Fournier's gangrene: challenges and pitfalls for genital reconstruction from a tertiary hospital in South Africa

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Abstract

Background: Fournier's gangrene (FG) is an acute urological emergency described as a necrotising soft-tissue infection of the genitalia and perineum with associated polymicrobial infection, organ failure and death. The use of broad-spectrum antibiotics and immediate surgical debridementare the mainstays of treatment. The extensive debridement of all the necrotic tissue, the associated wound care and the reconstruction of the defect remain a big challenge. The prevalence in low-income countries such as South Africa seems to be higher when compared to international statistics despite the lack of published data.

Patients and methods: A descriptive retrospective study was performed for the period of January 2006 up to December 2015 at Kimberley Hospital Complex, a facility which provides tertiary services to the Northern Cape Province (NCP) in South Africa. A search for all patients who underwent reconstructive procedures following the successful management of FG was performed using the Department of Plastic and Reconstructive Surgery's database. Challenges and pitfalls for the performance of the reconstruction were analysed.

Results: Sixty-four male patients underwent genital reconstruction after FG debridement. The age range was 16 to 78 years (mean 52.75). Fifty-six (87.5%) of the patients were referred from rural areas of the NCP. Fifty-nine (92.2%) were reconstructed with split-thickness skin grafting; of these 14% had initial partial graft failure. Most patients were referred from rural areas after debridement with suboptimal wound care and lack of management of the testicles which needed to be optimised before the reconstructive procedure.

Conclusions: Due to this high prevalence, lack of resources and severity of the disease, many general practitioners are expected to assist the patient diagnosed with FG by performing the initial and life-saving debridement. This proves to be a challenge for the less experienced doctor, who is expected to refer the patient to other centres for reconstructive procedures. Based on our experience, we analysed the challenges and pitfalls encountered and provided some strategies for the referring practitioner to perform surgical management for a better reconstructive outcome.

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Background

Fournier's gangrene (FG) is an infective necrotising soft-tissue infection of the perineal, genital and perianal regions, which may extend up to the abdominal wall between the fascial planes.[1,2] Several terms have been applied to FG over the years; these include "streptococcus gangrene", "necrotising fasciitis", "periurethral phlegmon", "phagedena" and "synergistic necrotising cellulitis".[1]

Currently the use of the term "necrotising soft-tissue infection" is being favoured, as this better describes the underlying pathology. Originally it was described by Baurienne in 1764 as an idiopathic, rapidly progressive soft-tissue necrotising process of the male genitalia; however Jean-Alfred Fournier, French dermatologist, became associated with the disease, which bears his name, after he described the condition in 1883.[3]

Although FG was initially defined as an idiopathic entity, an infective cause can now be proven in the majority of cases. Perineal or urogenital trauma is also linked to the pathogenesis of FG. The presence of co-morbidities, especially those resulting in a compromised immunity have been identified as predisposing factors. Infection is initiated when there is an imbalance between the host's immunity and the virulence of the causative microorganisms.[4]

FG is polymicrobial in nature and usually consists of the synergistic action of the normal perineal and genital skin commensals such as clostridia, klebsiella, streptococci, staphylococci, bacteroides and coliforms.[5] The most common pathogens are streptococcal species, staphylococcal and *Escherichia coli*. The infection ultimately causes an obliterative endarteritis which leads to necrosis of the skin and

underlying subcutaneous tissue. This infection may spread along the fascial planes.[6-8]

The treatment of FG involves multiple modalities. Patients presenting with sepsis, manifesting as hypo-perfusion or organ failure require aggressive resuscitation to restore normal organ perfusion and function.[1] Early, broad-spectrum antibiotics are indicated.[1-3] Underlying and potential predisposing co-morbidities such as diabetes or HIV should be addressed, as failure to do so may threaten the success of any other interventions implemented.[7,8] Surgery is needed for definite diagnosis and for the excision of the necrotic tissue.

The definite diagnosis of FG is made by examination under anaesthesia. The diagnosis is made when gangrenous tissue or overt purulence is found when making an incision in the area of greatest clinical concern. Once the diagnosis is established, all the necrotic tissue must be excised as it has been proven that early surgical intervention reduces mortality.[1-4] The skin should be opened to expose the full extent of the underlying subcutaneous and fascial necrosis. Blunt dissection should be used to examine along the fascial planes. When they separate easily, the tissue should be considered involved and must therefore be excised. Excised tissue samples should be sent for culture and histological assessment.[1]

After the initial clinical and surgical management of the patient, reconstruction of the affected areas is usually required. The time to proceed to the reconstructive phase of the disease is once the infection has been treated and healthy granulation tissue starts to develop. Options for the reconstruction include: primary closure; split-thickness skin grafts; local skin flaps or muscular flaps which are used to fill larger defects.[1,3] Most reconstructive techniques provide coverage and protection of testicular function. There is no conclusive evidence to so suggest the use of flap coverage of exposed testis over that of a skin graft.[9]

The aim of this study was to review the patients who underwent reconstructive procedures at our facility and analyse the challenges found during the period of the study, making recommendations to overcome pitfalls and facilitate the reconstruction phase of this pathology.

