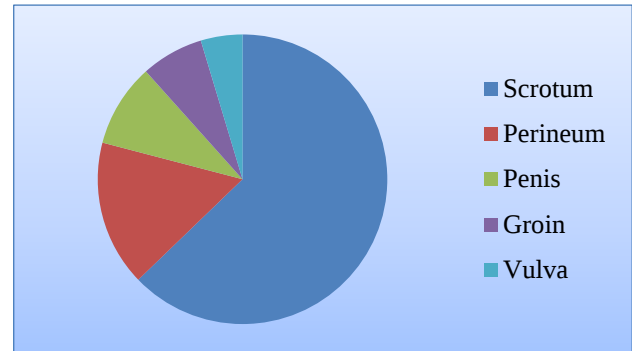


Figure 11: Affected site.

The most common aetiology was urogenital diseases. 4 patients had urethral stricture and underwent dilatation, epididymo-orchitis was noted in 5 patients, periurethral abscess was seen in 2 and 6 had perianal abscess. 3 patients had phimosis, and 2 patients gave history of trauma. 5 out of 6 patients with perianal abscess, 1 patient with urethral abscess and one patient with history of trauma along with 3 other patients having no specific aetiology were diabetics and were on treatment. Rest of 9 patients had no specific aetiology (Figure 12).

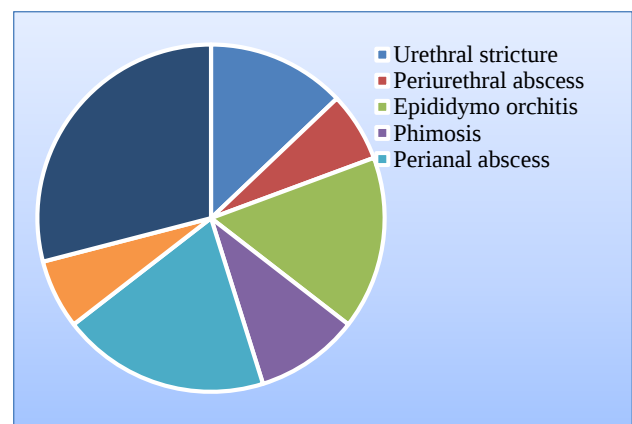


Figure 12: Aetiology of Fournier's gangrene in study group.

Diabetes mellitus was seen in 10 patients. Alcohol and smoking were the predisposing factors noted in 9 and 13 patients respectively, with 8 patients having both vices. One patient was on inhalational steroids for bronchial asthma (Table 1).

Wound cultures demonstrated polymicrobial infections with varied flora, and *Staphylococcus* (29%) was the predominant strain. Other organisms isolated were *pseudomonas* (19%), *streptococcus pyogenes* (19%), *E. Coli* (13%), *klebsiella* (10%), *proteus* (7%), *acinetobacter* (3%), and *citrobacter* (3%) (Table 2).

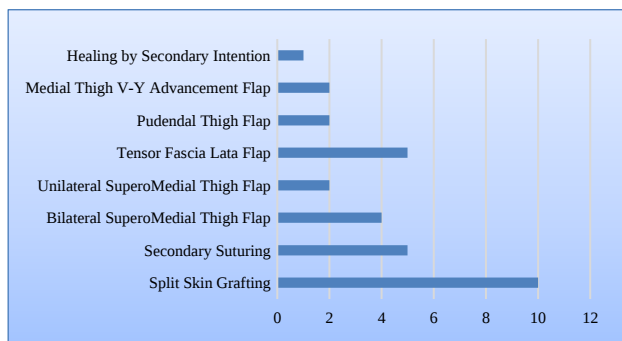
Table 1: Risk factors identified in the study group.

Predisposing factor	No. of patients
Diabetic mellitus	10
Alcohol	9
Smoking	13
Steroids	1
Extremes of age	2

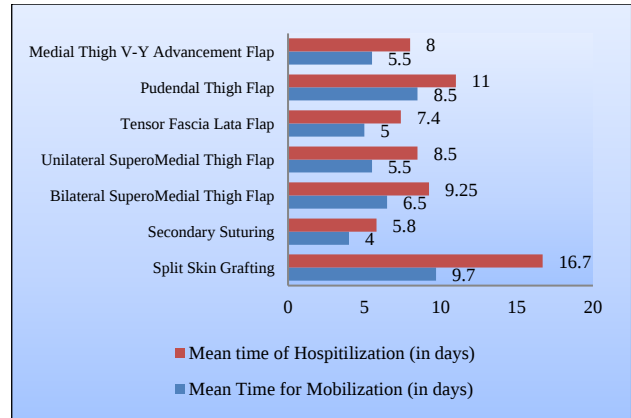
Table 2: Type of bacteria isolated from the wound.

