A novel surgical debridement technique for the treatment of Fournier’s gangrene

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LETTER TO THE EDITOR

Dear Editor,

Fournier’s gangrene (FG) is a life-threatening disease which is characterized by necrotizing fasciitis of the genital, perianal, and perineal regions.¹ FG was initially found in young healthy males in the late 1800s with the acute onset of fulminant idiopathic genital gangrene.² But now, FG has been seen in people of different ages, from newborn babies to the elderly.³ Previous studies suggested females constituted the majority of the cases of FG, characterized by necrotizing fasciitis of the genital, perianal, and perineal regions.⁴ However, due to the inability to obtain a precise diagnosis of FG in many cases, the death toll among females with the above symptoms has been underestimated.¹ Removing necrotic tissue as rapidly as possible through debridement was generally considered to increase the survival rate of patients suffering from FG;¹⁶ even among those with sepsis or septic shock.⁷ When performing debridement, surgeons needed to take into account the complete excision of necrotic tissue and the meticulous assessment of the potential salvageable soft tissue.⁸ Performing aggressive debridement has been the most common technique for the surgical treatment of patients with FG.¹⁹ However, aggressive debridement technique results in a large incision and severe trauma from resecting all necrotic skin, underlying subcutaneous tissue, fascia, and muscle until the viable tissue is reached. Herein, we summarize clinical practices of the minimal and intermittent cutting in debridement, suggesting that this technique combined with the analysis of clinical symptoms, laboratory diagnosis, and etiological and microbiological features will be a great addition to the armamentarium for patients with limited FG.

Sixty-five patients were diagnosed with FG and hospitalized between December 2015 and December 2018 in Beijing Rectum Hospital (Beijing, China). The study protocol was approved by the Ethics Committee of Beijing Rectum Hospital (elly-2020-003). Written informed consent was obtained from the patient for publication of this study and any accompanying images. Patients diagnosed with cellulitis, erysipelas, gas gangrene, or abscess during hospitalization were excluded from the study. FG was diagnosed through clinical practices dependent on patients’ medical history as well as physical examination or radiologic imaging. The diagnosis standards of FG were based on the presence of these conditions: temperature > 38°C, swollen perianal/scrotal region, skin erythema, purulence or wound discharge, and fluctuation or crepitus. The criteria for exclusion were: no full-layer necrosis found in the process of surgery and no necrotic tissue detected in post-surgery pathological testing. Furthermore, the diagnosis was confirmed by the evidence from surgical inspection and specimen collection. Moreover, the age, gender, disease etiology, factors of predisposing, initial symptoms, microbiologic test, length of stay in the hospital, the number of debridements, Fournier’s Gangrene Severity Index (FGSI), and outcomes of patients were collected and analyzed.

To calculate the FGSI, nine variables including temperature, heart rate, respiratory rate, serum sodium, serum potassium, white blood count, serum creatinine, hematocrit, and serum bicarbonate were collected and assessed. The deviation from the normal condition was graded by a number from 0 to 4 in terms of a previous study (Supplementary Table 1).² Of the sixty-five patients in the study, 7 females and 58 males, average age was 43.46 (standard deviation [s.d.]: 13.39) years, and average length of stay in hospital was 13.81 (s.d.: 8.40) days. The patients experienced the debridement procedure an average of 1.57 (s.d.: 0.81) times and the average FGSI score was 1.86 (s.d.: 2.22) points. All parameters showed no statistical significance between genders (all P ≥ 0.05; Supplementary Table 2).

Minimal and intermittent cutting of the traumatic zones was performed on all patients within 12 h of being admitted to the hospital. The standard treatment procedure was as follows: initial incision with a length of 2–3 cm based on the most obvious swelling, fluctuation, and crepitus area; then excision of the fusiform skin and subcutaneous tissue until the necrotizing tissues were exposed; then loosening and removal of some necrotizing tissues, forming a circular wound surface with a diameter of 2–3 cm. The above procedure was repeated at 2–3 cm intervals until the healthy tissue boundary was reached. Vessel forceps were then used to bluntly separate the abscess cavity between two incisions to discharge pus. A draining seton was left between every two incisions. The procedure concluded with washing the wounds with 3% hydrogen peroxide solution and physiological saline. The wound surface was then dressed with the cotton gauze. Specimens from the patients were used for culture and biopsy. The cotton gauze was changed twice a day until the disappearance of necrotizing tissue and the formation of healthy granulation tissue (Figure 1). Patients with severe sepsis received the support of vasopressors, continuous renal replacement therapy (CRRT), and
Intraoperative image. The intraoperative image of debridement et al. 2017; Immediate postoperative image. The procedure of minimal and intermittent cutting of the fascia, and muscle until viable tissue is reached. Moreover, aggressive debridement increases the operative time and results in the wound area requiring secondary intervention; plastic surgical reconstruction has even been performed for many patients with FG. Recently, hyperbaric oxygen therapy (HBOT) combined with surgical debridement was proved to be beneficial for patients with FG. In this study, all patients underwent minimal and intermittent cutting debridement within 12 h of being admitted to the hospital and all the patients survived from FG.

