

Understanding and preventing wound blistering

Surgical wounds generally heal by primary intention with no significant problems. However, the development of blisters can be painful, extend the inpatient stay, be expensive and may lead to surgical site infection. Numerous studies have compared a variety of wound dressings, evaluating their performance in preventing the development of wound blistering to perioperative wound skin, yet none present conclusive recommendations. A wound dressing should maintain a warm, moist healing environment and should not damage the periwound area, which could lead to blister formation. Protection of the periwound area is vital and can be achieved by choosing a dressing that does not adhere to surrounding skin, is easy to apply, easy to remove and flexible.

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KEY WORDS

Blistering
Surgery
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Generally, surgical wounds tend to heal with few problems. Nevertheless, the development of postoperative wound blistering can cause pain, discomfort, persistent wound leakage and possible risk of surgical site infection (Jester et al, 2000; Bhattacharyya et al, 2005; Cosker et al, 2005). Indeed, Ravenscroft et al (2006) argued that the main problems with surgical wounds following hip and knee surgery are blistering and infection.

Wright (1994) estimated the incidence of blistering to be between 13% and 35%. Skin blistering occurs when the epidermis is separated from the dermis and results from continued friction on the skin (Ravenscroft et al, 2006).

It has been suggested that wound blistering at dressing margins is a recurrent problem that has been relatively ignored, as it rarely extends a patient's hospital stay (Leal and Kirby, 2008). However, the incidence of superficial wound problems, such as skin blistering, especially in orthopaedic surgery, has been described as a commonly reported problem (Wright, 1994; Cosker et al, 2005).

There have been several studies that have attempted to quantify the incidence of postoperative wound blistering. Yet Tustanowski (2009) has argued that there has been a limited number of studies examining the effect of different dressings and that these have presented no conclusive recommendations.

Blistering after hip surgery caused by tape-related injuries has been reported to have an incidence of 21.4% (Polatsch et al, 2004). Jester et al (2000) reported an incidence of

blistering, using a variety of dressings, of 13%, whereas Cosker et al (2005) in a prospective study of patients undergoing hip or knee surgery, reported postoperative blistering rates as ranging from 6% to 24%, depending on the dressing used.

Causes of wound blisters

Wound blistering has been associated with a number of factors, including (Tustanowski, 2009):

- ▶▶ Movement of the wound site
- ▶▶ Choice of dressing
- ▶▶ Tape use
- ▶▶ Age
- ▶▶ Gender
- ▶▶ Type of incision
- ▶▶ Medications
- ▶▶ Comorbidity
- ▶▶ Cost-effectiveness of dressings.

Ravenscroft et al (2006) also suggested that a wound blister on or around an orthopaedic wound may be caused because the dressings are in place for a long period of time and are usually placed over the joint, where movement causes friction between the skin and leads to the dressing causing a shear force.

Ravenscroft et al (2006) also state that there are several other factors that may be responsible for the rate of

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blistering in patients undergoing joint replacement surgery. These include:

- ▶ Skin changes in older patients
- ▶ Soft tissue oedema following surgery
- ▶ Type of dressing used
- ▶ Mode of application of the dressing.

Performance of wound dressings in preventing wound blistering

Numerous studies have compared a variety of wound dressings and evaluated their performance in preventing the development of wound blistering to perioperative skin.

A prospective clinical audit of wound blistering undertaken on an orthopaedic unit in Glasgow, including more than 1,000 hip and knee arthroplasties, highlighted that skin blistering was common following the use of a traditional adhesive dressing and demonstrated a blister rate of 19.5% (Clarke et al, 2009).

In response to the high number of wound blisters, the authors piloted a new dressing design comprising a liquid film-forming acrylate (LFFA), which was applied to the periwound area, plus a highly absorbent Hydrofiber inner layer and a viscoelastic hydrocolloid outer layer.

In total, 173 patients received the dressing design incorporating the LFFA and 50 patients received the dressing design without the LFFA. The results showed that patients given the LFFA had at least as good results as those in the pilot study, with a blister rate of 2.3%.

