The Use of V.A.C. Instill in the Wounded Pediatric Population

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Abstract: V.A.C. Instill® Therapy Unit (Kinetic Concepts, Inc. [KCI], San Antonio, TX) incorporates negative pressure wound therapy (NPWT) with intermittent automated wound irrigation. The following case describes a 2-year-old male with right thigh compartment syndrome from an acutely developing hematoma. Devascularization of the overlying skin led to full-thickness skin necrosis of the anterolateral and posterior right thigh. Following emergent evacuation and a lateral fasciotomy, necrotic skin was excised and nonviable subcutaneous fat was debrided. Wound care included NPWT with the V.A.C. Instill Therapy Unit. Definitive coverage was achieved with a split-thickness skin graft, which took completely without surgical complications at the patient’s 4-month follow up.

V.A.C.® Therapy was designed to provide an occlusive, moist, negative pressure wound environment.¹,² Over the years, the benefits of this negative pressure wound therapy (NPWT) have been elucidated by various studies. These benefits include the removal of accumulating interstitial fluid,³ increasing oxygen tension in the wound,⁴ matrix proliferation through the mechanical stress that negative pressure puts on cytoskeleton elements,⁵,⁶ increased blood flow,⁷–⁹ and increased granulation tissue proliferation.¹⁰–¹⁷ The fact that the therapy system has been shown to reduce wound size more rapidly compared to standard moist wound care¹⁸–²¹ is of great importance. First introduced in 2004,²²,²³ the V.A.C. Instill® Therapy Unit incorporates NPWT with intermittent automated instillation of wound irrigation. Irrigation fluids range from Dakin’s solution to ones containing antibiotic agents. A review of the literature demonstrated that the use of the Instill unit only has been reported in the adult patient population. We report a case whereby the Instill unit was successfully utilized as part of the comprehensive surgical management of a complex lower extremity wound in a pediatric patient.

Case Report

A 23-month-old male presented with right thigh compartment syndrome secondary to an acutely developing hematoma in the context of a long-
standing history of a consumptive coagulopathy of unclear etiology. The patient underwent emergent evacuation of the right thigh hematoma along and fasciotomy by orthopedic surgery for increased anterior compartment pressures of 36 mmHg. The lateral fasciotomy indicated an increased anterior compartment pressure of 36 mmHg. Prior to presentation to the hospital the hematoma had been present for over 48 hours. Devascularization of the overlying skin ensued and the patient demonstrated full-thickness skin necrosis of the anterolateral and posterior regions of the right thigh, totaling 300 cm² (Figure 1A).

Plastic surgery was consulted for complex wound management. The patient required full-thickness excision of the necrotic skin as well as partial-thickness debridement of nonviable subcutaneous fat (Figures 1B and 1C). Multiple operative debridements followed to ensure complete removal of devitalized and infected tissue. Culture directed antimicrobial therapy was started for Stenotrophomonas maltophilia, Escherichia coli, and Enterococcus faecalis, which were cultured from wound tissue. Our comprehensive approach to wound care also included optimization of nutrition with supplemental enteral feeding, hyperbaric oxygen therapy (HBOT), and NPWT initially with the V.A.C. and subsequently with the Instill unit, which was set to a 2-hour interval with 10 seconds of instill and 5 minutes of hold. V.A.C. dressing changes required the use of anesthesia due to the patient’s age and relatively large size wound. The patient’s prolonged hospital course was complicated by persistent coagulopathy that required continuous fresh frozen plasma (FFP) transfusion. To limit the number of

Figure 1. A) Initial presentation of patient. B) Surgical excision of necrotic tissues. C) Final result of the surgical excision.

Figure 2. A) Anterior view. B) Lateral view. C) Posterior views of reconstruction 4 months after split-thickness skin grafting.
operative procedures and therefore total anesthesia in addition to the associated risks and the frequency of dressing changes, the Instill unit was initiated. The Instill unit with 0.25% strength Dakin’s Solution irrigation was used. With improved granulation tissue formation at the wound bed and complete removal of devitalized tissue, the patient ultimately underwent definitive wound coverage with a split-thickness skin graft harvested from the contralateral thigh. V.A.C. dressing was also used to bolster the skin graft for 7 days on continuous negative pressure of 125 mmHg. Mepitel silicone sheeting (Mölnlycke, Norcross, GA) was placed between the skin graft and the GranuFoam. There was 100% take of the graft and no surgical complications at the patient’s 4-month follow-up visit (Figures 2A, B, and C).

Discussion

It is in the greatest interest of the patient and the physician to take efforts to reduce the number of operations that pediatric patients must experience. The use of the Instill unit in the wounded pediatric patient has great potential in reducing the frequency of operations while not compromising the quality of wound care. The standard V.A.C. dressing change frequency is every 48 to 72 hours. While providing negative pressure, intermittent irrigation of the wound bed with antiseptic solution and maintaining a moist wound healing environment, the Instill unit allowed for less frequent dressing changes and less total anesthesia, as the Instill unit required changing only once per week. Although these once per week dressing changes are not in strict accordance with the KCI clinical guidelines, our clinical experience with the Instill unit in adults demonstrated that patients tolerate less frequent dressing changes without complication or impediment to wound healing. Furthermore, each of these dressing changes would likely require the extensive use of sedatives, analgesics, or anesthesia, themselves associated with morbidity. Use of the Instill unit decreased dressing change frequency and total exposure to anesthesia. It also decreased time and burden on nursing services and operating room facility use. The positive effects of the Instill unit on the wound itself are notable. The negative pressure environment that V.A.C. creates for the wounds has been shown to increase oxygen tension in the wound, increase the rate of formation of granulation tissue, increase overall blood flow, and decrease interstitial fluid accumulation and maintenance of a moist wound environment. The final result is faster wound healing. Unique to the Instill unit is its ability to continuously irrigate the wound with fresh solution. We speculate that this special feature actually helps to debride the wound, a finding which has been observed by Gabriel et al. This “hydrodebridement,” plays a key role in decreasing the formation of glycocalyx, a extracellular polymeric material that allows for the adherence of bacteria to wound surfaces and can only be removed through the forces of debridement.

This patient received diluted Dakin’s solution for his wound irrigation solution (0.25% sodium hypochlorite). However, a variety of irrigation solutions are available, including antibiotic-laced solutions, which may be invaluable in the therapy of an infected wound. Many types of irrigation solutions can be used in the adult patient population with the Instill. While we commonly use Sulfamylon, in the present case the patient had a complex bleeding disorder, which is a contraindication for the use of Sulfamylon due to concern of rare instances of coagulopathy associated with its use. Dakin’s solution (0.25% strength) was selected as an alternative. Gabriel et al. observed that the Instill unit allowed surgeons to perform less complex reconstructive procedures for major soft tissue defects while reducing donor site morbidity and decreasing anesthesia time. Wolvos et al. found that instillation of wounds with a solution mixture of lidocaine and an antimicrobial through the V.A.C. Instill system was able to help control both infection and pain.

Conclusion

Pediatric patients suffering from severe wounds represent an especially vulnerable patient population. Morbidity associated with frequent operative procedures for wound excisions, irrigation, debridement, and ultimately definitive wound coverage all contribute to wound care challenges. Reducing the number of operations that a pediatric patient must undergo reduces the anxiety that the patient and family experience during their hospital stay and reduces their exposure to anesthetic. The use of V.A.C. Instill may help to achieve this particular alternative. Although future studies are needed to investigate the outcomes of the use of the Instill in the pediatric patient population, the use of this particular NPWT system was a successful adjunct in wound management in this case.

References


