

Preventive incisional negative pressure wound therapy (Prevena[®]) for an at-risk-surgical closure in a female Rottweiler

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Summary

This case report describes a combination of negative pressure-wound-therapy (NPWT) and NPWT assisted incision management after resection of an abscess located at the right thoracic wall in a Rottweiler. The patient had a history of severe incisional complications after surgical interventions performed in the past, including repeated episodes of wound dehiscence, major skin necrosis and infection with and without a multiresistant strain of *Staphylococcus aureus* and several episodes of open wound management with healing rates between months and a year. Wound closure after resection of the mass was performed as a staged procedure. After two days of open NPWT the wound was primarily closed and a preventive incisional vacuum assisted therapy (CI-NPWT) was started for 7 days. The patient was discharged during therapy with the portable device in place. The Unit was removed at day 7 post wound closure, suture removal followed at day 10. Wound healing was uneventful and no major complications occurred at a follow up time of 8 months. This is the first description of closed incisional negative pressure wound therapy in the dog.

Keywords: negative pressure wound therapy, closed incision wound healing deficiency, abscess

Präventive Unterdrucktherapie (Prevena[®]) zur Augmentation einer geschlossenen Inzision mit erhöhtem Risiko für Wundheilungsstörungen bei einer Rottweiler Hündin

Der vorliegende Fallbericht beschreibt eine Kombination aus offener Wundtherapie mittels Unterdruck und Unterdruck Augmentation des verzögerten Primärverschlusses nach Resektion eines Abszesses an der rechten Thoraxwand eines Rottweilers. Die Patientin hat eine Anamnese von wiederholten schwerwiegenden Wundheilungsstörungen, die nach allen chirurgischen Eingriffen aufgetreten waren. Diese Komplikationen reichten von Nahtdehiszenz bis hin zu schweren Hautnekrosen mit und ohne Infektion durch ein multiresistentes *Staphylococcus aureus* Isolat; die Heilungsdauer lag zwischen Monaten bis hin zu einem Jahr. Nach Resektion eines Abszesses an der rechten Thoraxwand wurde ein schrittweiser Verschluss durchgeführt. Initial wurde die Wunde offen belassen und für zwei Tage mit einer Standard Unterdrucktherapie (NPWT) versorgt. Danach erfolgte der Wundverschluss und auf die geschlossene Naht wurde ein präventives Unterdrucksystem (CI-NPWT) angebracht. Diese präventive Therapie wurde ambulant während 7 Tagen durchgeführt. Anschliessend wurde der Unterdruckverband entfernt und die Fäden wurden am Tag 10 gezogen. Die Wundheilung war unauffällig und auch 8 Monate später waren keine Komplikationen aufgetreten. Der vorliegende Fall beschreibt erstmals eine präventive Unterdrucktherapie nach Wundverschluss beim Hund.

Schlüsselwörter: Unterdruck Wundtherapie, geschlossene Inzision, Wundheilungsstörungen, Abszess

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Introduction

The enhancement of wound healing by a vacuum was introduced in the early to late 1990's for the management of traumatic and inflammatory soft tissue defects (Rozhdestcin et al., 1987; Morykwas et al., 1997). The value of the system in prevention of wound dehiscence has become the focus of several current studies in human medicine (Gomoll et al., 2006; Stannard et al., 2012). Incisions that may benefit from this approach are clean, primary closed incisions with a high potential for complications due to classification within one of three categories (Wilkes et al., 2012; Stannard et al., 2013): a) injury that is known to be associated with high rate of wound complication, b) injury with profound soft tissue involvement, c) Patient with high risk for wound healing complications. Currently there are no published reports regarding the prophylactic use of a vacuum system on primary closed incisions in patients with a high risk for wound infection in veterinary medicine. This is the first report of the preventive usage of CI-NPWT using the Prevena™ device in a dog estimated a high risk candidate for incisional complications.

Case history

A 5 year old, female, spayed Rottweiler was admitted to the clinic for further investigation of a soft tissue mass of the size of a golfball located at the right thoracic wall that has been present for 1.5 years but started to grow significantly during the past 3 months. The patient had developed serious complications after a spay procedure performed three years prior to presentation resulting in superficial wound dehiscence and topical skin necrosis that healed by second intention with massive scarring

after topical treatment with honey. Total time to closure was 6 months. Furthermore, the patient had underwent extracapsular cranial cruciate repair using a FibreWire® device one and a half years before presentation that led to incisional dehiscence, skin necrosis, fistula formation and infection with a multiresistant strain of *Staphylococcus aureus* that resolved after transcutaneous removal of the FibreWire® suture through an open fistula. Total time to healing was one year. Superficial wounds (scratches and minor cuts) healed uneventfully by second intention when no surgical intervention was performed.

Clinical examination

The mass was firmly attached to the right thoracic wall, not painful on palpation and without signs of acute inflammation. A fine needle aspiration indicated a neutrophilic inflammation but malignant transformation of single cells could not be excluded. Despite the mass, the patient showed a depigmentation of the nasal plane that was already treated and was otherwise healthy. A routine laboratory panel as well as complete staging (thoracic radiographs, abdominal ultrasound) was unremarkable.

