VAC therapy and the post-surgical diabetic foot wound: Clinical experience

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Article points

1. Topical negative pressure has emerged as a management option for complex post-surgical wounds of the diabetic foot.
2. Within a short period of time, the central Cornwall diabetic foot clinic was able to demonstrate the benefit of VAC among individuals who have undergone surgery on a diabetes-related foot wound and as a result it is now a first-line treatment where there is a significant tissue deficit or exposed structures
3. VAC therapy is cost effective in terms of reducing: episodes of care, risk of further surgery and length of hospital stay.

Key words

- Topical negative pressure
- Vacuum-assisted closure
- Wound management

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Vacuum-assisted closure (VAC) is one of many treatment modalities, such as moist wound healing and topical medications, suitable for treating a range of post-surgical diabetic foot wounds. This article looks at a diabetic foot centre in Cornwall and the impact that the utilisation of VAC therapy has had on outpatients who have undergone diabetes-related foot surgery.

The worldwide incidence of diabetes is increasing year on year, contributing a significant burden on health and social service providers: the diabetes NSF attributes 5% of the total NHS budget and 10% of hospital inpatient resources to the care of the population with diabetes in the UK (DoH, 2003). As a result of delayed healing, high probability for amputation and disability, the diabetic foot ulcer has been cited as the most costly complication of diabetes and, as such, is a major burden on the health community (Apelqvist et al, 1994; Apelqvist, 1998; Dunn, 2007).

Central Cornwall diabetic foot clinic

To ensure the optimal management of people with acute diabetic foot problems in central Cornwall, a two-chair podiatry-led diabetic foot clinic was opened at the Royal Cornwall Hospital, Treliske, Cornwall, in January 2007. The clinic, open 5 days a week, is operated by two band-7 podiatrists and a band-3 podiatry assistant. Clinicians are able to call upon the expertise of physicians, vascular surgeons, specialist nurses, an orthotist, therapy teams and the vascular studies department.

The clinic aims to provide prompt and appropriate interventions for the promotion of wound healing and a reduction in the number of amputations. Current activity includes inpatient and outpatient care of people who have diabetes plus acute foot problems.

VAC therapy and the post-surgical diabetic foot wound

Topical negative pressure is indicated as an effective adjunctive therapy in the care of post-operative wounds and has emerged as a management option for complex post-surgical wounds of the diabetic foot (Armstrong et al, 2005; Edmonds and Foster 2005).

A literature search identified a pilot trial undertaken by McCallon et al (2000) dedicated to the post-surgical diabetic foot; a large, randomised, controlled trial undertaken by Armstrong et al in 2005 to determine whether VAC is clinically efficacious in treating open amputation wounds of the diabetic foot; and a retrospective study by Mendonca et al (2005) that included post-surgical diabetic foot wounds and a

number of case studies. The post-surgical diabetic foot was included in a number of other studies, but specific data could not be extrapolated.

Despite the complex nature of the post-surgical diabetic foot wound, the studies identified demonstrate an increase in rate of wound healing, a reduction in the time to complete wound closure and a trend towards a reduction in the need for further surgery. While the number of studies is small, the results would suggest that the use of VAC therapy in the post-surgical diabetic foot wound is of benefit to the individual with regard to reduced treatment period.

Clinical experience

Interest in topical negative pressure as an adjunctive therapy in the care of the post-surgical diabetic foot wound developed in the Central Cornwall diabetic foot clinic as a result of the research undertaken by Armstrong et al (2005). Supported by the local KCI clinical education specialists, VAC therapy was incorporated into the clinic's arsenal of management options for the post-surgical diabetic foot wound. Within a short period of time, the clinic was able to demonstrate the benefit of VAC in this patient group, in terms of: time to 100% granulation tissue formation; decrease in wound dimensions; foot salvage; and patient acceptance. With a demonstration of potential cost savings, a funding pathway was developed for podiatry outpatient VAC therapy.

Figure 1. Post-operative dorsal wound with exposed tendon and joint capsule.

Figure 2. Coverage of structures exposed by surgery at day 21.

Figure 3. Epithelialised wound suitable for a simple foam dressing.

Case report 1

Mr P is a 54-year-old with type 1 diabetes, significant peripheral neuropathy and Charcot neuroarthropathy. In May 2007, ten days after an elective bumpectomy to remove a plantar rocker deformity, Mr P presented with a spreading foot infection and tense abscess over the dorsal aspect of the third and fourth metatarsophalangeal joints. After admission to hospital for intravenous antibiotics, his abscess was surgically debrided.

Twenty-four hours post-op, Mr P was referred to the diabetic foot clinic for long-term management. On examination, the dorsal wound was deep, irregular and undermining, with exposed tendon and joint capsule, measuring 3.5 cm by 3.0 cm and 1.7 cm deep (*Figure 1*).

VAC therapy was initiated to promote rapid granulation over the exposed structures. In this case, the following were used: a primary dressing to protect exposed structures; VAC Vers-foam due to undermining; and a negative pressure of -150 mmHg. When the wound bed levelled, Granufoam was used at -125 mmHg.