The statistical analysis showed that removal of the LFFA from the design had no effect on blister or surgical site infection rates or on delayed discharge, with both series showing good results for those measures of effectiveness (Clarke et al, 2009). The authors suggest that they would recommend the use of the no-LFFA dressing design to minimise blister formation in total knee and total hip replacement wounds.

Recent studies also include research by Leal and Kirby (2008), who compared two dressings in order to find out whether results reported in a

study of orthopaedic patients (Cosker et al, 2005) could be replicated in a gynaecology setting in order to minimise risk of blistering, increase patient comfort, support patient care and give value for money.

There were a total of 67 patients in the evaluation, allocated to two groups. The trial group were prescribed vapour-permeable adhesive film dressing with an absorbent pad, and the control group were prescribed a self-adhesive absorbent dressing — 35 participants aged 28–55 years were allocated to the control group and 32 people aged 38–82 years were allocated to the trial dressing group.

The study resulted in a change of practice for patients undergoing abdominal gynaecological procedures and the authors have not reported any cases of blistering since the changeover.

None of the patients in the trial cohort developed blisters, compared with eight patients in the control group. The study resulted in a change of practice for patients undergoing abdominal gynaecological procedures and the authors have not reported any cases of blistering since the changeover.

Ravenscroft et al (2006) used a non-blinded randomised control trial to study two groups of patients due to have a total hip or knee replacement, or an operation for a fractured neck of femur (dynamic hip screw or a hip hemi-arthroplasty). They were prescribed either an absorbent perforated dressing with a traditional adhesive border or a combination of Hydrofiber and vapour-permeable film dressings applied to their wound postoperatively in theatre.

Two-hundred consecutive patients were entered into the trial after exclusion criteria were applied, with 183 being included in the study.

Seventeen patients were lost in the follow-up period, or had incomplete data. Ninety-eight patients were randomised to the absorbent perforated dressing and 85 to the Hydrofiber/film dressing combination. The research team's null hypothesis that there was no difference between the two dressings under test conditions was disproved.

They concluded that an elective operation was predictive of a healed wound, but this effect is modified when other factors are added to the equation. The researchers maintained that the wound dressing remained the single best indicator of a healed wound. Age, sex and American Society of Anaesthesiologists score illustrated no statistical relationship to outcome (Ravenscroft et al, 2006).

A clinical audit evaluating a vapour-permeable adhesive film dressing with absorbent pad and a self-adhesive absorbent dressing in 116 patients undergoing arthroscopic knee surgery, was reported by Bhattacharyya et al (2005). Sixteen patients were excluded from the analysis because of non-compliance with either the dressing regimen or failure to attend a follow-up assessment.

Fifty patients in each treatment group were included in the final analysis. Interestingly, the authors found no statistically significant differences in terms of blistering or wound infection between the two dressing regimens, although three patients treated with the self-adhesive absorbent dressing developed a tape blister and inflammation of the wound and one developed a wound infection.

No patients treated with the other dressing experienced a tape blister or wound infection. Fourteen (28%) patients treated with a self-adhesive absorbent dressing had periportal superficial inflammation at the time of suture removal (day 10), and this was significantly greater ($p < 0.001$) than the comparator group, where no signs of inflammation were reported (Bhattacharyya et al, 2005).

A comparative study between an absorbent cotton pad, wound pad and adhesive tape (standard dressing) and a Hydrofiber/hydrocolloid combination dressing was undertaken on 229 orthopaedic patients undergoing elective hip and knee replacement or repair of fractured hip (Meagher et al, 2009).

Patients were randomly allocated to either standard or combination dressing groups to compare the clinical and cost-effectiveness of two postoperative dressings in orthopaedic hip and knee surgery. The authors identified that incidence of blistering for elective total hip and knee replacement was 21.4% in the standard dressing group and 4.1% in the combination group, indicating a significant difference ($p=0.001$). Similarly, the incidence in the hip fracture group was 50% for the standard dressing compared to 0% in the combination group.