Bacterial flora isolated	No. of cases	Percentage
<i>Staphylococcus aureus</i>	9	29%
<i>Pseudomonas</i>	6	19%
<i>Streptococcus pyogenes</i>	6	19%
<i>E. Coli</i>	4	13%
<i>Klebsiella</i>	3	10%
<i>Proteus</i>	2	7%
<i>Acinetobacter</i>	1	3%
<i>Citrobacter</i>	1	3%

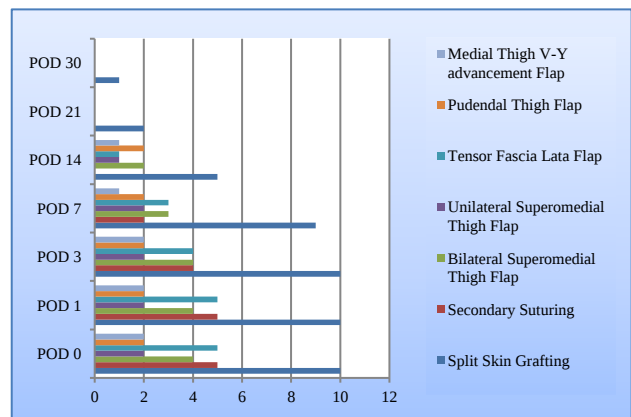
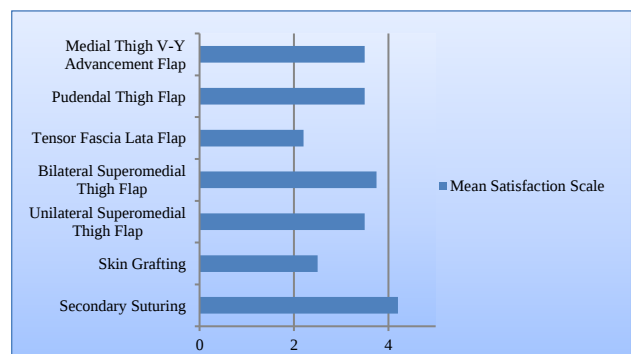
10 patients were treated by split-thickness skin graft, 5 by secondary suturing, 4 by bilateral and 2 by unilateral superomedial thigh flap, 5 by tensor fascia lata flap, 2 by medial thigh V-Y advancement flap, 2 with pudendal thigh flap and one case healed by secondary intention due to patient's refusal for surgery (Figure 13). Diversion colostomy was done in one patient with large perineal wound to avoid faecal contamination. Suprapubic cystostomy was done in 2 patients with urethral stricture.

**Figure 13: Type of reconstructive procedure used for wound coverage.**

Shortest hospital stay was 13 days and longest was 53 days since admission. Post final procedure, patients who underwent secondary suturing required least hospital stay with a mean of 5.8 days followed by patients with tensor fascia lata flap and medial thigh V-Y advancement flap requiring mean of 7.4 and 8 days respectively. Those patients who underwent skin grafting required longest stay of 16.7 days. All flap cases were mobilized early but those with skin grafting required longer immobilization. Mean time for mobilization was shortest in secondary suturing with 4 mean days and longest in skin grafting cases, of 9.7 days (Figure 14).

**Figure 14: Mean time for mobilization and mean time of hospitalization in patients after definitive procedure.**

Post-operative pain was assessed on post-operative days (POD) 0 (operated day), 1, 3, 7, 14, 21 and 30. Pain was assessed on the basis of patient requiring analgesics for relief with analgesics being administered on demand only. Skin grafted patients complained of longer and intense pain during post-operative period particularly in the donor site. Patients who underwent secondary suturing had least intense pain and after 1 week none of these patients required analgesics (Figure 15).

**Figure 15: Number of patients requiring analgesic for pain relief during post-operative period.****Figure 16: Mean patient satisfaction scale.**

Patient satisfaction was assessed based on a scale ranging from 0 to 5. Mean was calculated for each procedure at the end of 2 months after definitive procedure and ranged from 2.2 to 4.2 with former being for tensor fascia lata patients and latter awarded by patients who underwent secondary suturing (Figure 16). There was no mortality during the study period.

