

Blistering and skin stripping affecting coronary artery bypass graft patients

KEY WORDS

- ▶ Blister
- ▶ Infection
- ▶ Surgery
- ▶ Surveillance

Despite substantial reductions in the incidence of donor surgical site infection at the Royal Brompton Hospital, some coronary artery bypass graft (CABG) patients experience skin blistering and skin stripping (SBSS) at leg incisions following vein harvest. Method: Continuous, prospective surgical site surveillance of CABG patients was combined with tissue viability review over a 9-month period. Expert clinical opinion was sought on key areas of interest identified during the process. Results: A classification system was developed and a SBSS rate of 7% was established. Conclusion: Following vein harvest, the lower limbs of CABG patients are vulnerable to adverse skin reactions of blistering and/or skin loss thought to be associated with two principal mechanisms of pressure oedema and /or skin trauma caused by a highly adherent dressing.

The annual incidence of donor surgical site infections for coronary artery bypass graft (CABG) patients has decreased at the Royal Brompton Hospital (RBH) from 4.3% in 2009/10 to 1.3% in 2011/12. This is largely due to the introduction of a minimally invasive surgical approach, endoscopic vein harvest (EVH), in November 2009.

However, in July–September 2011, a trust-wide snapshot audit of CABG patients found a blister rate of approximately 7% (Rochon, 2012). The incidence of postoperative blister formation in the UK has been reported as 13–35% (Lee and Ying, 2008).

Concerns over skin blistering and skin stripping (SBSS) in the CABG peri-incisional area prompted an advanced nursing team (ANT) review at RBH. The ANT group comprised a clinical nurse specialist in surveillance, an advanced practitioner in infection control, a clinical nurse specialist in tissue viability and the modern matron/senior nurse for cardiothoracic services. The aims of the review were:

- ▶ To develop a new trust-wide classification tool for assessing perioperative skin SBSS.
- ▶ To seek expert clinical medical opinion on possible causes of SBSS.
- ▶ To provide complete and comprehensive audit data in order to implement solutions to prevent and/or reduce the incidence of SBSS around the

surgical incision (*Figure 1*) and to improve the patient experience.

- ▶ To review current trust data on donor site complications and to review RBH incidence of SBSS affecting CABG-related incisions in order to identify any common themes or trends.

AUDIT DATA

An audit of 390 patients who underwent CABG surgery between July 2011 and March 2012 at RBH found 7% ($n=29$) experienced adverse skin blistering and/or skin loss thought to be associated with two principal mechanisms, pressure oedema and skin stripping (*Figure 2*).

Blistering is thought to be caused by the application of the dressing (Poh-Fitzpatrick, 2012) and/or light compression bandaging of the lower limb (particularly if the spiral application is not providing a uniform pressure), which may create



Figure 1. Open technique surgical incision affected by blistering, showing honeycomb pattern.

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a direct pressure or compression effect leading to oedema blisters (Figure 3).

It is believed that skin stripping is related to the removal of high tack/high adherent dressing material causing skin trauma (Cutting, 2008) (Figure 4).

During the audit period, three CABG patients had blisters affecting their sternal incision. Blisters affecting sternal incision only are not included in rates because it was thought there may be different mechanisms involved. In cases where both sternal and donor issues were evident, allergic reaction was more likely.

Recommended practice at RBH is to apply OPSITE™ Post-Op Visible (Smith & Nephew) to sternal wounds and OPSITE™ Post-Op (Smith & Nephew) to donor incisions until bandages are no longer required, and then use OPSITE Post-Op Visible. The rationale for this is OPSITE Post-Op Visible used in the immediate post-surgical period may create a honeycomb pattern of oedema blisters (Figure 1). This may be due to the pressure applied by the bandaging to the honeycomb patterned dressing.

Correct dressing use minimises the risk of blistering. The dressing should not be pressed down during application. Dressings should be removed carefully (not in one continuous motion). The island should be supported and a gentle lateral motion to loosen the film adhesive should be used, working around the island, until the adhesive is loosened completely before the dressing is removed (Smith & Nephew, 2010).