Overall, the rate of blistering in both elective and trauma groups was reduced by 25% in those who had the combination dressing ($p<0.001$) when compared to the standard dressing group (Meagher et al, 2009).

A survey of 113 surgical nurses in Finland asked participants to subjectively compare the performance of self-adherent five-layered absorbent foam with a soft silicone wound contact layer and other dressings they had used previously (Pukki et al, 2008). Previously used dressings included either a basic, single-layer dressing (an island-type dressing with traditional adhesives), or a combination bandage to dress surgical wounds.

Results of the survey highlighted that 91% of participants reported that they had observed a decrease in detrimental periwound skin reactions (42% considering the decrease to be significant) following the introduction of the soft silicone dressing, compared to previously used dressing regimens (Pukki et al, 2010).

In relation to the use of Hydrofiber dressings, one trial (Vogt et al, 2007)

did not find any significant differences in patient comfort and wound complications between a Hydrofiber and a central pad dressing. In contrast, Abuzakuk (2006) identified that a Hydrofiber dressing was superior to a central pad and a non-woven dressing in the incidence of blister rates and patient comfort following lower limb arthroplasty.

It is important that attention is given to the condition of the surrounding skin, for example, to whether it is friable, damaged, there are any areas of previous trauma, and whether there are any underlying medical conditions that may affect the skin.

Ravnskog et al (2011) undertook a randomised control trial where patients were split into two groups — one received a Hydrofiber dressing and the other an alginate dressing. Both dressings were covered with the same adhesive polyurethane film. All patients admitted for primary hip arthroplasty were randomised to the trial and out of the 201 patients asked to participate, 200 agreed to take part.

The outcome measures included skin damage (erythema, blisters and skin injuries) and the dressing's ability to handle exudate. Photographs of the dressing and the periwound skin were taken. Patients were asked to note skin problems, discomfort at mobilisation and pain at dressing removal. In the alginate group, there were significantly fewer blisters in the wound area compared with the Hydrofiber group (7% versus 18%, $p=0.03$). During dressing removal, significantly fewer patients in the alginate group reported pain than in the Hydrofiber group (2.1% versus 15%, $p=0.01$) (Ravnskog et al, 2011).

Preventing wound blistering

A wound dressing should maintain a

warm, moist healing environment and should not damage the periwound area, which could lead to blister formation.

Protection of the periwound area is vital and can be achieved by choosing a dressing that does not adhere to surrounding skin, is easy to apply, easy to remove and flexible. Flexibility of the wound dressing is essential, especially for orthopaedic wounds that are prone to swelling and have an increased risk of friction between the wound and dressing. Orthopaedic patients are encouraged to actively mobilise the operated joint postoperatively.

Furthermore, Cosker et al (2005) suggested that an orthopaedic wound dressing should be permeable and transparent, to allow inspection of the wound without the need to remove the dressing. It should also have the ability to act as a barrier to bacteria and water but not moisture vapour, and should be waterproof.

Interestingly, in a study of patients undergoing breast reconstructive surgery (Meuleneire et al, 2008), more than 80% of patients treated experienced postoperative skin lesions as a result of poor dressing choice. Following the use of a thin, self-adherent five-layered absorbent foam with a soft silicone wound contact layer, none of the patients developed even a minor blister around the postoperative wound.

The authors concluded that the use of the soft silicone dressing was more cost-effective in the long term because it reduced traumatic problems such as skin blistering.

Conclusion

Postoperative blistering is a problem associated with surgical wounds that is often overlooked. It is important that, when assessing a patient's wound, attention is given to the condition of the surrounding skin, for example, whether it is friable, damaged, if there are any areas of previous trauma, and whether there are any underlying medical conditions

that may affect the patient's skin condition such as rheumatoid arthritis.

Some medications may also affect the periwound skin and wound healing.

