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Case report

The Role of Negative Pressure Wound Therapy in Patients with Kidney Transplantation

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ABSTRACT

Kidney transplantation is the best treatment modality for patients with end-stage renal disease. Wound healing is impaired in these patients, and factors such as immunosuppression, older age and comorbidities have a negative impact on wound healing. Recently, negative pressure wound therapy has become an important wound management technique. We present two patients with wound healing issues in the early posttransplant period. In both patients, an immunosuppressive treatment was administered, which included tacrolimus, mycophenolate mophetil and high-dose corticosteroids with anti-IL-2 induction therapy. Postoperatively, the wounds became inflamed with dehiscence. Negative pressure wound therapy was successfully applied to aid the wound healing. The treatment duration period was two weeks for one patient and three weeks for the other. After the treatment period, the wounds were significantly improved and were closed. After the secondary wound closures, the posttransplant course was uneventful in both patients. Presently, one and three years after the transplantations, both patients have well functioning kidneys. According to our limited experience, negative pressure wound therapy is a feasible and effective dehiscence wound treatment following kidney transplantation.

Key words: *negative pressure wound therapy, kidney transplantation, end-stage renal disease, postoperative complication, wound infection*

Introduction

Kidney transplantation is the best treatment modality for patients with end-stage renal disease (ESRD)[1]. Compared with patients on haemodialysis, transplanted patients have a better survival rate and quality of life. Still, transplantation is major surgical procedure with possible surgical and immunological complications. Delayed wound healing is a complication that causes significant morbidity and prolonged hospital stays.

The treatment of wounds with negative pressure was first described in 1993 by Fleischmann[2]. His group applied negative pressure on open fractures, which resulted in improved granulation tissue formation with no bone infections. Later, this therapy was used in the treatment of traumatic, acute and chronic wounds. Currently, negative pressure wound therapy (NPWT) is used in almost all fields of medicine and can be applied to nearly every body region[3]. The principles of this therapy are based on the application of uniform negative pressure, which helps draw wounds closed and removes infectious materials and interstitial fluid. This leads to tissue decompression, perfusion improvements and granulation tissue formation[4]. We present two kidney transplantation patients that were NPWT treated, beacuse of wound infections and dehiscence.

Case Report

A 48-year-old woman with ESRD was admitted to our hospital for a planned kidney transplantation. The cause of her ESRD was chronic glomerulonephritis. There was good human leukocyte antigen (HLA) match, with only two mis-matches. After transplantation (deceased donor), an immunosuppression therapy was started, which included tacrolimus, mycophenolate mofetil and high-dose corticosteroids. The sixth day after transplantation, the patient developed a deep wound infection with dehiscence that was associated with a copious discharge. Next, the wound was opened, debridement was performed, and the wound was prepared for NPWT. A porous sponge was

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fashioned to the specific size and shape of the wound and was situated within the wound. An evacuation tube was embedded in the sponge, thus ensuring an equal pressure distribution to all spaces within the system. The wound site was then covered with an adhesive drape, thereby converting the open wound into a controlled closed wound. An evacuation tube was connected to a canister where the effluent wound fluid was collected, and the latter was connected to an adjustable vacuum pump that generated negative pressure (usually 125 mmHg). The main unit delivered negative (subatmospheric) pressure to the wound site, which was applied by tubing that decompressed the foam dressing, continuously or intermittently. We started with the continuous mode and, after a few changes, switched to an intermittent mode (5 minutes on and 2 minutes off). The sponge was changed at the bedside every 72 hours, and the wound was reexamined. There was a progressive reduction in the wound size, and the development of healthy granulation tissue was evident. Additionally, a swab from the wound was taken and appropriate antibiotics were administered. Three weeks after the NPWT was started, a secondary closure was performed. Six weeks after the kidney transplantation, the patient developed hydronephrosis, which was caused by stenosis of a ureterovesical anastomosis. Antegrade dilatation of the stenosis failed; however, the patient was successfully treated with a Boari flap. Now, three years after the kidney transplantation, the kidney function is normal.

The second patient was a 61-year-old man. The cause of his renal insufficiency was granulomatous glomerulonephritis, which was caused by Wegener's granulomatosis. There was a good HLA match, with three mis-matches and immunosuppression therapy was started with tacrolimus, mycophenolate mofetil and high-dose corticosteroids. Because of a wound infection, we opened the wound and NPWT was administered. The procedure was identical to the first patient's, and two weeks later, the wound was secondarily closed. In the early postoperatively course, the patient developed complete urinary retention and a transurethral resection of the prostate was successfully conducted. The further postoperative clinical course was uneventful, and the transplanted kidney function was excellent one year after transplantation.

The University Hospital Rijeka ethics committee approved the patients medical record use, and informed consent was obtained from both patients.

