Negative Pressure Wound Therapy with Multiple Drainage Holes for the Treatment of Pressure Ulcer with Undermining: Case Reports

Hiroyuki Miura, Yumiko Ito, Tomoko Matsuda, Ayano Abe, Syun Kitaba
Department of Dermatology, Kinki Central Hospital, Itami, Japan.
Email: tori2@mac.com

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ABSTRACT
Noninvasive treatment of pressure ulcers with undermining is often difficult. To decrease the risk of bleeding in such conditions, negative pressure wound therapy (NPWT) has been applied. We treated a pressure ulcer with wide undermining using NPWT after opening drainage holes in the undermined area. This method can reduce the risk of bleeding and promote the rapid closure of the undermined area.

Keywords: Negative Pressure Wound Therapy; Pressure Ulcer; Undermining

1. Introduction
Negative pressure wound therapy (NPWT) is gaining popularity as an acute and chronic wound management, and can prevent bacterial infection, eliminate edema, and facilitate neovascularization [1-3].

Noninvasive treatment of pressure ulcers with undermining is often difficult. To decrease the risk of bleeding in such conditions, NPWT has been applied. However, closure of the undermined area requires a long operative time [3,4]. Therefore, we treated a pressure ulcer with wide undermining using NPWT after opening drainage holes in the undermined area. This method can reduce the risk of bleeding associated with incising the entire undermined area and promote the rapid closure of the undermined area.

2. Case Reports
2.1. Case 1
An 86-year-old woman, with right-sided paralysis due to cerebral infarction, had been suffering from a Stage III pressure ulcer for 3 months. Examination revealed a pressure ulcer (4 × 3 cm) with a widely undermined area (8 × 5 cm) on the right great trochanter. Blood tests revealed a low albumin level (3.2 g/dL) and slight anemia (Hb, 10.4 g/dL). NPWT using the polyurethane foam-based NPWT system (RENASYS; Smith & nephew, Florida, USA) at −80 to −120 mmHg for a month neither reduced the size of the ulcer nor improved the undermining (Figure 1(A)). Therefore, we opened several drainage holes using a 5-mm punch biopsy needle on the undermined surface under local anesthesia, instead of incising the entire undermined area (Figure 1(B)). After confirming the absence of bleeding over night, we started NPWT again at −120 mmHg.

Twice a week, when the dressing had been changed, basic fibroblast growth factor (bFGF) (Fiblast splay; Kaken, Tokyo, Japan) was applied to the ulcer and drainage holes.

Two weeks after this treatment, the sizes of the ulcer and the undermining were 3 × 2 cm and 3 × 1.5 cm, respectively (Figure 1(C)). During 2 weeks of additional NPWT, no improvement of undermining was observed. Therefore, we performed a histological examination of the undermined area. In the specimen of the undermined area, which closed rapidly, the tissue of the ceiling portion was granular. On the other hand, in the specimen of the remainder of the undermined area, the ceiling portion was covered with irregular epithelium, thought to have prevented closure of the dead space (Figure 1(D)). Therefore, we stopped NPWT and continued bFGF and hydrocolloid dressing and so on, sometimes performing debridement of the ceiling surface using a curet. After 2 weeks closure of the undermined area was observed, and there was complete epithelialization of the ulcer after 5 weeks (Figure 1(E)).

2.2. Case 2
An 80-year-old woman had been suffering from stage III sacral pressure ulcer for several years, consist of an ulcer...
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3. Discussion

Pressure ulcers can form anywhere on the body, although they most frequently develop in the sacral area (30% - 40%). The great trochanter is another location where pressure ulcers occur frequently (10% - 15%) [4]. They are caused by pressure, traction, friction, or their combination.

The treatment of a pressure ulcer with undermining is challenging. It is recommended that an incision be made above the undermined surface, although this is an invasive approach that carries the risk of bleeding. To prevent bleeding, NPWT has been applied to such conditions. However, undermining closure requires a long operative time and is sometimes unsuccessful [3,4].

To promote the closure of the undermined area, we administered a basic fibroblast growth factor (bFGF)
喷雾因为bFGF已被报道能加速伤口愈合，通过促进新血管化、肉芽组织和上皮化[5]。此外，我们假设在被侵蚀的区域创建的引流孔可能会减少被侵蚀区域下的死区，从而允许天花板和死区底部之间的强接触。事实上，随着NPWT的进行，引流孔逐渐缩小，引流孔内充满大量肉芽组织。然后在关闭引流孔后，肉芽组织可能向下延伸到底部，因为结果的疤痕似乎牢固地紧贴在下层，没有移动。

在我们的两个病例中，天花板的非均匀上皮化被观察到。这种不均匀的上皮层被认为防止了被侵蚀的区域闭合，因为这种组织需要通过组织学、皮肤镜或其它方法在进行NPWT前进行识别。

因此，引流孔中的肉芽组织可能在作为安克固定和封闭被侵蚀区域中发挥了作用。此外，我们相信NPWT在被侵蚀区域创建的引流孔可能成为治疗带侵蚀的压疮的治疗选择。

**REFERENCES**