When choosing a dressing, referral should be made to the local formulary and local and national guidelines should be adhered to. Additionally, expert advice can be sought from the tissue viability team. Practitioners must record the condition of the perioperative wound area and immediately establish a plan of care to prevent the formation of wound blisters should the skin appear to be vulnerable. **WUK**

References

AAbuzakuk TM, Coward P, Shenava Y, Kumar VS, Skinner JA (2006) The management of wounds following primary lower limb arthroplasty: a prospective, randomised study comparing Hydrofiber and central pad dressings. *Int Wound J* 3(2): 133-7

Bhattacharyya M, Bradley H, Holder S, Gerber B (2005) A prospective clinical audit of patient dressing choice for post-op arthroscopy wounds. *Wounds UK* 1(1): 30-4

Clarke JV, Deakin AH, Dillon JM, Emmerson S, Kinninmonth AWG (2009) A prospective clinical audit of a new dressing design for lower limb arthroplasty wounds. *J Wound Care* 18(1): 5-11

Cosker T, Elsayed S, Gupta S, Mendonca AD, Tayton KJ (2005) Choice of dressing has a major impact on blistering and healing outcomes in orthopaedic patients. *J Wound Care* 14(1): 27-9

Jester R, Russell L, Fell S, Williams S, Prest C (2000) A one hospital study of the effect of wound dressings and other related factors on skin blistering following total hip and knee arthroplasty. *J Orthop Nurs* 4(2): 71-7

Leal A, Kirby P (2008) Blister formation on primary wound closure sites: a comparison of two dressings. *Wounds UK* 4(2): 31-7

Meagher H, Daly A, Loganathan K, O'Dwyer S, Saunders J (2009) A comparison of the clinical and cost effectiveness of two post operative dressings on blister formation following orthopaedic hip and knee surgery. *NIHS Res Bull*, June. Available online at: www.hse.ie/eng/staff/Leadership_Education_Development/National_Institute_of_Health_Sciences/Research_Bulletin/Research_Bulletin_Archive/June_09_H_Meagher.pdf [accessed: 26 November, 2011]

Meuleneire F, Mulier P, Martens MC, Fostier A, Goossens K (2008) Introducing of a New Procedure for Preventing Skin Lesions after Oncologic Breast Surgery. Poster presentation at the 3rd Congress of the World Union of Wound Healing Societies, Toronto, Canada, 2008. Available online at: <http://less-pain.com/documents/evidence/WC-M-033.pdf> [accessed: 26 November, 2011]

Polatsch DB, Baskies MA, Hommen JP, Egol KA, Koval KJ (2004) Tape blisters that develop after hip fracture surgery: a retrospective series and a review of the literature. *Am J Orthop* 33(9): 452-6

Key points

- ▶▶ The development of postoperative wound blistering can cause pain, discomfort, persistent wound leakage and possible risk of surgical site infection.
- ▶▶ Wound blistering has been associated with a number of factors: movement of the wound site; choice of dressing; tape use; age; gender; type of incision; medications; comorbidity; and cost-effectiveness of dressings.
- ▶▶ There have been numerous studies that have evaluated the performance of a variety of wound dressings in preventing the development of wound blistering to the perioperative wound skin.
- ▶▶ A wound dressing should maintain a warm, moist healing environment, but should not damage the periwound area because this could lead to blister formation.

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The website for wound care professionals

The screenshot shows the Wounds UK website interface. At the top, there's a navigation bar with links for Home, Journal, Events, Product Directory, E-Academy, Awards, About Us, Links, Webinars, and Contact. Below this, the main content area is divided into several sections: 'What's new?' featuring articles like 'After an Ag case reports' and 'Innovative 3D-thickness electronic wound assessment technology to be launched at Harrogate'; 'RELATED JOURNALS' listing various journals; 'UPCOMING EVENTS' for Harrogate 2011; and 'Highlighted features' including 'Tally SPAT educational tool launched' and 'Applied Wound Management Supplement - Part 2'. A search bar and 'QUICK SEARCH BUTTONS' are also visible on the right side.