THE USE OF NEGATIVE PRESSURE WOUND THERAPY ON AN OPEN ABDOMINAL WOUND

Open abdominal wounds present a challenge to clinicians involved in the care of affected patients. The surgeon is faced with the decision of whether to close a wound or not, and the nursing staff must decide how to reduce the risk of the wound deteriorating.

This case study looks at how a patient with an open abdominal wound was cared for under the guidance of the Tissue Viability Nursing Service within the author's acute hospital.

ABDOMINAL COMPARTMENT SYNDROME

A compartment syndrome is a condition in which increased pressure in a confined anatomical space adversely affects the function and viability of the tissues therein.

Intestinal perforation can lead to an increase in intra-abdominal pressure and this, in turn, can lead to abdominal compartment syndrome, which is related to increased morbidity and mortality of the critically ill patient (Kovac et al, 2007).

Abdominal compartment syndrome occurs when the intra-abdominal pressure increases, which in turn increases the risk of intra-abdominal sepsis, bleeding, renal failure and death. The decision to decompress the abdomen is often based on the presence of organ dysfunction.

NEGATIVE PRESSURE WOUND THERAPY

Negative pressure wound therapy (NPWT) is an active wound therapy that is used to promote wound healing by applying a controlled negative pressure to the wound bed. The exact mechanisms by which NPWT improves wound healing remains unclear, however, the literature indicates that, when used appropriately, NPWT can be cost effective (Searle and Milne, 2010).

There are many clinical benefits associated with NPWT, including increased local blood flow to the wound by dilation of arterioles; reduced tissue oedema through the removal of excess fluid; stimulation of granulation tissue, resulting in progressive wound closure; stimulation of cell proliferation; removal of free radicals from the wound; reduction in wound volume; protection from outside contaminants; decrease in wound bioburden; and maintenance of a moist wound-healing environment (Best Practice Statement, 2008).

The economical benefits of NPWT include:

- A reduction in the length of the hospital stay
- Prevention of hospital admission for large or chronic wounds, and pre-operative wound bed preparation
- Cost-effective wound treatment where previously lengthy and ineffective dressing regimens were used
- Reduction of clinician intervention time and visits (Trueman, 2007; Searle and Milne 2010).

CASE HISTORY

A 19-year-old patient was admitted to hospital with abdominal pain. He was diagnosed with a strangulated hernia and required emergency surgery. Post-operatively, the patient's condition deteriorated and he was taken back to theatre for a further laparotomy, where a small bowel perforation was noted, leading to the patient requiring a small bowel resection. He underwent delayed wound closure three days later. The patient's condition deteriorated further, as he developed abdominal compartment syndrome and required further surgery to decompress the bowel. The wound could not be closed by primary intention (sutured) and was, therefore, left open.

'The decision to decompress the abdomen is often based on the presence of organ dysfunction'

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Management

When the tissue viability nurse (TVN) first reviewed the patient, he was still ventilated and sedated in the intensive treatment unit (ITU). The wound had been dressed in theatre with a film dressing, which had been attached to wall suction to manage the exudate. The surgical team had requested the advice of the tissue viability nurse to determine an appropriate wound management regimen due to the decision not to take the patient back to theatre for delayed primary closure due to the fragility of the bowel.

The wound to the abdomen was an unusual shape due to both a transverse and midline incision being made during theatre (*Figure 1*). The abdomen was markedly distended, although ITU staff had indicated that there was a noticeable reduction in size. A total of 600ml exudate had been collected via the wall suction over a two-day period.

The options for abdominal wound management are limited, however, the TVN decided to use an NPWT dressing (Renasys® F/AB [Smith & Nephew]) dressing. This comprises an organ protection layer, which is covered with a foam wound filler (*Figure 2*). The aim of this therapy was to reduce the oedema around the wound and the bowel, reduce the nursing time spent on wound management, reduce the risk of wound infection, and improve patient comfort and satisfaction when awake.

The Renasys F/AB was applied with the Renasys® EZ Plus (Smith & Nephew) machine due to the expectation of high exudate levels, and the pressure was set to -80mmHg. The optimum pressure for the Renasys F/AB is between -80mmHg and -120mmHg. The decision was made to use the lower pressure due to the consultant's concerns regarding the fragility of the bowel and the mesh.

