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Original Research

Negative Pressure Wound Therapy in the Management of Late Deep Infections After Open Reconstruction of Achilles Tendon Rupture

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ABSTRACT

Infection is a major complication after open reconstruction of Achilles tendon ruptures. We report on the use of vacuum-assisted closure (VAC) therapy in the treatment of late deep infections after open Achilles tendon reconstruction. Six patients (5 males [83.33%], 1 female [16.67%]; mean age, 52.8 [range 37 to 66] years) were been treated using an identical protocol. Surgical management consisted of debridement, lavage, and necrectomy of infected tendon parts. The VAC therapy was used for local wound preconditioning and infection management. A continuous negative pressure of 125 mm Hg was applied on each wound. For final wound closure, a split-thickness skin graft was performed. The skin graft healing process was also supported by VAC therapy during the first 5 days. The VAC dressings were changed a mean average of 3 (range 1 to 4) times until split-thickness skin grafting could be performed. The mean total duration of the VAC therapy was 13.6 ± 5.9 days. The mean hospital stay was 31.2 ± 15.9 days. No complications with regard to bleeding, seroma, or hematoma formation beneath the skin graft were observed. At a mean follow-up duration of 29.9 (range 4 to 65) months, no re-infection or infection persistence was observed. The VAC device seems to be a valuable tool in the treatment of infected tendons. The generalization of these conclusions should await the results of future studies with larger patient series.

The ideal treatment after Achilles tendon rupture remains a controversial issue. Conservative management has been associated with a greater risk of repeat rupture compared with surgical treatment. However, recent reports have shown similar functional results between operative and nonoperative treatments (1–3). Surgical reconstruction offers, in most cases, the advantage of a lower rate of repeat rupture; however, surgery has been associated with a greater risk of wound healing complications and infections (4). In the past 20 years, the observed incidence of deep infections in association with Achilles tendon surgery has increased (5). The actual deep infection rate has been estimated to be 2% to 4%, with an overall wound healing complication rate of 7% to 13% (1,4,6). Although several therapeutic algorithms exist for the treatment of Achilles tendon ruptures, no exact guidelines are available for the management of postoperative infections. Multiple surgical revisions can result in a devastating clinical outcome (5,7). Hence, the need for new and effective management options is apparent.

The concept of negative pressure wound therapy was introduced in the late 1990s. (8) Since then, vacuum-assisted closure (VAC) therapy has been established as a valuable option in the treatment of difficult and infected wounds (9,10). Several advantages have been attributed to the system, such as accelerated formation of granulation tissue, elimination of interstitial edema, and bacterial clearance (11).

In the present retrospective study, we describe our experience with VAC therapy in the treatment of late deep infections after open Achilles tendon reconstruction.

Patients and Methods

Between January 2001 and December 2008, 6 consecutive patients (5 males, 1 female, mean age, 52.8 [range 37 to 66] years) with late deep infections after open Achilles tendon reconstruction (ICD codes M65.07 and M65.17) (Figs. 1 and 2) were treated by means of the negative pressure wound therapy (VAC®, KCI, Medizinprodukte GmbH, Wiesbaden, Germany). No patient had relevant comorbidities or risk factors (diabetes mellitus, tobacco use, vascular diseases, prior local steroid injection). Demographic and treatment data are summarized in the Table.

All surgeries were performed by 2 of the authors (J.K., K.A.). All patients were treated according to the following protocol: the tendon was exposed over its entire length, and each wound was meticulously debrided and cleaned under sterile conditions. All

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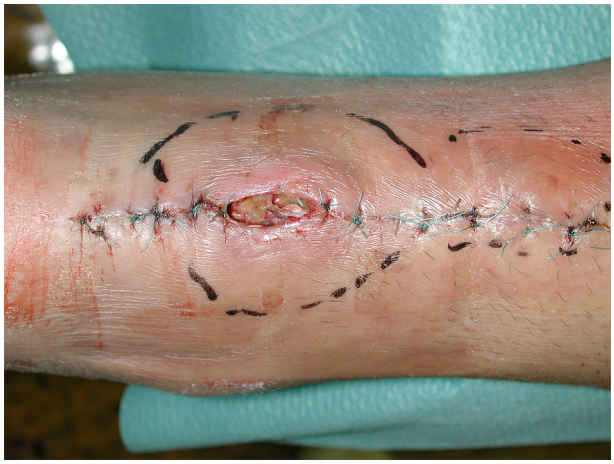

Fig. 1. Local findings at the site of late infection 2 years after open Achilles tendon reconstruction in a 57-year-old male patient.

infected, necrotic, and ischemic parts of the tendon and peritendineum were debrided. Each wound was cleansed with Ringer solution. After obtaining hemostasis, the VAC-foam was trimmed at the bedside to the appropriate size for each individual wound (Fig. 3). In all cases, the polyvinyl alcohol (PVA) sponges were used because they caused less pain and overgrowth of the granulation tissue formation beyond the wound margins on the intact skin areas in comparison with the polyurethane sponges. Each wound surface was covered with an adhesive drape approximately 4 to 5 cm beyond the margins of the wound to create an airtight seal. The Tracpad connector was centrally placed on each wound, after a hole of approximately 2-cm diameter was cut through the drape. The end of the evacuation tube was adjusted to the collection canister, and the negative atmospheric pressure was applied (125 mm Hg continuously).

