

Treatment of early chronic infections with tumor prosthesis by intermittent negative pressure wound therapy with instillation

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ABSTRACT

Introduction: Vacuum-assisted closure (VAC) has been used to manage nearly every type of wound seen in orthopedic field including early prosthetic hip and knee infections. In this study, we aimed to present our treatment results of two patients with total and proximal femoral mega prosthesis respectively. **Case Series:** With the diagnosis of periprosthetic infection, in both cases, prosthesis were disassembled and sterilized in autoclave. Prosthesis were reimplanted after sterilization and Vacuum Assisted Closure system with instillation. **Patients were successfully treated and no signs of infection were detected until ten to twelve months postoperatively.** **Conclusion:** Mega prosthetic infections pose a great challenge

to an orthopedic surgeon and the patient. Besides its economic cost, it causes significant morbidity to the patient. Intermittent negative pressure wound therapy with instillation may be promising technique for the treatment of devastating infections associated with tumor prosthesis.

Keywords: Infection, Instillation, Megaprosthesis, Vacuum assisted closure

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INTRODUCTION

Vacuum-assisted closure (VAC) has been used to manage nearly every type of wound seen in orthopedic field including early prosthetic hip and knee infections. Topical usage of prolonged negative pressure to promote healing of wounded tissue was first described by Fleischmann [1]. VAC uses negative pressure to remove excess fluid, debris and enhances tissue perfusion with granulation tissue formation. However, it is not clear if it has a positive effect in lowering bacterial bio-burden in infected wounds which leads to the innovation of VAC instill and VAC therapy with silver-coated foam. Megaprotheses are used in selected patients with bone

tumors and can be defined as special bone and joint prosthesis which help to compensate large bone defects as a result of bone stock loss like in malignant bone tumors.

Although Lehner and Bernd reported good outcome with VAC instill therapy for an early chronic periprosthetic hip and knee infections, there have been no literature about the VAC instill therapy for the treatment of early chronic infections of mega prosthesis [2].

In this study, we aimed to present our treatment results of two patients with total and proximal femur mega prosthesis respectively.

CASE REPORT

Case 1

The patient was 41-year-old, male with a diagnosis of giant chondrosarcoma of the pelvis and femur. He had undergone a hemiarthroplasty of his right hip due to a low energy trauma three years ago in another orthopedics and traumatology center which we presumed to be due to a pathological fracture. He had enlarging gluteal and thigh mass since then and was referred to us with the diagnosis of possible malignant bone tumor. His MRI of the pelvis and thigh revealed a lobular, heterogenic and hypo intense huge mass starting from the trochanteric area to the shaft of the femur in T1 weighted images. His biopsy revealed chondrosarcoma and limb sparing surgery but with the possibility of external hemipelvectomy was offered to the patient, whom then lost to follow up. Later, he presented to us with a pathological femur fracture and total femoral reconstruction with total femur tumor prosthesis and pelvic reconstruction using ice-cone prosthesis was done after total femur resection and internal hemipelvectomy.

The patient was doing well until he presented with a fistula at his distal thigh after six months postoperatively. His culture revealed *Acinetobacter baumannii*. Her CRP level was 23 mg/dL (normal value is less than 1) and ESR was 82 mm/h. He was operated on with the diagnosis of periprosthetic infection. The total femoral mega prosthesis was completely disassembled and extensive debridement with polyethylene liner changing was done. After re-sterilization of the whole femoral prosthesis in a sterilization unit, it was re-implanted. However drainage persisted one week after the procedure. Then, he was operated again with changing polyethylene liners and re-sterilization of the femoral component. But this time VAC instill (VAC Instill®, Therapy system-KCI Medical, San Antonio, Texas, USA) therapy had been started (Figure 1).

A negative pressure of 200 mmHg was applied for two days and then the pressure was decreased to 125 mmHg with 12 cycles of instillation per day (dwell time: 30 minutes) using polyhexanide biguanide (PHMB + Betaine) wound irrigation solution [Prontosan® B. Braun Medical, Melsungen, Germany]. One week later, drained fluid was serous in nature and the sponges were removed

under general anesthesia with additional debridement and new sponges were put in. The wound was clean and well granulated (Figure 2). The cultures of the sponges were negative. At the following week, his sponges were removed again and the week after primary closure was done. His inflammatory markers decreased to normal values {C-reactive protein (CRP) was 0,6mg/dL and erythrocyte sedimentation rate (ESR) was 15mm/h}. He is well 12 months of postoperatively with no signs of infection.



Figure 1: Intraoperative appearance of the 41 year old male patient's leg with VAC instillation application.



Figure 2: Clinical appearance of the 41-year-old, after cessation of VAC therapy prior to closure.

Case 2

The patient was 72-year-old woman with the diagnosis of chondrosarcoma of proximal femur. She had a fracture of her right proximal femur after a fall and a proximal femoral nail was applied in another clinics. However, her pain increased gradually and her fracture did not heal six months after the operation with no signs of infection. So they had planned a revision operation

during which they recognized pathological tissues which was consistent with chondrosarcoma as shown by pathology results. Afterwards, she had been referred to our clinic. Her MRI of the femur revealed a hypo intense and heterogenic lesion in T1 and lobular hyper intense lesions in T2 weighted images. The patient was operated with wide resection and removal of the proximal femur including the diaphysis and implantation of proximal femur mega prosthesis. She was lost to follow up after the operation; and she returned to our clinic three months postoperatively with the symptoms of intense pain and swelling of the thigh and high fever. Her CRP level was 17mg/dL (normal value is less than 1) and ESR was 90 mm/h. An aspiration of the thigh revealed purulent fluid and her culture displayed methicillin resistant staphylococcus aureus (MRSA) proliferation. She was operated with the aim of eradication of infection without removal of femoral prosthesis. The proximal femoral prosthesis was completely disassembled and extensive debridement was done following reesterilization of the prosthesis in sterilization unit. The prosthesis was subsequently reimplanted. Additionally VAC instillation therapy was started (VAC Instill®, Therapy system-KCI Medical, San Antonio, Texas, USA) (Figures 3 and 4).