Some smaller, sponsored studies suggest OPSITE Post-Op visibly reduces the incidence of skin stripping and/or blistering (Leal and Kirby, 2008; Byrne-Murphy, 2009). However, the issue of dressing choice to prevent blistering remains unresolved (Dumville et al, 2011; Ousey et al, 2011).

A standard approach to bandaging following CABG surgery could improve haemostasis, reducing bleeding and bruising, and improve patient comfort by reducing limb oedema. Although training has been revisited, there remains scope for improvement.

No published blister classification specifically for surgical patients was found. A classification system was developed by the RBH ANT for local auditing purposes (Figure 5).

The audit established the following:

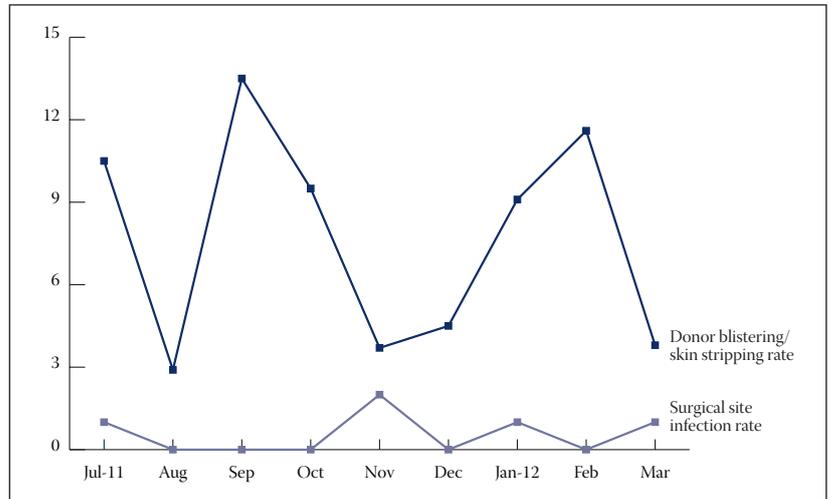


Figure 2. An overview of monthly donor surgical site infection and donor blister/skin stripping rates per 100 CABG operations (July 2011–March 2012).

- ▶▶ SBSS affects patients in different surgical teams.
- ▶▶ SBSS most commonly occurs in the area of the donor incision.
- ▶▶ SBSS affects endoscopic, stripped and open vein harvest incisions.
- ▶▶ The majority of blisters develop before day 3; one third of patients had blisters identified on day 1.
- ▶▶ Over half of the those who developed SBSS had skin vulnerable to pressure or shear forces. A strong adhesive dressing is not advised on vulnerable skin or for wounds requiring frequent dressing changes (Rippon et al, 2007).
- ▶▶ The current dressing choice (OPSITE) is ideal for the majority of CABG patients when considered alongside NICE guidelines (2008).

Characteristics of incisions and trends

This review benefits from previous trust audits of donor incisions; as well as expertise in lower limb management (Jakeman, 2010). Surgical site infection surveillance data indicate that approximately half of all patients who have undergone CABG surgery experience lower limb oedema. It would not appear that there is a direct correlation between blistering and lower limb oedema alone. Table 1 shows the most frequently observed characteristic in patients with SBSS was fragile skin (associated with bruising or bleeding or pre-existing skin problems). In most cases this can be identified most easily and accurately within



Figure 3: Oedema blister



Figure 4: Skin stripping



Figure 5. Royal Brompton & Harefield NHS Foundation Trust blister/skin stripping classification. a. Minor blistering/skin stripping: small blisters (<1cm diameter), up to two observed, no evidence of infection. b. Moderate blistering/skin stripping: size 1–2cm, up to three blisters observed, no evidence of infection. c. Severe blistering/skin stripping: large blisters/skin stripping (>2cm) and/or clusters of four or more blisters and/or infected.

the operating theatre environment (Taustanowski, 2009). Lower limb oedema, in conjunction with other factors such as pressure on the limb from bandaging or stockings (Naccarato et al, 2010) and the use and management of wound dressings (Conway and Whettam, 2002), is implicated in other patients.