Tissue and foam samples were sent for further microbiologic and histopathologic examination at each revision. All foam parts and tissue samples were cultured over a period of 7 days. Tissue samples were incubated on blood agar plates. The foam parts were incubated on blood agar plates and in tryptic soya broth (Becton-Dickinson, Heidelberg, Germany). All positive results received from our Microbiologic Institute indicated a microbial growth with $>10^5$ colony forming units (CFU)/mL. A further differentiation with an exact bacteria count is not routinely made in our hospital.

Postoperatively, the operated leg was immobilized in a dorsal cast in 20° plantarflexion until definitive wound closure was possible. The patients were mobilized on crutches with non-weightbearing on the extremity. A systemic antibiosis was administered according to the resistance profile of the particular organism for 6 weeks.

As soon as a sufficient formation of granulation tissue over the Achilles tendon occurred (Fig. 4), a split-thickness skin transplantation (factor 1.5, thickness 0.3 mm, donor area: ipsilateral thigh) was performed for definitive wound closure (Fig. 5). The skin graft was secured with a VAC-dressing (PVA, 125 mm Hg, intermittent) for the first 5 days. The choice for the intermittent pressure modus was made based on the enhanced formation of granulation tissue over the skin transplant (8, 19). After the wound had healed, the dorsal cast was replaced by a Vario-Stabil shoe (Orthotech, Gauting-Stockdorf, Germany) for another 4 weeks. A retrospective analysis of the patients' records was conducted with regard to the following parameters by one of the authors (P.M.): age, gender, causative organism, number of VAC®-dressings change, total length of the VAC-therapy, total length of hospital stay, type of antibiotic therapy, complications, follow-up, and clinical outcome at the latest follow-up.

Due to the study design no approval of the Institutional Review Board was necessary.

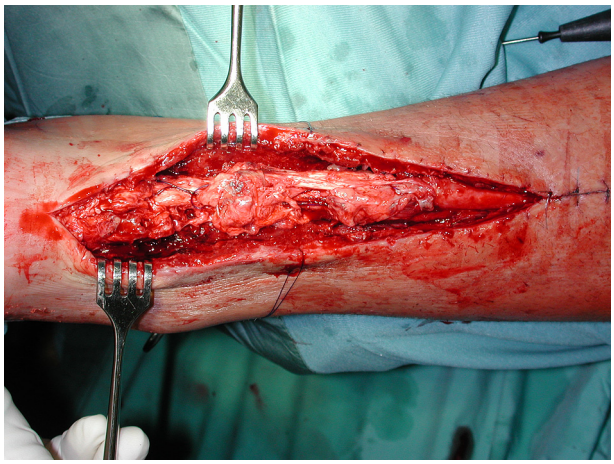

Fig. 2. Intraoperative findings indicating a distinct manifestation of the infection in all tissue layers.

Results

A statistical description of the case series is provided in the Table. At least 1 organism could be identified in the wound in 5 patients (83.33%). In 1 patient (16.67%), the microbiologic findings were negative; however, the histopathologic examination indicated the presence of acute infection and inflammation. Complete excision of the Achilles tendon was not necessary in any of the patients. The VAC dressings were changed a mean average of 3 (range 1 to 4) times until split-thickness skin grafting could be performed. Each VAC dressing was changed after a mean of 4.5 (range 2 to 7) days. The mean total duration of VAC therapy was 13.6 ± 5.9 days. The mean total hospital stay was 31.2 ± 15.9 days. At the latest revision, the microbiologic findings of the cultures from either the tissue or foam samples were negative in all cases. During VAC therapy, no device-related complications (blockage or breakage of the tubes or seals or leaks) were observed. After split-thickness skin grafting, no seroma or hematoma formation beneath the skin graft was seen in any patient. All skin grafts had healed after 14 days, and full weightbearing was achieved within 6 to 12 weeks after the end of therapy in all patients. Patient records only documented whether the skin grafts healed after 14 days but not the precise time it took in each case. Similarly, clinical examination took place after 6 and 12 weeks, and it was only documented that all patients achieved full weightbearing within this time but not the exact amount of time. At a mean follow-up period of 29.9 (range 4 to 65) months, no re-infection or infection persistence had been observed (Fig. 6). The Thompson test results were negative for all patients after surgical treatment. No patient reported local tenderness over the tendon at palpation. No patient required any walking aids at the latest follow-up visit. The range of motion was good (≥10° of dorsiflexion and 30° of plantar flexion) in all patients (Fig. 7).

Discussion

Infection after open Achilles tendon repair is a hazardous complication that can endanger the functional outcome. The present study has demonstrated that VAC therapy can be a valuable adjunct in the management of these infections. After changing the VAC dressings a mean of 3 times, a split-thickness skin graft could be performed for definitive wound closure. At a mean follow-up period of 29.9 months, no re-infection or infection persistence could be observed in any of our patients, with good functional results.

Although several well-planned studies or meta-analyses have been published about the treatment of Achilles tendon ruptures (1–4), the reported data on the management of infections are scarce. Several surgical options have been proposed, including local tendon transfer (12), local (13) and free flap coverage (14), and tendon resection without reconstruction (15). However, these surgical interventions are not always free of complications. Pajala et al (5) reported a high rate of tendon loss in a case series of 6 patients with deep infections after Achilles tendon reconstruction. Surgical management followed by split-thickness skin grafting failed primarily. Even after treatment with a muscle flap or a tendon graft, the occurrence of thrombosis complicated the treatment course. The functional outcome of the Achilles tendon has been worse in patients with infection than in those with repeat rupture (5).

In a retrospective analysis of 167 open Achilles tendon repairs, Bruggeman et al (16) sought to identify the specific risk factors