More importantly, the patients in our study showed lower mortality and a shorter length of hospital stay on average, compared with previous reports. In summary, the present study demonstrates that the minimal and intermittent cutting debridement technique can reduce operative time and soft-tissue destruction, revealing a previously unrecognized surgical method for the treatment of FG.

The main limitations of the present study were the small cohort size and relatively short follow-up period. Another limitation was that most of the patients exhibited mild symptoms based on their FGSI scores. Further studies with large cohorts and patients with FGSI > 9 or FGSI ≤ 9 are required to evaluate this technique.

**AUTHOR CONTRIBUTIONS**

XHC and PPQ conceived and designed this study, and drafted the manuscript. ZXZ helped to draft the manuscript and perform the statistical analysis. JYL and JJZ collected and analyzed the data. All authors read and approved the final manuscript.

**COMPETING INTERESTS**

All authors declared no competing interests.

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Supplementary Information is linked to the online version of the paper on the Asian Journal of Andrology website.

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### Supplementary Table 1: Fournier’s gangrene severity index

| Physiological variable/point assignment | High abnormal values | Normal | Low abnormal values |
|----------------------------------------|----------------------|--------|---------------------|
|                                        | 4                    | 3      | 2                   | 1       | 0       | 1    | 2    | 3   | 4   |
| Temperature (°C)                        | >41                  | 39-40.9| -                   | 38.5-38.9| 36-38.4| 34-35.9| 32-33.9| 30-31.9| <29.9 |
| Heart rate                              | >180                 | 140-179| 110-139             | -       | 70-109 | -     | 55-69 | 10-54| <39  |
| Respiratory rate                        | >50                  | 35-49  | -                   | 25-34   | 12-24  | 10-11 | 6-9  | -    | <5   |
| Serum sodium (mmol I⁻¹)                 | >180                 | 160-179| 155-159             | 150-154 | 130-149| -     | 120-129| 111-119| <110  |
| Serum potassium (mmol I⁻¹)              | >7                   | 6-6.9  | -                   | 5.5-5.9 | 3.5-5.4| 3-3.4 | 2.5-2.9| -    | <2.5 |
| Serum creatinine (mg per 100 ml, ×2 for acute renal failure) | >3.5                 | 2-3.4  | 1.5-1.9             | -       | 0.6-1.4| -     | <0.6  | -    | -    |
| Hematocrit (%)                          | >60                  | -      | 50-59.9             | 46-49.9 | 30-45.9| -     | 20-29.9| -    | <20  |
| White blood count (total mm³ x 10³)     | >40                  | -      | 20-39.9             | 15-19.9 | 3-14.9 | -     | 1-2.9 | -    | <1   |
| Serum bicarbonate (venous, mmol I⁻¹)    | >52                  | 41-51.9| -                   | 32-40.9 | 22-31.9| -     | 18-21.9| 15-17.9| <1.5  |

Nine variables including temperature, heart rate, respiratory rate, serum sodium, serum potassium, white blood count, serum creatinine, hematocrit, and serum bicarbonate were collected and assessed. -: no result.

### Supplementary Table 2: Comparison of gender differences on outcome in patients with Fournier’s gangrene

|                                   | Male (n=58; mean±s.d.) | Female (n=7; mean±s.d.) | P    |
|-----------------------------------|------------------------|--------------------------|------|
| Age                               | 43.05±13.39            | 46.86±13.95              | 0.482|
| Number of debridement             | 1.55±0.84              | 1.43±0.53                | 0.708|
| The days for the duration of hospital stay | 14.1±8.75          | 11.7±4.46                | 0.488|
| FGSI                              | 1.87931±2.29475        | 1.71429±1.70434          | 0.855|

Categorical variables were designated as the frequency (%) and the quantitative variables were designated as the mean±s.d. A comparison between categorical variables was carried out by Fisher’s exact or Chi-square test, while the difference between quantitative and ordinal variables was performed by applying Mann–Whitney U or Wilcoxon rank sum test. Statistical analysis was IBM SPSS Statistics version 25.0 (SPSS Inc., Chicago, IL). Data were considered significant when P<0.05. s.d.: standard deviation; FGSI: Fournier’s gangrene severity index.