



Case Report

Low-energy Shockwave Therapy in the Management of Wound Healing Following Fournier's Gangrene

Jens J. Rassweiler^{a,*}, Walter Scheitlin^b, Ali Serdar Goetzen^b, Marie-Claire Rassweiler-Seyfried^c

^a Department of Urology and Andrology, Danube Private University, Krems, Austria; ^b Department of Urology, SLK Kliniken, Heilbronn, Germany; ^c Department of Urology and Urosurgery, University Medical Center Mannheim, Medical Faculty Mannheim, University of Heidelberg, Mannheim, Germany

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Abstract

We report on postoperative management of wound healing in four cases of Fournier's gangrene successfully treated with low-intensity shockwave therapy (LI-ESWT). In three cases, LI-ESWT (3 sessions per week with 2000 shockwaves at 3 Hz applied at 0.25 mJ/mm²) was able to close wound dehiscence secondary to plastic surgery with skin flaps. In one patient, LI-ESWT resulted in complete closure of an extensive wound with restoration of the local scrotal and penile skin. This is the first report of successful application of LI-ESWT for this indication. Restoration of local skin rather than wound closure by fibrous tissue could be related to promotion of stem cells, which has been discussed previously for other indications, such as treatment of chronic ulcers and restoration of the pelvic floor.

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1. Case report

Fournier's gangrene is an acute necrotizing fasciitis affecting the external genitalia or perineum (Fig. 1A). It requires immediate radical surgery with complete removal of affected tissue (Fig. 1B). Once the patient is stabilized and the wounds are clean, postoperative management includes mesh grafts and skin flaps [1], both of which can be associated with secondary wound healing problems that may require a secondary surgical procedure (Fig. 1C). On the basis of promising results for low-intensity shockwave therapy (LI-ESWT) in the management of chronic ulcers [2–4], we first used LI-ESWT in three cases of Fournier's gangrene with secondary healing of skin flaps (Fig. 1D). We were subsequently

able to achieve complete closure of an open wound using LI-ESWT alone (Fig. 2).

Three men (aged 57, 61, and 68 yr) were admitted with severe Fournier's gangrene requiring complete excision of the scrotal and perineal skin (Fig. 1A, B and Fig. 2A, B). They were all treated in our intensive care unit for 10–14 d. Wound dressing was applied every other day. Once granulation of the wound started, we closed the wound using a skin flap from the surrounding area. Unfortunately, all three cases showed wound dehiscence during follow-up (Fig. 1C). We treated all three patients with LI-ESWT using a Duolith SD1 ultra (Storz Medical, Taegerwilen, Switzerland) electromagnetic device three times weekly (Monday, Wednesday, Friday) with application of 2000 shockwaves at 3 Hz at an

* Corresponding author. Department of Urology and Andrology, Danube Private University, Steiner Landstraße 124, 3500 Krems-Stein, Austria. Tel. +43 676 842419370; Fax: + 43 2732 704787060. E-mail address: jens.rassweiler@gmail.com (J.J. Rassweiler).