DISCUSSION

Though, Jean Alfred Fournier described this disease in 1883, as a rapidly progressing and potentially fatal gangrene of the genitourinary area characterized by abrupt onset in healthy young men in absence of any specific aetiology, over time the definition has encompassed necrotizing fascitis of the genital and perineal area with many predisposing and aetiological factors being determined. As previously considered, it is certainly not unique to men and also has been described in women. It is now termed as synergistic, polymicrobial, necrotizing fascitis of the genitourinary, perianal and perineal region which can occur in any age irrespective of gender.¹²

In the present study, male to female ratio was 14.5:1, more than that reported in Gurdal M study of 10:1.2.¹³ Most of the patients in the present study had specific aetiology with defined predisposing factors. Urethral stricture and periurethral abscess were the main aetiological factors noted in our study. Diabetes was the most common co-morbid condition in our study, with 10 patients being affected. This association of diabetes with Fournier's gangrene is due to defective phagocytosis, microangiopathy and increase incidence of genitourinary and perianal infections.^{14,15} Predisposing factors like alcoholism, chronic smoking, extremes of age, use of steroids were also evident. Chronic liver disease, HIV infection and other conditions causing immune compromise leading to fulminant infection have also been associated with Fournier's gangrene but were not seen in our study group.¹²

Infection extends rapidly along Colles' and Dartos fascia and via Scarpa's fascia may involve the abdominal wall.^{14,16} It has been noted that in Fournier's gangrene, the resultant microvascular thrombosis with subsequent dermal necrosis is due to anaerobes which release enzymes such as collagenase, heparinase along with platelet aggregation and complement fixation induced by aerobes.

In Fournier's gangrene, commonly *Enterobacteria*, particularly *Escherichia coli*, *streptococcal* and *staphylococcal* species and *Clostridia*, are encountered frequently in combination.^{14,17} In the present study, it was seen that *Staphylococcus*, *Streptococcus* and *Pseudomonas* were the predominant isolates in culture. Only one patient had 2 organisms isolated, i.e. *streptococcus* and *pseudomonas*, while rest had single organism cultured. Studies have shown that

staphylococcus and *streptococcus* produce enzymes such as streptokinase, streptodornase, hyaluronidase, which cause tissue damage.¹⁸

Fever, pain, swelling, erythema and tenderness of the genitalia and perineum and gangrene are the most common clinical presenting features.^{14,19} Patients may also present in shock or altered mental status due to systemic symptoms of sepsis.

Complete removal of all necrotic tissue including skin, subcutaneous tissue and fascia, until well-vascularised tissue remains should be the aim of wide surgical debridement and this may require multiple sittings to achieve. Since testis has independent blood supply directly from the abdominal aorta via testicular artery, it remains unharmed and orchidectomy is not necessary.¹⁶ Treatment with hyperbaric oxygen for Fournier's is debatable, as its use in any other wound management and may support surgical debridement but not second it. As proven in many studies, early surgical debridement and antibiotic use with hyperbaric oxygen has significant survival advantage.¹⁷ Use of negative pressure wound therapy (NPWT) has also been advocated by many researchers such as Morykwas and others reporting enhanced bacterial clearance.²⁰ However the greatest difficulty is in application of NPWT owing to anatomy of the region. But if applied will aid in treatment of large perineal wounds by reducing infection, speeding granulation and promoting wound contraction.

After stabilizing the patient, removal of the necrotic tissue and controlling the disease process, the resultant soft tissue defect has to be addressed with appropriate reconstructive procedure.

Out of 31 patients in our study, treated in Adichuchanagiri Institute of Medical Sciences, 30 patients underwent various reconstructive procedures; one patient refused surgery and healed by secondary infection at domiciliary care, though with a longer bedbound time and morbidity. The aim of the selected procedure is to cover the defect as aesthetically as possible and also to retain the functionality of urogenital and anorectal region.

Described reconstructive options in medical literature are many and include primary or secondary suturing, split thickness skin grafting, advancement flaps, fasciocutaneous, myocutaneous or muscle only flaps or perforator flaps. Though as prescribed in literature, procedures are to be followed according to reconstructive ladder with lower rung simple procedures to be preferred over complex procedures, it may not hold good always and may require the operative surgeon to opt complex procedures to attain desired wound closure. Hence each case has to have tailor made reconstructive plan taking into account patient's general condition, defect location and severity, availability of locoregional tissue and patient's wish too.

