WOUND BED PREPARATION WITH AN ENZYME ALGINOGEL IN THE TREATMENT OF PRESSURE ULCERS

'The goal of wound bed preparation is to stimulate granulation tissue, prepare the wound for surgical closure or to achieve wound closure'

KRIS BERNAERTS
Clinical Nurse Specialist (CNS) wound care, University Hospitals Leuven, Belgium

ADINDA TOPPETS
CNS wound care, University Hospitals Leuven, Belgium

INGRID KEYAERTS
Support team wound care, University Hospitals Leuven, Belgium

MARINA REYNAERTS
Support team wound care, University Hospitals Leuven, Belgium

JAN VRANCK
Department of Plastic and Reconstructive Surgery, University Hospitals Leuven, Belgium

Clinicians are confronted with various wounds on a daily basis, including surgical and traumatic wounds, oncological wounds, radiation wounds, diabetic foot wounds, venous ulcers, as well as a large number of pressure ulcers.

Despite the many efforts that clinicians undertake on a daily basis to prevent decubitus wounds, there is still a prevalence of between 7% and 9% (category 1–4 [4%] to category 2–4 [5%]) at the University Hospital of Leuven, a Belgian facility with 1,800 beds. About one-third of these wounds come from other departments outside of the hospital.

In many cases, these decubitus wounds can be treated conservatively, but clinicians also regularly see a large number of pressure ulcers that require comprehensive surgical debridement or flap surgery. Thorough wound bed preparation is thus essential for treating these wounds.

WOUND BED PREPARATION

Wound bed preparation focuses on debridement, bacterial balance, management of wound exudate and the overall health status of the patient (Sibbald et al, 2000). The goal of wound bed preparation is to stimulate granulation tissue, to prepare the wound for surgical closure or to achieve closure of the wound (Schultz et al, 2005).

In order to optimise wound bed preparation for these decubitus wounds, negative pressure wound therapy (NPWT) is often used after surgical debridement, although enzyme alginogels also have an important added value here. Enzyme alginogels combine the benefits of a gel, an alginate, and antibacterial enzymes. They address each of the four components that underpin wound bed preparation described in the TIME (tissue, infection, moisture, edge) framework (Beele et al, 2011). They clean the wound and carry out continuous debridement of the wound bed through their alginate content, breaking down necrotic tissue through hydration and autolysis.

The lysed necrotic tissue and the excess of wound exudate, including bacteria, are then absorbed into the product's structure. They restore bacterial balance and incorporate a unique, broad spectrum of antibacterial enzymes that are effective against a range of clinical isolates, including Methicillin-resistant *Staphylococcus aureus* (MRSA) (Desmet, 2009), without destroying the host skin cells essential for wound healing.

Enzyme alginogels also create a moist wound healing environment, while ensuring that the wound edges are protected (Beele et al, 2001).

CASE REPORTS

Case 1

The first case is a 72-year-old obese woman with type II diabetes, arterial hypertension and chronic kidney failure. The reason for admission was pneumonia, respiratory distress and multiple organ failure. She developed a category 4 sacral pressure ulcer due to bad overall health.

In mid-July, the wound care nurse originally encountered a superficial decubitus wound that was reddish-yellow in colour and had little exudate.

The initial treatment consisted of the necessary preventive measures, thorough

Figure 1: Wound at 20/07/10. TIME-related symptoms: red-yellow wound bottom (T); no signs of infection (I); moderate exudate (M); red, irregular wound edges (E).

Figure 2: Wound at 26/08/10. TIME-related symptoms: red-yellow wound bottom after extensive debridement (T); large infection risk (I); strong exudate (M); very deep wound with undermined wound edges (E).

Figure 3: Wound at 14/09/10. TIME-related symptoms: red granulated wound bottom (T); no signs of infection (I); strong exudate (M); undermined wound edges (E).

wound cleaning and disinfection and treatment with an enzyme alginogel (*Figure 1*).

The wound evolved relatively favourably, but two weeks later, a small cavity was discovered, for which a superficial debridement was performed. When the necessary surgical debridement was performed one week later, the wound care nurse was confronted with a very large cavity, a deep, reddish-yellow, category four decubitus wound with undermined wound edges and excess exudate.