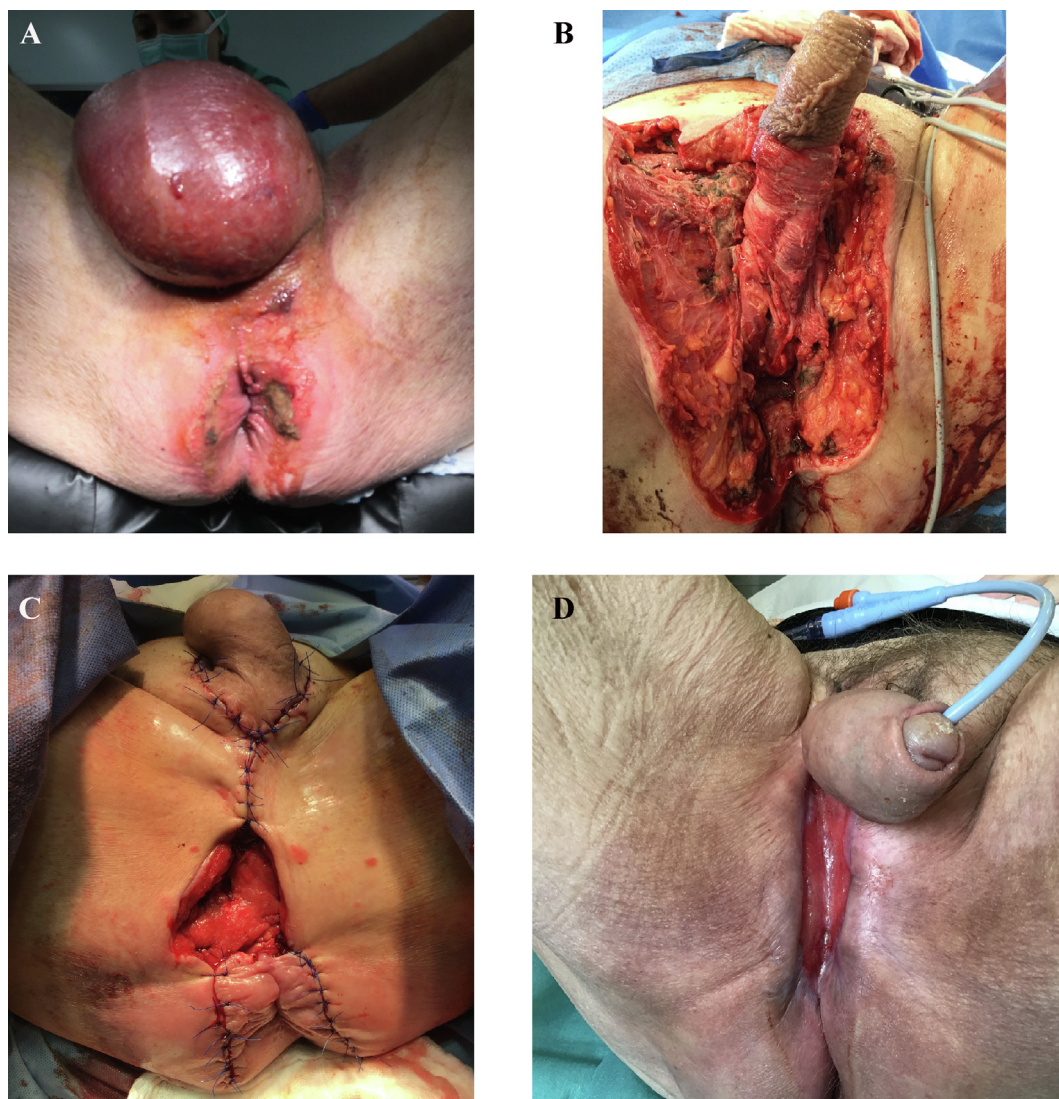


Fig. 1 – Low-intensity extracorporeal shockwave therapy (LI-ESWT) for management of secondary wound healing following skin-flap plastic surgery for Fournier's gangrene. (A) Initial presentation with severe Fournier's gangrene (acute necrotizing fasciitis) in the genital and perineal area. (B) Radical excision of the involved tissue. (C) Secondary healing after closure of the defect with skin flaps. (D) Healing of the wound after treatment with LI-ESWT (2000 shocks, 3 Hz, 0.25 J/mm²) three times weekly for 6 wk. No further surgical intervention was required after 12 wk.

energy density of 0.25 mJ/mm² distributed equally around the rim of the wound. All three wounds showed dramatic progress in the healing process (Fig. 1D) with almost complete healing after 12 wk. No further surgical procedure was required.

A fourth, relatively young patient (age 27 yr) was admitted with complete necrosis of the scrotal and penile skin requiring radical excision (Fig. 2A, B). He was in the intensive care unit for 7 d. Since there was not much tissue available for adequate plastic surgery of the penile and scrotal skin, we started to treat the patient using the LI-ESWT protocol. Interestingly, he responded very well to the treatment, starting with intensive granulation tissue covering the wound after 6 wk (Fig. 2C) but, much more impressively, we were able to achieve complete closure of the wound at 12 wk (Fig. 2D) without any surgical procedure. This involved closure not just with fibrotic tissue but also restoration of the residual local scrotal skin and penile skin.

2. Discussion

As early as 1990, Haupt and colleagues [5] investigated the effect of shockwaves on wound healing in an *in vivo* porcine model using a Dornier XL1 experimental lithotripter and concluded that low energy levels (14 kV) were associated with an increase in vascularization. Schaden et al. [2] initiated the first trials on LI-ESWT for wound healing more than 10 yr later in 2007. In the meantime, several experimental and clinical studies documented accelerated tissue repair and regeneration in various wounds following ESWT [3,4]. However, the biomolecular mechanism by which this treatment modality exerts its therapeutic effects remains unclear. Potential mechanisms include initial neovascularization with ensuing durable and functional angiogenesis. Furthermore, recruitment of stem cells, stimulated cell proliferation and differentiation, anti-inflammatory and antimicrobial effects, and suppression of nociception are