For the ANT work to consider lower limb oedema, the Waterlow pressure ulcer risk assessment tool was used because it incorporates oedema in skin type assessment. The Waterlow score is a convenient, valid and reliable tool in the prevention of pressure ulcers (Bell, 2005). During January–March 2012, there was one CABG patient with a Waterlow score of >30 who did not develop SBSS.

OTHER FACTORS

A number of other factors were reviewed, including diabetic status, antiseptic pre-operative preparation solution, the possible roles of contact irritant or allergic reaction, and medications.

Diabetes

Diabetic blisters, also called bullosis diabeticorum or diabetic bullae, are relatively rare; large, irregularly shaped blisters on the legs and feet. The diabetic status of a patient is unlikely to be an

important contributing factor in the appearance of blistering. However, people with diabetes may experience higher white blood cell count and oedema, which may pose a risk of blisters in conjunction with other variables, including a highly adherent dressing. Diabetic status is included in the Waterlow score.

Irritant or allergic reaction to the dressing

In the case of an irritant or allergic contact reaction the SBSS area would be red, itchy and eczematous. In particular, where a honeycomb pattern is observed, an inverse pattern would be expected with blistering at the point where the dressing is in contact with the skin. In addition, it would be expected that other areas in contact with the trigger would similarly be affected, i.e. if the dressing was on the sternal wound and the donor wound, both sites would be affected.

Two patients did have blistering at the leg and sternal wound. Patients affected by blistering warrant dermatological referral. Note that there are blistering diseases associated with trauma.

Endoscopic vein harvest

At RBH, EVH is associated with a lower incidence of SBSS than the open technique. EVH demonstrates substantially lower wound complications (Aranki and Shopnick, 2011). Schultz et al (2006) report a blister rate of 0.3% for patients receiving EVH.

In January–March 2012, EVH was used in 72% of CABGs (*n*=89), with three patients developing SBSS (3.4%). Open technique was used in 34 cases, with six patients developing SBSS (18%). Two points were considered when looking at EVH

Table 1. Themes identified during review of SBSS (*n*=29)

Documented difficult harvest, excessive bruising or bleeding from donor site (<i>n</i>)	16
Pre-op issue identified (<i>n</i>)	6
Repeated dressing changes (<i>n</i>)	4
Waterlow score >30 (<i>n</i>)	3

blisters, CO₂ insufflation and heat irritation.

CO₂ insufflation is used during EVH and blistering possibly may arise from over-inflation or errant course, particularly during the harvest of superficial veins.

EVH systems use electrocautery to seal and cut branch vessels and adjacent tissues. However, bipolar diathermy settings are kept as low as possible during EVH and used in an intermittent fashion in order to avoid damage to endothelial cells.

The experience of the operators in EVH manages these issues. No single operator was associated with blistering, nor is the incidence of SBSS as high as with the open technique (possibly because EVH benefits from a smaller dressing surface requirement). Additionally, SBSS was seen at sternal and thoracotomy wounds which would not be related to CO₂.

Antiseptic solution

The choice of antiseptic did not appear to influence the development of SBSS. RBH uses Chloraprep® (2% chlorhexidine gluconate/70% isopropyl alcohol) for the majority of CABG patients, with Betadine®, aqueous solution of 10% povidone-iodine as an alternative. From January–March 2012, the rate of blistering with Chloraprep was 7% (8/108 including sternal blistering/skin stripping), and with Betadine was 9% (3/32). No current literature suggests a causal relationship between antiseptic solutions used intra-operatively and blister formation (Lee and Ying, 2008).

Antiseptic used in surgery may be a cause of allergic contact dermatitis (Ancona et al, 1990). Skin reaction, pooling of solution, not allowing the antiseptic solution to dry by evaporation, the chemical heat created from antiseptic and drape, and the removal technique of the drape are all possible factors in other postoperative blistering cases where blistering appears entirely separate to the peri-incisional area.