Dressings were renewed twice-weekly with support from the TVN and the negative pressure clinical specialist from Smith & Nephew. After a week of tolerating the dressing with no adverse effects of applying NPWT to this vulnerable area reported, the pressure was increased to -90mmHg.

The patient was transferred from ITU to the high-dependency unit (HDU) following safe weaning from the ventilation and sedation, and showing signs of a good response to treatment. After 10 days of NPWT, the wound dimensions had decreased (*Figure 3*). Although there was still some evidence of abdominal distension.

The patient's nutritional needs were being met by total peripheral nutrition (TPN), however, it was decided that, as the patient was awake, the surgical team needed to ensure the effects of peristalsis within the bowel would not have a detrimental effect on the still distended abdomen. It was hoped that this would actually help with the reduction of the distension as the muscles within the bowel would become active again. A nasojejunal (NJ) feed was, therefore, commenced.

On day 13 of NPWT, the patient began to slowly mobilise around the HDU, however, the dressing started to leak. This was resolved by increasing the pressure to -100mmHg. The increase in pressure kept the dressing secure.

The patient started opening his bowels and there were signs that the abdominal distension was reducing slightly further. A soft diet was introduced and tolerated by the patient.

The patient was transferred to a surgical ward as he had continued to respond well to his treatment and it was felt that he no longer required a critical care bed. On day 20 of NPWT, the wound dimensions had decreased further, while the wound was granulating well over the mesh. The decision was made to stop the Renasys F/AB treatment and commence the gauze wound filler with a Renasys® Go (Smith & Nephew) machine. This was commenced at the optimum pressure of -80mmHg.

The patient tolerated this new treatment well and on day 24 of using NPWT (and after four days using gauze) the wound dimensions had decreased even further (*Figure 4*).

Some 28 days following the commencement of NPWT, the patient was discharged home, into the care of the Community Nursing Services. Wound management continued at home with support from the Tissue Viability Service (*Figure 5*). Progress continued, evidenced in *Figure 6* (42 days after commencing NPWT) and *Figure 7* (52 days after commencing NPWT).

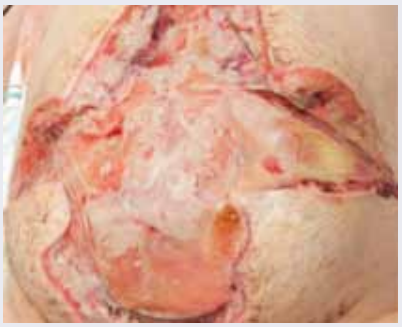

Figure 1: Initial wound presentation.

Figure 2: Renasys F/AB dressing in situ.

Figure 3: Wound 10 days after using NPWT.

Figure 4: Wound 24 days after using NPWT.

Figure 5: Renasys-G/P dressing in situ.

Figure 6: Wound 42 days after using NPWT.

COST EFFECTIVENESS OF NPWT

Research comparing the cost effectiveness of NPWT and conventional dressings has been undertaken (Moues et al, 2005; Vuerstaek et al, 2006; Apelqvist et al, 2008).

These studies have indicated that while the direct cost of NPWT products were higher than conventional dressings, when considering overall use of resources, including cost of care, nursing intervention and hospitalisation, the total cost of using NPWT were lower.

The cost of dressing materials used in terms of this patient's treatment was higher due to the use of NPWT, however, nursing time was reduced as the dressing was only required twice-weekly rather than at least daily as would have been necessary for conventional dressings.

The use of NPWT reduced the risk of wound infection due to the maintenance of a complete dressing seal, therefore, preventing ingress of bacteria, and reducing the frequency of dressing changes.

It is likely that the patient's pathway from ITU to ward and then on to discharge would have been prolonged in the absence of NPWT, as it was necessary to ensure the wound was showing signs of healing before the consultant was happy for the patient to be discharged under the care of the community nursing team.

Searle and Milne (2010) identified that therapies such as NPWT should be commonplace, and that tissue viability professionals should be appointed to direct service provision and ensure high standards (Department of Health [DH], 2009).

CONCLUSION

Although the unit costs of NPWT may be perceived to be high, there is a real possibility that materials and rental costs can be offset by, for example, reduction in the length of hospital stay, lower frequency of dressing change, and a reduction in complications and the need for further surgical interventions. This case study supports this, as the patient quickly progressed to being discharged with no further wound complications once the NPWT had been applied. WUK

Figure 7: Wound 52 days after using NPWT.