Incisional Negative Pressure Wound Therapy: Its Role in the Diabetic Foot

Justin P. Kaminski, D.P.M., Alison M. Migonis, D.P.M., Kevin L. Riemer D.P.M., AACFAS, Barry I. Rosenblum D.P.M., FACFAS

Pre-operative

Case Report

We present 3 patients with history of diabetes and peripheral vascular disease with chronic non-healing foot ulcerations. Patients ages ranged between 52-68. All patients underwent multiple failed debridement of their ulcerations and elected to undergo debridement and closure or amputation.

Post-operative

The patients all had iNPWT applied intraoperatively. iNPWT was left in place for 1 week and patients were made strict non-weight bearing. All patients’ incisions healed with no subsequent breakdown: noted at a minimum of 11 months post-operatively.

Analysis & Discussion

Wound complications following surgery remains an unfortunate outcome. Incisional negative pressure wound therapy has become a viable option for treating high risk incisions. Foot and ankle surgeons are constantly looking for innovative ways to reduce dehiscence and wound complications on high risk patients. Studies have shown the effectiveness of incisional negative pressure wound therapy in reducing incidence of infection and seroma as well as increasing strength and apposition of incisions.

While there is limited literature regarding the use of iNPWT in foot and ankle surgery, there is ample evidence to support its use elsewhere in the body. As studies become available, it becomes clear that iNPWT may play a significant role in reducing wound dehiscence complications in high risk incisions in the foot and ankle. Incisional negative pressure wound therapy has the potential of reducing the incidence of surgical site dehiscence and infections, which can be catastrophic for the high risk patient.

At our institution, we have found promising results for the use of incisional-negative pressure wound therapy to aid in the healing high risk incisions within the foot and ankle. This is a treatment modality that should be considered in our high risk patient population. Still more studies are needed addressing this modality to confirm its benefits in lower extremity surgery.

References


Statement of Purpose

Surgical site infections lead to increased morbidity, mortality, length of stay and health care costs. Diabetes, especially when complicated by neuropathy and peripheral vascular disease, is a known contributing factor that increases the risk of postoperative wound healing complications and infection. We present our experience with incisional negative pressure wound therapy (iNPWT) for high risk incisions in patients with diabetes, neuropathy and arterial insufficiency.

Literature Review

Complication rates with lower extremity surgery vary throughout literature. Dehiscence with free flap surgery has been reported by Donker et al et al 1984. The characteristics of a patient having diabetes mellitus and age greater than 80 were significantly associated with increased rates of dehiscence. Pre or post amputation antibiotic administration was not found to influence stump infection or dehiscence (9).

Mueeller et al reports complication rates following transmetatarsal amputation including skin breakdown in 27% of patients, with 48% occurring in the first 3 months (6). Pollard et al observed wound dehiscence in 50/101 of patients undergoing a TMA. Of these patients, 55% went on to heal the stump and 33% had chronic stump breakdown. Post op wounds were noted in 19 out of the 101 patient and were successfully treated with oral antibiotics and local wound care (1).

Recent studies have shown multiple benefits to using negative pressure wound therapy to aid in wound management. Dragu et al investigated the use of iNPWT on abdominal incisions. In comparison of NPWT vs conventional dressing, the iNPWT group was shown to have reduced serious drainage and exudate reducing the time needed for a drain to be in place and subsequently reducing the length of hospitalization.

Serous drainage and exudate reducing the time needed for a drain to be in place and subsequently reducing the length of hospitalization. They also found a decreased incidence of seroma and hematoma formation with the iNPWT group (2).

Stannard et al looked at calcaneal, pilon, and tibial plateau fractures and the use of iNPWT. These injuries are associated with high infection rates, and wound dehiscence. Compared to patients in the control group, patients in the iNPWT group experienced a 1.9% lower infection rate and a lower incidence of dehiscence (3).

Wilkens et al concluded that the use of iNPWT reduced tension on the tissue as well as reduced associated appositional forces on the incision. Wilkens et al also concluded that the force to disrupt an incision was increased by about 50% with use of iNPWT (7).

A study performed by Kalpak et al, compared closed incision with application of iNPWT to closed incision with absorbant pads. Forty days post incision, they obtained a biopsy to the incision site. It was found that the incision with the iNPWT had narrower scar area of the deep dermis compared to the abdominal pad group as well as higher mechanical properties in the iNPWT group. They concluded that iNPWT on a closed incision improves wound healing via better apposition of the incision site (5).

Horch et al found that both blood flow and oxygen saturation levels were increased with iNPWT (6). Atkins et al in 2011 found that perfusion increased among the patients who underwent negative pressure therapy and decreased among the controls (2).

Figure 1A: Patient 1 pre-op with gangrenous hallux, 4th, and 5th toes

Figure 1B: TMA performed

Figure 1C: Application of iNPWT

Figure 1D: Incision remains healed 11 months post-op

Figure 2A: Patient 2 pre-op with chronic ulcer to prior TMA stump

Figure 2B: Excision of ulcer and reaction of bone with closure of wound

Figure 2C: Application of iNPWT

Figure 2D: Incision remains healed 12 months post op

Figure 3A: Patient 3 pre-op with open hallux amputation due osteomyelitis

Figure 3B: Pre-op chronic planar 4th metatarsal head ulcer with osteomyelitis

Figure 3C: TMA performed with application of iNPWT

Figure 3D: Incision remains healed 17 months post-op

Figure 3E: Pre-op chronic plantar ulcer with osteomyelitis

Figure 3F: TMA performed with application of iNPWT

Figure 3G: Incision remains healed 17 months post-op

Figure 3H: Pre-op chronic plantar ulcer with osteomyelitis

Figure 3I: TMA performed with application of iNPWT

Figure 3J: Incision remains healed 17 months post-op