Patients and methods

This was a descriptive retrospective study conducted at Kimberley Hospital Complex (KHC), by the Department of Plastic and Reconstructive Surgery and Burns (DPRSB), from January 2006 to December 2015. Consent for the study was granted by the Northern Cape Province (NCP) Research Committee and the Medical Director of the KHC.

The Department's database for all "genital reconstruction" caused by FG performed during the period was consulted and the age, gender, geographic area and reconstructive procedure performed were collected and compiled. For the same period the registry of the urology ward at KHC and theatre registry books were consulted to get the entries for patients admitted with Fournier's gangrene and debridement for FG respectively. The patient's files were not retrieved for the purpose of this study. The photography database of the patients who underwent genital reconstruction was also consulted for analysis of the reconstructive procedures performed.

KHC is the tertiary referring hospital of the NCP in South Africa, satellite of the University of the Free State. Although not all patients presenting with Fournier's gangrene in the province are referred to Kimberley Hospital, most of them end up being treated in Kimberley Hospital. As the largest and least inhabited province in the country, referrals of patients from district hospitals are delayed, and the initial management of patients is usually done by medical officers with or without surgical experience in the management of this pathology.

All referred patients who underwent reconstructive procedures from 2006 were treated solely by the plastic surgeon based at KHC. The initial clinical and surgical management of those patients was either initiated at the referring facility or by the Department of Urology at KHC.

Results

The registry books from the urology ward and main theatre at KHC showed that 137 patients were admitted and/or underwent surgical debridement for FG during the period of this study. Sixty-four (46.7%) patients were referred to the plastic surgery department for genital reconstruction. We assume that the remaining patients did not require any major reconstructive procedures as they were managed primarily by the urology department, either by allowing healing by secondary intention or by performing delayed closure. All patients who underwent reconstruction by our department were male. The age of these patients varied from 16 to 78 (mean 52.75 years old). Table I depicts the distribution of the patients according to age. Nearly 66% of the patients were older than 41 but younger than 70 and two patients were under 20 years old.

Out of the 64 treated patients, eight (12,5%) originated locally from Kimberley. The majority of patients (87.5%) were referred from rural settings of the NCP situated at considerable distances away from Kimberley (up to 800 Km). Figure 1 depicts the distribution of patients according to the year they were treated in the unit. Between 2007 and 2008, one-third (32.8%) of the patients underwent reconstruction in the unit.

Fifty-nine patients (92, 2%) were reconstructed with split-thickness skin grafting (STSG) of the areas debrided (Figure 2) and five patients (7.8%) underwent local advancement flaps of the scrotum

Table I. Number of patients who underwent genital reconstruction after debridement of FG in

KHC from January 2006 to December 2015	
Age (years)	**Number (%)**
≤ 20	2 (3.1)
21–30	2 (3.1)
31–40	8 (12.5)
41–50	12 (18.8)
51–60	16 (25)
61–70	14 (21.9)
≥ 71	6 (9.4)
unknown	4 (6.3)
Total	**64 (100)**

Figure 1. Number of patients treated in the unit per year (2006–2015)

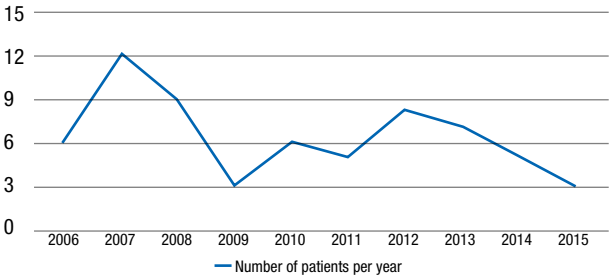

Figure 2.

Figure 3.

Figure 4.

Figure 5.

(Figure 3). In 10 patients (15.5%) the STSG was done only for the penis, in three (4.7%) only for the scrotum. In 21 patients (32.8%) the areas debrided extended beyond the genitals (lower abdominal wall/groin/upper thighs) and were also grafted (Figures 4 and 5). Out of the 64 patients, nine patients (14%) needed a second procedure with repeat STSG due to partial graft uptake.