A negative pressure of 200 mmHg was applied for two days and then the pressure was decreased to 125 mmHg with 12 cycles of instillation per day (dwell time: 30 minutes) using polyhexanide biguanide (PHMB + Betaine) wound irrigation solution [Prontosan ® B.Braun Medical, Melsungen, Germany]. One week later, the drained fluid was still not serous in nature and the sponges were removed under general anesthesia with debridement and the new sponges were put in. The following week the drained fluid returned to serous nature and the sponges were changed again. At the following week, primary closure was done. Patient's CRP and ESR levels also decreased to normal values (CRP was 0,8mg/dL and ESR was 18mm/h). She is well with no signs of infection with 10 months postoperatively.



Figure 3: Intraoperative appearance of the 72 year old female patient with infected proximal femur tumor prosthesis prior to VAC instillation therapy application.



Figure 4: VAC instillation therapy application after debridement of the wound and sterilization of tumor prosthesis in 72-year-old patient.

DISCUSSION

Limb salvage surgery with endoprosthesis replacement is the most common reconstruction for patients with sarcoma. The infection rate is high compared to conventional knee and hip arthroplasty, which has been reported to be between 0.2% and 4% [3]. Periprosthetic infections remain the main complications of arthroplasty. Racano et al reported that the risk of postoperative infections for limb salvage surgery with endoprosthesis replacement was approximately 10% [4]. In early infections, the implant can often be left in place with radical debridement and polyethylene replacement until 4 weeks after the operation. However, in late infections, in addition to radical debridement all prostheses must be revised to eradicate infection by either one- or usually two-stage revision. However, this results in significant economic costs and patient morbidity [5].

The current literature tends to support a two-stage revision as the definitive treatment for established prosthetic infection. The successful eradication of a total joint replacement infection with a two-stage re-implantation protocol is over 90%, while the success rate with a one-stage protocol is approximately 80% [6].

In these two cases, prosthesis were sterilized into autoclave and reimplanted again. Although autoclaved tumor bone for reconstruction is a known technique in tumor surgery [7, 8], to the best of our knowledge this method has not been reported before in infected tumor prosthesis surgery.

Reviews of the literature have shown a proteoglycan-containing biofilm covers the implant and acts as a barrier for the pathogens to protect them from host anti-inflammatory responses [9, 10]. Complete eradication of the pathogen is impossible in most cases, because many antibiotics administered intravenously cannot penetrate this biofilm [10]. When used for bone fixation, the

implants are needed only temporarily and can be removed when the fracture is healed, but in prosthetic operations this couldn't be possible. Vacuum-assisted closure (VAC) has been used to treat for these types of infections in orthopaedic surgery including early prosthetic hip and knee infections [1]. VAC-Instill therapy is a combination of traditional negative pressure wound therapy and intermittent instillation of a topical wound treatment solution [2]. It is composed of three phases: instillation of saline, local antiseptics, or antibiotics followed by a delay to allow the solution to soak and finally the application of negative pressure to the wound for the suction of fluids and debris.

Different antiseptic solutions for wound irrigation (eg, polyhexamine bigluconate [PHMB], saline, or antibiotics) can be considered. Relevant evidence regarding dwell time, the level of negative pressure, and the frequency of the instillation is not described in the literature. We chose polyhexanide biguanide (PHMB + Betaine) as the wound irrigation solution. An in vitro study by Ikeda et al showed an advantage to using PHMB for the treatment of soft-tissue injuries without bone involvement compared to povidone-iodine and silver nitrate [11]. The use of a PHMB solution is advised when treating infections similar to those described in this study [12, 13]. A small in vitro study showed wound dressings combined with PHMB lowered bacterial activity in 32% of the tested samples [13]. The successful use of intermittent NPWTi for early acute and early chronic periprosthetic infections has also been reported. Lehner and Bernd reported the successful treatment of knee and hip periprosthetic infections with intermittent NPWTi [2]. Instillation of antibiotics and local antiseptics to the wound bed and intermittent negative pressure acting together may enhance distorted vascularization and oxygenation of the infeced soft tissue with the possible contribution to eradication of bacterial biofilm.

CONCLUSION

Mega prosthetic infections pose a great challenge to an orthopedic surgeon and the patient. Besides its economic cost, it causes significant morbidity to the patient. Intermittent negative pressure wound therapy with instillation may be promising technique for the treatment of devastating infections associated with tumor prosthesis. However further studies are needed.

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Author Contributions

Yalçın Turhan – Substantial contributions to conception and design, Acquisition of data, Drafting the article, Revising it critically for important intellectual content, Final approval of the version to be published
 Korhan Özkan – Substantial contributions to conception and design, Analysis and interpretation of data, Drafting the article, Final approval of the version to be published
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Guarantor of Submission

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Consent Statement

Written informed consent was obtained from the patient for publication of this case series.

Conflict of Interest

Authors declare no conflict of interest.

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