Coverage of exposed structures was achieved by day 21 (*Figure 2*). Reduction in wound dimensions occurred throughout the 8 weeks of VAC therapy, with an overall reduction in size of 1.0 cm, 0.9 cm and depth by 1.7 cm to lie flush with surrounding tissue.

Following VAC therapy the wound was dressed with a simple foam dressing and continued to epithelialise (*Figure 3*).

In the author's opinion, while alternative treatment options – such as moist wound healing – could have achieved the same goal, the high levels of exudate would have required daily dressing changes, the risk of infection would have been greater and the desired outcome would have taken longer to achieve.

Case report 2

Mr M is a 66-year-old male with type 2 diabetes plus a history of smoking. A recently retired hotelier, Mr M experienced no ill health prior to a diagnosis of type 2 diabetes in December 2006. In January 2007, following a 1-month episode of digital gangrene and rest pain, a fifth toe with partial fifth metatarsal amputation and revascularisation procedure was performed.

In May 2007, Mr M presented to the Central Cornwall diabetic foot clinic with a necrotic amputation site and increasing pain. Following a femoral-popliteal bypass, Mr M was transferred back to the foot clinic for long-term management. At this point in time it was decided not to surgically debride the lateral foot, but to wait and see how it reacted to increased blood flow.

VAC therapy was chosen for its ability to encourage angiogenesis and thereby increase nutrition and oxygen to the wound bed. The initial wound measured 6.0 cm by 5.5 cm, was 0.3 cm deep and covered with 100% necrosis and slough (*Figure 4*). VAC therapy was used in combination with sharp debridement, offloading footwear and advice to decrease activity levels and weight bearing.

A steady increase in percentage granulation tissue coverage was noted, with 50% granulation at day 19 (*Figure 5*) and 100% at day 38. Applied for a total period of 6 weeks, the overall wound dimensions decreased by 2.6 cm, 2.3 cm

and the depth by 0.3 cm, to lie flush with surrounding tissue (*Figure 6*).

The diagnosis of diabetes and quick succession of vascular problems resulting in a minor amputation had a profound effect upon Mr M, who was fearful of the future and experienced bouts of depression during the healing process. When the VAC therapy was later discussed, both Mr M and his wife highlighted the sense of hope they felt at each dressing change as tangible differences in colour and size were observed.

Discussion

Observed benefits and outcomes

A proportion of the individuals referred to the Central Cornwall diabetic foot clinic have undergone minor or partial foot amputation, incision and drainage, and surgical debridement or surgical foot reconstruction. Over the last 8 months, 21 outpatients attending the diabetic foot clinic have been managed with VAC therapy:

- Sixteen individuals with minor or partial foot amputation received outpatient VAC therapy in combination with debridement and offloading. Of these, 12 have reached ≥2 month post-VAC follow up and 11 of the 12 are making good progress or are healed. The twelfth individual went on to a below-knee amputation due to severe ischaemia and non-healing.
- Five individuals received VAC therapy following other surgical intervention and all are progressing well or healed.

Two of the partial-foot amputees had been told that a failure to heal would result in major amputation due to the amount of tissue already lost and structural instability. In these cases, major amputation was avoided and foot stability restored within adapted footwear.

While these results do not form part of a research project, it could be suggested that such outcomes are comparable to the reduced risk of further surgery and high proportion of healed or healing wounds noted in the prospective studies undertaken by McCallon et al (2000) and Armstrong et al (2005).

Patient quality of life

The VAC Freedom unit allows the individuals the independence to continue with normal activities, facilitating a decrease in dependence on others, reducing social isolation and maintaining the individual's position and status within the family and wider community,

Problems with unpleasant odour and strike-through are, to a greater extent, prevented within this closed system, providing the individual with the confidence and security to socialise and resume a normal lifestyle.

Cost effectiveness

In the modern health service, where opportunity exceeds the limit of budgetary constraints, providers of wound care must make decisions based on a ratio of the cost of an intervention to a measure of its clinical effect (Bolton et al, 1996; Donaldson et al, 2002; Kernick, 2003).

VAC therapy has the potential to reduce episodes of care, risk of further surgery and length of hospital stay. Such a strategy must, therefore, be seen as a cost-effective intervention in the care of high-risk individuals with diabetes who have undergone foot surgery.

Conclusion

The post-surgical diabetic foot wound is complex and challenging. VAC therapy provides a means of optimising the potential for healing, thereby reducing the treatment period, improving the patient experience and reducing the overall cost of procedures.

Within the Central Cornwall diabetic foot clinic, VAC therapy – in conjunction with sharp debridement, skin care and offloading measures – has been adopted as a first-line treatment for the diabetic post-surgical foot where there is a significant tissue deficit or exposed structures. ■

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Figure 4. Initial wound with necrosis and slough.

Figure 5. Granulation tissue coverage at 50% by day 19.

Figure 6. Wound after 6 weeks, lying flush with surrounding tissue.