Though primary and secondary suturing will yield the most desirable result, it is seldom possible taking into account the aggressiveness of the disease, causing tissue destruction and wide defects. If defect involves less than 50% of the scrotal surface area, an advancement flap gives good aesthetic result.¹⁵ For defects involving more than 50% of the scrotum, skin grafts or pudendal thigh flaps are wise choices.^{15,21} In cases of combined scrotal and perineal defects pudendal thigh flap, anterolateral thigh flap, superomedial thigh flap or gracilis muscle flaps can be used.^{15,16} With advancement in wound management, cases treated successfully using dermal regeneration templates have been reported.²⁰ The use of these synthetic dermal substitutes have been opined to reduce scarring and pliability of skin providing functional and aesthetic benefits.²²

One of the hotly pursued factor in treatment of Fournier's gangrene is the effect of the engaged procedure on spermatogenesis. This is especially important in adult males. However, studies have shown that though there is significant decrease in spermatogenesis after neoscrotum creation in post Fournier's gangrene patients, apparently it is not severe enough to impact fertility and child bearing capability of the male patient and overall ability of the couple to achieve pregnancy remains unaltered.²⁶

Mean time required for hospitalization was shortest in patients who underwent secondary suturing, followed by locoregional flaps. It took longer time to ambulate skin grafted patients, as these patients needed immobilization. Hospitalization requirement was lengthier in skin grafted patients owing to immobilization and frequent dressing changes. The emphasis is that though skin grafting is in the lower rung of the reconstruction ladder, mean hospitalization and mean mobilization time in these cases was markedly more.

Post-operative pain management was done using NSAIDs and occasionally opioids. Analgesia was provided only on demand rather than pumping patients with inadvertent amount. It was noted that analgesia was required more in skin grafted patients owing to the pain in donor site rather than at the closed defect site. Frequency of administration of analgesic drugs in these patients was also more along with prolonged duration. One patient required analgesics even at the end of 1 month after final surgery. Patients with secondary suturing required pain relief for lesser duration and less frequently. This may be due to smaller defect size which was closed with locally available native scrotal tissue. This was followed by locoregional fasciocutaneous flaps. However, these patients in whom tissue was recruited regionally had dragging pain due to donor site attachment. However, with time this passed and patients never required analgesic for this.

One patient who refused any reconstructive procedure due to risk involved for surgery owing to chronic congestive cardiac failure had the longest hospital stay of 53 days. She also required frequent dressing changes and

longer analgesic treatment. However, with proper wound care she recuperated well avoiding surgery, but at the cost of lengthier morbidity and longer hospital stay, and also she had undergone diversion colostomy in the initial stage to avoid fecal contamination.

One unique variable included in the study was including patient satisfaction with respect to final outcome of reconstructive procedure. This was assessed using a scale from 0 to 5, with 0 denoting: not at all satisfied, 1: somewhat satisfied, 2: neutral, 3: slightly satisfied, 4: satisfied and 5: extremely satisfied.

As expected patients who had underwent secondary suturing had a high satisfaction rate. Mean satisfaction in these patients was 4.2. This was followed by patients who underwent locoregional flaps with the exception of patients who underwent fascia lata flap for defect closure. Satisfaction in fascia lata flap patients was lowest of the lot. Skin grafted patients also recorded a low mean satisfaction of 2.5. However, considering the fact that most of these patients had timely intervention and escaped death, the outcome of the reconstruction didn't bother them much and were very much indebted.

Though in the present study we didn't have any mortality, Fournier's gangrene has high mortality due to rapid progression of disease leading to sepsis and death. This problem is compounded by unavailability of timely medical intervention. Still, yet, reported mortality rates in many studies range from 0 to 80%, depicting grievousness of the disease.^{13,23}

As seen in many studies factors like extremes of age, deferred appropriate treatment all contribute to raise in mortality.^{24,25} Due to relatively high incidence of Fournier's gangrene in our hospital region, early diagnosis, prompt aggressive multiple sittings of surgical debridement, initial broad spectrum followed by accurate antibiotic therapy based on culture reports with intensive care instituting fluid and nutritional support have all contributed to no mortality in our study.

CONCLUSION

Thus, to conclude, age and gender is not discriminated by Fournier's gangrene and all necrotizing fasciitis of the urogenital, perineal and perianal regions is ought to be included in the disease spectrum. Aetiology and predisposing factors have to be identified and addressed promptly. Synergism of polymicrobes play an important role in the ferocity of the disease locally and generally, hence broad-spectrum antibiotics covering Gram positive and negative and also aerobes and anaerobes have to be started. This is to be followed by specific antibiotics depending on culture reports. Aggressive surgical debridement and supportive therapy is the core of treatment regime. Often neglected aspect is the choice of reconstructive procedure to be employed foreseeing the final outcome and depends on multiple factors including

patient age, general condition, choice of the patient and ease of treating doctor with procedure. Locoregional flaps have best outcome next only to secondary suturing.

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Ethical approval: The study was approved by the Institutional Ethics Committee

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