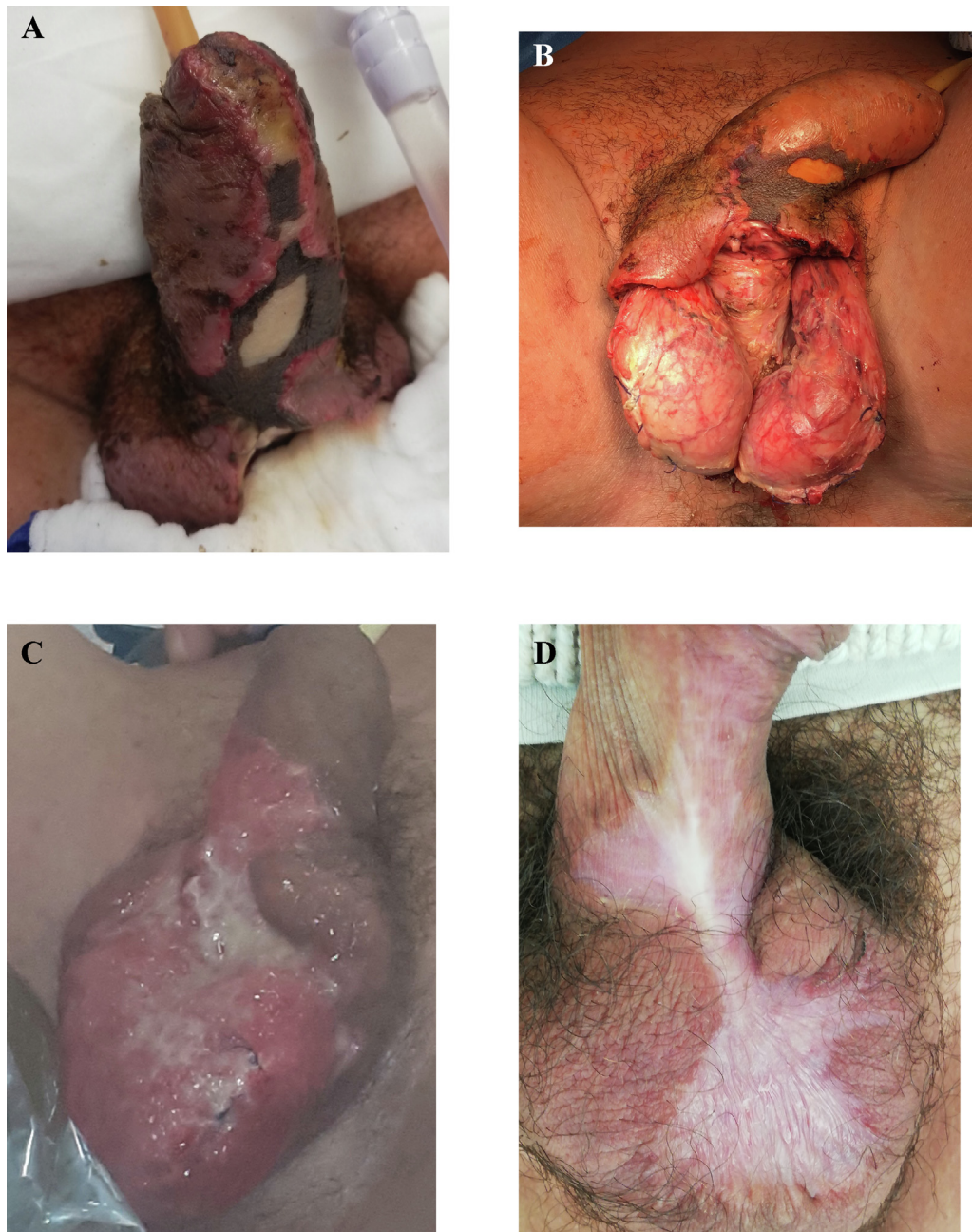


Fig. 2 – Low-intensity extracorporeal shockwave therapy (LI-ESWT) as a single management strategy for wound healing following radical excision of infected tissue after Fournier's gangrene. (A) Initial presentation with severe Fournier's gangrene involving the penis and scrotum. (B) Radical excision of the involved tissue. (C) Development of granulation following LI-ESWT (2000 shocks, 3 Hz, 0.25 J/mm²) three times weekly for 6 wk. (D) Complete restoration of the wound by scrotal and penile tissue after 12 wk. No surgery was required.

considered important facets of the biological responses to therapeutic shockwaves [3].

One advantage of ESWT for wound healing is that the effect can be seen directly, unlike in urological indications such as Peyronie's disease, erectile dysfunction, and lower urinary tract symptoms [6,7]. Our fourth case of complete restoration of the local skin, with a distinction between scrotal and penile skin, might indicate that stem cell activation could be the underlying mechanism [3]. In this context, the recent studies by Tom Lue's group [8] showing experimentally the proliferation of stem cells of the pelvic floor

muscles in a birth injury simulation model are very interesting.

In conclusion, the positive effect of LI-ESWT on healing is very interesting for urologists dealing with secondary wound healing, such as in postoperative management of Fournier's gangrene. A further indication could also be urethrocutaneous fistula following hypospadias repair. Further controlled studies are needed to evaluate the extent to which these results are due to LI-ESWT. However, Fournier's gangrene is relatively rare so it might be difficult to conduct such studies.

Conflicts of interest: Jens J. Rassweiler has received honoraria as a consultant for Storz Medical. The remaining authors have nothing to disclose.

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