Discussion

NPWT is a non-invasive, dynamic and unique system that helps to promote wound healing[5,6]. The two basic factors for wound dressing based wound healing are occlusion and absorption. Reepithelisation is faster with occlusive dressing compared with exposed wounds that are allowed to dry[7]. Excessive exudate causes skin maceration around the wound and allows bacterial growth, all of which impairs wound healing[8]. NPWT using the occlusion and absorption principles has beneficial wound healing effects. Moreover, the NPWT effects are a product of tissue strain, as well as reduced inflammation and bacterial load. Subatmospheric pressure induce microdeformations or tissue strain. The strain promotes cellular proliferation, growth factors elaboration and angiogenesis[9]. Additionally, NPWT reduces the amount of oedema fluid, proteolytic enzymes, acute phase proteins, metaloproteases, proinflammatory mediators and cytokines, and also increases blood flow in the tissue[10]. NPWT also reduces bacterial load in the wound, decreases interstitial fluid and improves the local blood flow[3].

Local infections, hypoxia, trauma, foreign bodies or systemic problems such as diabetes mellitus, malnutrition or immunodeficiency are most frequently responsible for delays in wound healing[3]. Before NPWT use, the wound must be cleaned of debris and necrotic tissue, with adequate wound bed preparation and patient comorbidity optimisation. NPWT complications include infections (which are related to the dressing piece retention in the wound), bleeding and even death (caused by bleeding from the exposed vessels)[3]. Careful patient selection and serious management with the NPWT materials are the best methods for complication prevention. The NPWT contraindications include exposed organs (as well as vessels and nerves), exposed anastomotic sites, malignancy (in the wound), untreated osteomyelitis, nonenteric and unexplored fistulas, necrotic tissue and active bleeding.

NPWT has become a mainstay treatment of acute and chronic wounds, such as chronic venous and diabetic foot ulcers, open fractures, pressure ulcers, infected sternal and mediastinal wounds, skin grafts and open abdomens[3,11,12]. After determining the need for NPWT, filter material type, wound contact layer and pressure levels still must be assessed. The filtering material that can be used (under occlusive dressing) includes black foam, white foam and gauze; however, there is no evidence indicating which one is best. The wound contact layer allows for easier removal of the filter material, which leads to less damage to the underlying structures (e.g., exposed bowel or mediastinal wounds). The accepted pressure for treating the wounds is 125 mmHg because this pressure best promotes granulation formation[13]. NPWT can be used with intermittent or continuous negative pressure.

Kidney transplantation procedured use immunosuppression therapies to prevent graft rejection. Some immunosuppressive drugs, such as corticosteroids and mTOR inhibitors, have a negative impact on wound healing. This results in prolonged hospitalisation and delayed recuperation. Despite improvements in the surgical techniques and antibiotic prophylaxis, improper wound healing is still a problem in transplanted patients[1].

Data regarding NPWT use in kidney transplantation patients are limited. Shreshta et al. reported 9 patients with wound dehiscence after kidney transplantation and treated them with NPWT[14]. The NPWT system was removed after a median of 9 days (range 3–30 days) and complete healing was achieved in all patients. The median hospital stay after the NPWT initiation was significantly shorter compared with conventional wound treatments. There were no noticeable complications related to wound

therapy. Heap et al. described two patients where NPWT was used to heal complex urinary fistula wounds following renal transplantation into an ileal conduit[15]. They used a negative pressure of 75 mm Hg instead of the standard 125 mm Hg. The authors finally stated that the use of NPWT might be very helpful in some selected urinary fistula cases. In contrast, Ortiz et al. reported that the use of NPWT slowed neocystoureterostomy healing, which perhaps lead to the development of a urine leak[16].

According to our limited NPWT assisted wound healing experience, reduced hospital stays and simplified wound management were observed in the transplanted patients. The device provided a sterile and closed drainage system and, in that way, reduced the possibility of infections which is a very important issue in immunosuppressed patients with immunosupression. A prospective study with more patients is needed to examine the usefulness of NPWT in this group of patients.

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ULOGA TERAPIJE NEGATIVNIM TLAKOM U LIJEČENJU RANA NAKON TRANSPLANTACIJE BUBREGA

SAŽETAK

Transplantacija bubrega je najbolja metoda liječenja bolesnika u završnom stadiju bubrežnoga zatajenja. U tih bolesnika postoji problem zaraštavanja rane, a čimbenici kao što su imunosupresija, starija dob i popratna oboljenja imaju negativni učinak na cijeljenje rana. Terapija s negativnim tlakom je novija metoda liječenja koja pomaže cijeljenju rana. Prikazujemo dva bolesnika koji su imali problem s cijeljenjem rane u ranom razdoblju nakon transplantacije bubrega. Primjenjena imunosupresivna terapija se sastojala od takrolimusa, mikofenolat-mofetila, visokih doza kortikosteroida uz anti-IL-2 indukcijsku terapiju. Postoperativno je došlo do upale rane s dehiscijencijom. Kod bolesnika je uspješno primjenjena terapija s negativnim tlakom kroz dva odnosno tri tjedna. S obzirom na znatno poboljšanje rane korištenjem negativnoga tlaka ista je sekundarno zatvorena. Kasniji posttransplantacijski tijek je bio uredan. Danas, jednu i tri godine nakon transplantacije bubrega oba pacijenta imaju dobro funkcionirajući bubreg. Terapija negativnim tlakom je, prema našem ograničenom iskustvu, efikasna metoda u liječenju rana s dehiscijencijom nakon transplantacije bubrega.