Discussion

A search done on Pubmed, Google Scholar and Medline for articles related to 'Fournier's gangrene' and 'reconstruction' and 'Africa' or 'South Africa' yielded no results. Although no published data was found on this matter, it is assumed that the numbers are higher than in high-income countries. A retrospective study conducted at the Union Hospital in Wuhan, China, documented 24 patients diagnosed with FG between March 1996 till December 2011 (15 years).[10] In another study conducted at University Hospital Erlangen, Germany, only seven patients were treated for FG between 1980 and 1992.[9] In the urology unit at the University of Nigeria Teaching Hospital, Enugu, 34 patients were treated for FG between January 1995 and December 2008. Out of the 28 patients studied, 22 had direct scrotal skin apposition, while eight had a combination of scrotal skin suture apposition and STSG.[11]

Early aggressive debridement is the cornerstone and life-saving initial treatment. Fournier's gangrene severity index (FGSI) at admission serves as a good predictor for the disease severity and needs to be considered when forming the initial assessment and planning.[6] Surgery should be undertaken with the patient in the lithotomy position to allow better access to the perineal structures. Radical debridement of areas of overt subcutaneous necrosis is essential. It is important to recognise that the extent of the disease cannot be assumed from the margins of cutaneous necrosis. Easily separated skin and subcutaneous tissue should be regarded as involved, with debridement stopping where these tissues do not separate easily. After the initial surgery, the wound should be closely monitored. If there is any doubt about tissue viability, the patient should be taken back to theatre for further debridement. Multiple procedures are often required, with a mean of two to four procedures per patient.[12]

The debridement of the deep fascia, muscle and testicles is not usually required as they are rarely involved in the necrotising process.[1] The tunica albuginea protects the spermatic cord and

Figure 6.

usually prevents the testicles and spermatic cord from being involved in the necrotic process. If the testicles are uninvolved and exposed, they should temporarily be placed in a subcutaneous thigh pocket to prevent desiccation, until healing or reconstruction is possible; this was the case in two of our patients. This facilitates the reconstructive procedures that may need to be performed at a later stage. If a testicle is necrotic or the viability is questioned, an orchiectomy must be performed.[13] In our study only one patient needed this procedure (Figure 6).

Wound-bed preparation after successful debridement is important for reconstruction at a later stage (Figures 7 and 8). Advanced wound dressings should be used to promote granulation of the wound bed and prevent further infection or critical colonisation of the wound. The initial predisposing or co-morbid factors that rendered the patient prone to develop FG might also affect wound healing in these patients, and the initial systemic insult from the necrotising process might impair wound healing.[13] For example: HIV, diabetes mellitus, non-benign disease, chronic vascular disease, renal impairment, alcohol abuse or any other systemic disease that causes impairment of the immune system should be identified and treated accordingly. Nutritional support during the preparation phase is an important detail that is often overlooked and should be addressed to optimise the healing process and to allow for adequate wound-bed preparation.[8]

Negative pressure wound therapy (NPWT) is an excellent dressing for temporary wound closure. It manages the exudate and increases fibroblast migration that result in improved granulation tissue formation and lowering bacterial counts that will aid in graft-uptake success. It also allows for advancement of the wound

Figure 7.

Figure 8.

edges which assists in creating a smaller defect which might need reconstruction.[12] Formal NPWT devices are not always necessary as sub-atmospheric pressure can be applied to the wound using wall suction and a "homemade" dressing. This is done by inserting a simple suction-drain tubing, containing multiple holes, between sterilised foam, cut geometrically according to the wound bed. The foam is then covered with adhesive, plastic dressings in such a way that the wound margins are overlapped, ensuring a good airtight seal. The use of Friar's Balsam, a topical antiseptic, on the surrounding skin is a useful trick to enhance and prolong adhesion of the dressing. The tubing is then connected to a suction device.

Depending on the wound bed, either surgical or non-surgical (dressings) treatment should be applied. In the NCP, the rural areas do not always have access to advanced dressing materials; as such, wound care must be done with only basic supplies and dressings with the continued aim of preparation of the wound bed for later reconstruction. In most of the cases this constitutes a challenge, delaying the process of reconstruction and the patient's length of stay in hospital. In our facility we have access to a few advanced wound dressings used as clinically indicated according to the wound bed presented; in the case illustrated a sequence of medicinal honey (anti-microbial and debridement action), followed by amorphous gel were used to provide an adequate wound bed.

Debridement may leave external genitalia (penis/scrotum), perineal and abdominal wall skin defects. Small scrotal defects heal well by secondary intention, but this may be a lengthy process for larger

Figure 9.