The purpose of wound care was to prepare this wound for flap surgery as soon as possible. To this end, NPWT was initially started, which had to be abandoned rather quickly due to unexpected haemorrhaging.

On August 26, the patient was restarted on an enzyme alginogel. The wound still had a red wound base that was slightly granulated, but fibrin was present. The wound edges were still undermined and the wound was strongly exudative and infected with *Staphylococcus aureus (Figure 2)*.

Three weeks later, in mid-September, the wound had evolved favourably. The team noticed a red, granulating wound base with limited fibrin tissue.

The wound edges were still undermined. The wound was still strongly exudative, but did not exhibit any signs of infection. The patient's condition was slightly more stable in the meantime, but she was still insufficiently stable to undergo a major procedure, such as flap surgery. In consultation with the plastic surgeon, the decision was made to continue with the conservative treatment (*Figure 3*). When the wound was evaluated one month later, the authors saw that it had become a great deal smaller.

This was due to the properties of the enzyme alginogel, continuous wound debridement, antimicrobial activity, maintenance of a moist-healing environment and protection of the wound edges and epithelial cells. The wound edges had become whole and solid and much less undermined. The wound bed had evolved into a red, granulating wound without signs of infection and with a moderate amount of exudate.

Given the enormous change in the wound, a decision was made in consultation with the plastic surgeon to continue to treat the wound conservatively and not to have the patient undergo surgery for the time being.

When the wound was examined one month later, the authors noticed that the wound had become even smaller, measuring 3.5cm x 2cm, with a red, granulating wound bed and a moderate amount of exudate. In the meantime, the patient was ready to be discharged and cared for at home (*Figure 4*).

When the patient returned for a follow-up visit in mid-December (after about five months), the wound was almost fully healed.

Figure 4: Wound at 17/11/10. TIME-related symptoms: red granulated wound bottom (T); no signs of infection (I); moderate exudate (M); solid wound edges (E).

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Figure 5: Wound at 19/11/10. TIME-related symptoms: red-yellow wound bottom (T); no signs of infection (I); moderate exudate (M); unhealthy wound borders (E).

Figure 6: Wound at 23/12/10; NPWT stopped on 18/12/2010 and started with compresses of iodine solution; 23/12/10 start enzyme alginogel; red-yellow wound bottom (T); high risk of infection (I); strong exudate (M); undermined wound borders (E).

Figure 7: Wound at 27/12/10. TIME-related symptoms: red granulating wound bottom with restricted fibrin tissue (T); no signs of infection (I); strong exudate (M); undermined wound borders (E).

Figure 8: Wound at 02/02/11. TIME-related symptoms: red granulating wound bottom (T); no signs of infection (I); moderate exudate (M); strong wound borders (E).

Case 2

A second similar case centres on a 44-year-old morbidly obese man weighing 150kg with type II diabetes, hyperlipidaemia, chronic obstructive pulmonary disease and asthma. He developed a category four sacral pressure ulcer due to bad overall health and limited mobilisation (*Figure 5*). After debridement, the authors encountered a very large decubitus wound. NPWT was then undertaken, but due to a very large haematoma, had to be stopped.

The wound was irrigated for several days and filled with compresses with iodine solution. The patient was started on an enzyme alginogel on December 23 (*Figure 6*).

After a week, the authors noted a red granulated wound with a small amount of fibrin coating. The wound continued to evolve favourably and further granulate without clinical signs of infection, and even had a similar wound bed aspect to negative pressure therapy. The wound edges were solid and beginning to contract (*Figure 7*).

Given that it was impossible to perform a flap reconstruction, due to pulmonary problems and obesity, the patient was discharged from the hospital at the beginning of February and the current treatment strategy was continued, namely: weight reduction, mobilisation, pressure alleviation of the sacral region and wound care consisting of irrigation and application of enzyme alginogel (*Figure 8*).

The wound appeared to granulate progressively and to epithelialise under the enzyme alginogel. As long as no weight reduction was achieved, no further intervention was possible. Several weeks later, the patient unfortunately died from a respiratory complication.

Case 3

This case focuses on a 70-year-old woman who developed a category 4 pressure ulcer after a cardiac procedure (coronary artery bypass graft [CABG]). This was a bilateral

Figure 9: Wound at 14/09/10. TIME-related symptoms: yellow fibrin, black necrosis (T); no signs of infection (I); no exudate (M); red irregular wound borders (E).