Medications

Some medications can cause mild, blistering skin reactions. Furosemide in high doses is associated with epidermolysis bullosa in patients with renal failure with clinically normal skin (Kennedy and Lyell, 1976; Goldfrank, 1994). Blisters would not be expected to be specific to the incision, but

would be widely scattered (Lee, 2006), especially if administered intravenously. Note that certain medications are included in the Waterlow score.

Other factors

Data on other factors were collected, such as on- or off-pump procedures (off-pump blister rate 4.9%, on-pump blister rate 7%). Data on ethnicity was not obtained because it was decided that such categorisation would be unsatisfactory for the purposes of this audit.

DRESSING APPLICATION AND REMOVAL

OPSITE Post-Op Visible and OPSITE Post-Op should be applied lightly and stretch should not be a problem with this dressing. Nevertheless, there remain some issues with dressing management including the highly adherent film placed over the vulnerable incision trapping or creasing the skin under the film, and the vertical removal of the complete dressing (rather than the gentle lateral pulls along the dressing border to release the film), all of which pose a risk to vulnerable skin.

The tissue viability team stresses the importance of careful dressing technique. Data on incorrect removal of the dressing could not be obtained for the period examined.

In response to the first cross-site audit (July–September 2011), six educational sessions on OPSITE Post-Op Visible were attended by 72 RBH staff members. These were provided by the Smith & Nephew clinical adviser between September and December 2011. This also helped address nursing staff turnover. This follows on from a large-scale educational programme that accompanied the introduction of the product.

Educational posters from Smith & Nephew showing the correct dressing application were placed in more prominent locations.

Ongoing on-the-spot training about appropriate dressing application is provided by senior ANT.

REPEATED DRESSING CHANGES

Studies demonstrate frequent dressing changes will cause skin trauma (Cutting, 2008; Rippon et al, 2007; Waring et al, 2008; Waring et al, 2011). One patient had a low Waterlow score and no identifiable risk factors, but still developed SBSS had repeated daily dressing changes. The tissue

“There remain some issues with dressing management”

viability nurse recommended Safetac® (Molnlycke) gentle border dressing.

ANT recommendations:

- ▶ The tissue viability team examined several low adherence/gentle dressings and agreed to advocate the use of dressings with Safetac technology for these patients. Other silicone contact dressings were trialled and Safetac technology dressings were preferred as patients required fewer dressing changes.
- ▶ Early referral of patients with fragile skin or who develop SBSS postoperatively.
- ▶ Change in wound management if heavy exudate, fragile skin, blisters or skin stripping.
- ▶ New guidelines on the management of postoperative wounds for patients with sensitive skin, including pre-operative identification

CONCLUSION

This study demonstrates the incidence of surgical blistering in the CABG patient group at RBH and provides a RBHT classification system of blistering/skin stripping. Expert input into possible contributing factors was sought.

A SBSS rate of 7% is lower than established rates in other categories of surgery (Lee and Ying, 2008). The next step is to develop strategies to reduce this rate, particularly in those people at high risk of SBSS. Strategies to reduce blisters due to pressure oedema are likely to be different than those to reduce skin stripping.

Maintaining good skin integrity is important. After the first 48 hours, surgical cardiac wounds continue to be covered with a dressing in order to provide a barrier to the outside environment; and the current dressing offers this and other significant advantages including facilitating early patient mobility and patient showering with the dressing *in situ*. NICE (2008) indicates no one dressing is demonstrably better than any other, but these ANT data suggest that CABG wounds healing by primary intention, particularly donor site harvest wounds, may benefit from risk stratification and trial of dressing materials/processes to ensure quality care of surgical wounds. Key to further works is drawing on the expertise of clinical colleagues to address these findings. A three month re-audit of blister/skin stripping rates following any intervention/change in practice is advised. 

Note: Smith & Nephew has transferred OPSITE to Mantis Surgical as part of a new partnership.

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