Figure 10.

defects, and reconstructive surgery may be necessary as secondary wound healing is characterised by contracture and deformity of the scrotum, as well as cosmetically unacceptable results. Therefore it is usually recommended that the testicles be placed in subcutaneous thigh pockets during initial debridement; heat regulation should not be impaired if they are placed superficially, but there is a risk of spermatic necrosis.[11] An unfortunate sequelae of placement of the testicles in a subcutaneous thigh pocket is that it can cause discomfort when walking. The main aesthetic and psychological problem is the absence of the scrotum. If the testicles are not buried in the pocket they should be sutured together with a few interrupted absorbable sutures, inferior/ventral to the penis during debridement.

The placement of the testicles inferior to the penis is an important consideration for the further reconstruction and closure of the defect left after debridement. Hyper-granulation around the base of the penis is a complication of the healing process and must be released prior to undertaking any reconstruction. There are some cases where the testicles are loosely held in place by the surrounding granulation tissue, in which case there is a possibility that they might be spontaneously released and mobilised during the healing process or post reconstruction. When this happens it will adversely affect any reconstructive procedure undertaken.[12] Figure 9 depicts some of the cases that illustrate the challenges we had to face in our study.

Consideration should be given to skin coverage, aesthetics and functionality of the testicles (Figure 10). Scrotal defects of less than 50% of the stratum can be repaired by using local cutaneous advancement flaps. Regional flaps can give a good aesthetic result, but are not ideal skin. The skin is frequently too thick and has different characteristics in terms of texture and colour. Potential complications of local and regional flaps include flap necrosis, wound dehiscence, and donor-site complications such as seromas or haematomas. Multiple methods using flaps have been described, including fasciocutaneous flaps, gracilis fasciocutaneous and musculocutaneous flaps, groin flaps, rectus abdominis muscle flaps and even flaps created by tissue expansion.[12-15] In addition, flaps require multiple procedures or more prolonged and technically challenging operations which lead to longer hospital stays when compared to STSGs. In our setting, theatre time is limited and due to the large burden of patients requiring surgical services, it would be inefficient to perform such lengthy and technical procedures when simpler procedures such as STSG would allow for a greater number of patients to be treated with an equivalent, if not better, outcome. Thus, whenever possible, local tissue was advanced to close the defects (five cases reported in our study). STSG was used to reconstruct bigger defects due to the lack of availability of surrounding skin.

The STSG is the most commonly used technique for reconstruction of post-debridement defects in FG. It was used in 92,2% of our patients with good results. It is the recommended procedure as it gives a good aesthetic result and can be performed in settings with limited resources and expertise. STSG can be used as long as the tunica vaginalis is intact. In an attempt to counteract excessive contracture of the graft during the healing process, it is recommended that an intermediate STSG is harvested.[12,14] This can easily be performed

Figure 11.

by any surgeon who has access to an electric dermatome. If the testicle was not buried during the initial debridement, the weight of the testicle in the anatomical position can aid in counteracting the contracture after grafting.

Urinary and faecal diversion may be needed to promote wound care by decreasing contamination (Figures 5 and 11). Suprapubic cystostomy is required in cases where gross urinary extravasation or periurethral inflammation is present. In milder cases, a urethral catheter may suffice. Gross anal sphincter, colonic or rectal involvement necessitate diversion with the use of a Flexi-Seal™ or the formation of a colostomy.[1] Due to the limitation of using a Flexi-Seal™ for more than 29 consecutive days, most patients had already had a colostomy performed prior to referral to our department for reconstruction.[16]

Conclusion

The challenges and pitfalls identified for the genital reconstruction of defects post-debridement of Fournier's gangrene in our setting, with our recommendations to overcome them and assist rural hospitals, were:

- During the debridement of the necrotic tissue, the aesthetic outcome was not taken into consideration. As concluded from our findings we recommend to suture the testicles together on the inferior or ventral aspect of the penis. This prevents the retraction of the testicles, facilitates the reconstruction and ultimately leads to a more favourable cosmetic outcome.
- As identified in most of our cases, the wound bed was not appropriately prepared for reconstructive procedures to be performed. This caused a delay in the management of the patients. Most patients were referred from rural settings with limited resources, thus "homemade" NPWT would be a good option to overcome this pitfall.
- STSG was used for reconstruction in most of our cases with good aesthetic results. If the above-mentioned recommendations are adhered to, the need for a reconstructive surgeon to perform more complicated procedures will not be necessary. STSG can then be performed at lower-level hospitals with access to a dermatome.

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