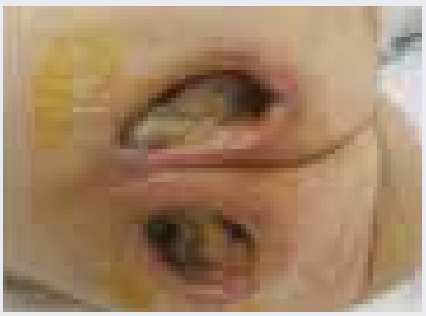

Figure 10: Wound at 27/10/10 TIME-related symptoms : yellow fibrin (T); no infection (I); strong exudate (M); undermined wound borders (E).

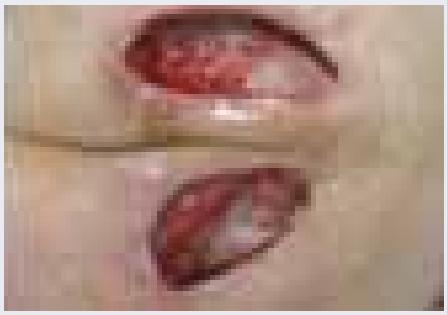

Figure 11: Wound at 10/11/10. TIME-related symptoms: red-yellow wound bottom (T); no infection (I); moderate exudate (M); solid wound edges (E).

Figure 12: Wound at 18/11/10 after a bilateral gluteal rotation flap.

Figure 13: Wound at 6/05/11. TIME-related symptoms: yellow fibrin (T); infection with MRSA (I); moderate exudate (M); unhealthy wound edges (E).

Figure 14: Wound at 17/05/11. TIME-related symptoms: red granulated wound bed (T); infection with MRSA (I); moderate exudate (M); undermined wound edges (E).

Figure 15: Wound at 21/06/11. TIME-related symptoms: red granulated wound bed (T); no signs of infection (I); moderate exudate (M); solid wound edges (E).

decubitus wound, which was initially treated with an enzyme alginogel in order to further debride the wound (*Figure 9*). The patient was also immensely afraid of another operation and wanted to receive conservative treatment. Due to an increase of exudate, the treatment was switched from Flaminal® Hydro to Flaminal® Forte, an enzyme alginogel with a higher concentration of alginates after two weeks.

The wound became increasingly clean and the severity of the wound became clearer. Ultimately, the patient was convinced of the necessity of surgery, which took place on October 21. After debridement, the wound continued to be treated with enzyme alginogels (*Figure 10*). On November 5, the wound was sufficiently clean and treatment was switched to NPWT (*Figure 11*). The patient was finally able to undergo a bilateral gluteal rotation flap on November 18 (*Figure 12*).

Case 4

The fourth case centres on a 90-year-old male patient who was admitted due to a general deterioration of his health, decreased appetite and progressive dyspnoea. He had been residing at a nursing home for quite some time, where he developed the onset of a decubitus wound through decreased appetite, the general deterioration of his health and his limited mobilisation.

Due to his bad general health, this wound evolved into a category 4 decubitus wound, which was additionally colonised with methicillin-resistant *S. aureus* (MRSA), despite the necessary preventive measures being taken.

On May 2, the wound was debrided by a plastic surgeon and further treated with an enzyme alginogel (*Figure 13*). Two weeks later, the authors found a red, granulating wound, despite the MRSA colonisation (*Figure 14*).

On May 19, the doctors decided to start NPWT, but had to stop after three weeks due to clinical signs of infection. After several days, the patient was switched to polyvidone iodine gel and on June 18 he was put back on enzyme alginogel to hydrate the wound and stimulate the granulation tissue with a non-cytotoxic product (*Figure 15*).

The patient was discharged to the nursing home on June 23. When he returned for a follow-up some three weeks later, clinicians saw a small red granulating wound without any sign of infection (the results can be seen in *Figure 16).*

CONCLUSION

These cases show that the application of an enzyme alginogel is a very good adjuvant to NPWT in the preparation of the wound bed. This contributes to wound healing from the point of debridement to re-epithelisation and meets all the components of the TIME framework. WUK

DECLARATION

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Figure 16: Wound at 15/07/11. TIME-related symptoms: red granulated wound bed (T); no signs of infection (I); moderate exudate (M); healthy, solid wound edges (E).