Surgical procedure

The history of the patient presented a major concern for further complications after surgical management and thus a staged approach was planned. The patient was put under general anaesthesia and a MRI scan was performed. On the right side at the level of the 4th to 6th rib a well-circumscribed (8 cm × 5 cm × 2 cm), mildly

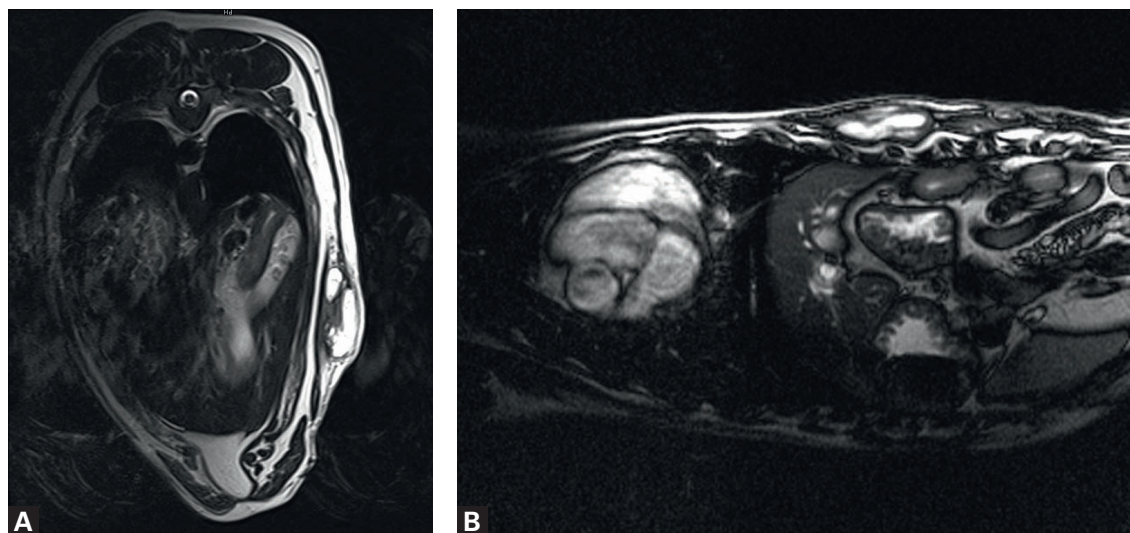


Figure 1: MRI showing a cavitated mass with diffuse enhancement of contrast medium at the right lateral thoracic wall (T1W with contrast, transversal (A) and coronar (B) view).

cavitated mass was visible with a T2-weighted hyperintensity and a T1-weighted hypointensity of the central part. The periphery appeared isointens to the soft tissues in T1-W and T2-W sequences. The periphery and surrounding soft tissues showed a diffuse enhancement of contrast medium in T1-W sequences. The findings were indicative for abscess formation (Fig. 1).

After the MRI the dog was routinely prepared for surgery. The skin was clipped, cleaned using a standard soap solution (povidone-iod) and disinfected using alcohol. A marginal en bloc excision of the mass was performed to the level of the ribs. The created wound had a length of 15 cm, a depth of 2.5 cm and a width between 8 and 6 cm.

NPWT procedure

After lavage, the V.A.C. dressing was applied in standard fashion. The NPWT sponge (V.A.C. GranuFoam™, KCI Medical, Wiesbaden, Germany) was cut to match the wound, sealed by the corresponding adhesive bandage and connected to the NPWT Unit (V.A.C. freedom, KCI Medical, Wiesbaden, Germany). Continuous vacuum therapy was started at a negative pressure of 125 mm/hg for 3 days. No suture material was introduced to the wound at this time point. Therapy was tolerated well and no associated complications occurred.

Incisional NPWT

The dog was put under general anaesthesia again at day 3 post mass removal and the remaining smaller defect (15 cm length, width between 3 and 2 cm, depth 1.5 cm) was closed in 3 layers using 3.0 polyglycaprone 25 sutures and a CI-NPWT unit (Prevena™ Incision Management System, KCI Medical, Wiesbaden, Germany) was applied over the sutured defect (Fig. 2). The vacuum therapy was initiated at 125 mm/hg continuous mode and the handheld unit was secured to a conventional dog harness. The dog was discharged the following day with the unit in place. In order to prevent dislodgement or destruction of the drape, the dog was wearing a protective bandage over the NPWT dressings and an e-collar.

Bacteriology

A microbial swab was taken from the wound bed after mass removal that revealed infection with *Pasteurella canis* and *Pasteurella dagmatis*. Based on the results an antibiotic therapy with marbofloxacin (2 mg/kg once daily, orally) was initiated for 3 weeks. Analgesia was

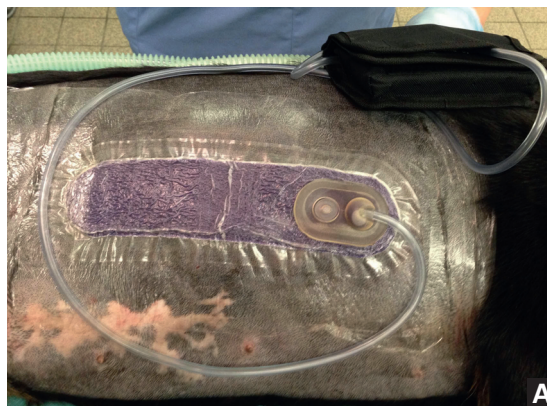


Figure 2: The CI-NPWT system was applied over the incision (A). Local appearance of the incision site at the time of CI-NPWT removal (B) and the day of suture removal (C). No adverse reactions were visible.

achieved by administration of carprofen (4 mg/kg once daily, oral) for 5 days. A second microbial swab taken prior to wound closure showed persistent mild colonization of the wound by *Pasteurella canis* and *Pasteurella dagmatis*.

Histopathology

The pathohistological examination confirmed the inflammatory nature of the mass with abscess formation and formation of fibrosis but no signs of malignant transformation.

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Follow up examination

The patient was returned to the hospital 7 days after wound closure and the CI-NPWT was removed without the need for sedation. No complications occurred during the time of treatment and no signs of skin reaction were visible after removal. The incision was well adapted and only minor signs of discharge were visible within the dressing (Fig. 2). No secretion was accumulated in the adapted tank. The owners reported that the dog showed no signs of discomfort and behaved as usual. Three days later the sutures were removed. An owner consultation by telephone confirmed that the dog had had no further complications eight months past surgery.

Discussion

The patient in the present case has been graded as a high-risk patient for wound healing disturbances based on the previous history. It had developed major wound complications after every invasive procedure performed in the past - the reason of which could not be identified. Predisposing factors for wound healing complications have been identified and include male sex, duration of surgery, duration of anaesthesia, usage of propofol, endocrinopathies and disturbances of the immune system (Nicholson et al., 2002; Frey et al., 2012; Hostetter 2012; Mayhew et al., 2012). The body condition score of the described patient was normal, there was no evidence for an endocrinopathy based on the performed tests (T4, TSH) and no increased susceptibility to infections was reported. In addition, the dog healed other small wounds without complications.

Another possible source could have been a reaction to topical agents such as cleaning solutions, disinfectants or suture material. The dog showed no signs of skin reactions after clipping, cleaning and disinfection of the surgical sites and sites where peripheral catheters were placed during the hospitalization. A fact that makes an adverse reaction towards disinfectants less likely. Polyglactin 910 was used in all former surgeries and it is known that the tissue responses of polyglactin 910 are more severe compared to polyglycaprone 25 (Kirpensteijn et al., 1997). Suture material in this case was therefore used very restricted in the present case and limited to polyglycaprone 25. The infection after knee surgery was additionally associated with an infection with multi-resistant *Staphylococcus aureus*. Infected surgical implants are frequently associated with wound healing disturbances and fistula formation (Vasseur et al., 1988; Frey et al., 2012). Whether or not the infection in combination with the implant was cause or consequence of the following wound healing complication cannot be concluded retrospectively.

Traditionally, the negative pressure wound treatment (NPWT) technique has been described in wounds that have already converted into clinical problems (Morykwas et al. 1997; Adkesson et al., 2007; Guille et al., 2007; Owen et al., 2009; Mullally et al., 2010; De Maria et al., 2011), but some recent papers also focused on the beneficial effect of the vacuum on primary wound healing in human medicine (Pachowsky et al., 2012; Stannard et al. 2012;). These studies concentrated on the effects that may be exerted on closed incisions in high-risk patients and the potential of the technique to prevent wound healing disturbances. Reported benefits of CI-NPWT include a decrease of seroma formation compared to control groups in high impact trauma cases (Stannard et al.; 2006; Stannard et al. 2012) or after total hip arthroplasty (Pachowsky et al., 2012) as well as a lower overall infection rate after high velocity trauma injuries (Stannard et al., 2012), median sternotomies (Atkins et al., 2009; Colli 2011) and orthopaedic surgeries (Gomoll et al., 2006; Reddix et al., 2009). Experimental studies documented a 63% lower seroma formation in experimentally created incisions treated with CI-NPWT compared to controls, higher lymphatic clearance and higher mechanical stability of the incisions at day 3 (Kilpadi and Cunningham 2011; Meeker et al., 2001). All of these promising publications warrant the preventive usage of CI-NPWT in high risk incisions. and increasing numbers of case reports in human medicine confirm the positive effect in man (Reddix et al., 2009, Colli 2011), but so far this is the first case where the technique was applied in a dog. (Reddix et al., 2009, Colli 2011). No wound healing disturbances occurred despite the history of the patient. However, since it is a preventive system and we had only one case, we have not proved, that the uneventful healing was truly linked to the system. However, the CI-NPWT can be easily applied to closed sutures, is well tolerated by the patient and treatment is possible on an out of house basis. The owner satisfaction was high and he felt, that the device did not restrict the dog or himself in any way. CI-NPWT may be an effective approach to prevent incisional complications. The current data regarding the effect of the system warrants further evaluation for the usage in veterinary medicine.

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