ASSESSING THE:
OPEN SURGICAL WOUND

Most surgical acute wounds will heal uneventfully in a predicted timeframe. However, a small proportion of these patients will develop complications and their surgical wound will not heal as planned. This article examines the aetiology, assessment and treatment of open surgical wounds.

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Figure 1. A dehisced abdominal wound.

Any type of invasive surgery can result in the patient being left with a surgical wound of one kind or another (*Figure 1*). Most of these acute wounds will heal uneventfully in a predictable timeframe and only result in a small scarred area for the patient. Over time, this will strengthen, fade and flatten (Timmons, 2006; Kelly, 2007).

However, for a small proportion of these surgical patients complications will arise and their wound will not heal as planned. For some, the wound may open up spontaneously (dehisce) due to a variety of reasons, such as infection (*Figure 2*), haematoma, mechanical stress, poor blood supply (ischaemia) (*Figure 3*), oedema or malnutrition. Wound dehiscence is a term used to describe a separation in a surgically closed wound. This can either be a partial dehiscence, involving only the superficial layers of the skin, or a complete dehiscence, involving deeper tissues (*Figure 4*). In the case of an abdominal wound, dehiscence may even involve exposure of the small or large bowel (Pudner and Ramsden, 2000).

Other patients may have their wounds left open intentionally by the surgical team, with some having primary closure achieved at a later date (delayed primary closure). However, the majority of open surgical wounds heal by secondary intention where the wound granulates from the base up and epithelialises to form a larger area of scar tissue. Secondary intention involves a

Figure 2. Sternal dehiscence due to Methicillin-resistant Staphylococcus aureas *infection following coronary artery bypass grafting (CABG) surgery.*

prolonged healing time.
The management of a patient with an open surgical wound is dependent on understanding the reasons why the surgical wound is open and then undertaking a comprehensive/holistic assessment.

Why is a surgical wound open?

A surgical wound may be left open intentionally by the surgical team or may become dehisced at a later date.

Left open intentionally

If a patient's surgical wound has been left open intentionally after surgery, it is usually for one of the following reasons:

- The wound edges cannot be approximated and therefore primary closure is not possible (*Figure 5*)
- The wound is heavily infected/ contaminated and to try and attempt to close it would possibly result in further infection and subsequent wound breakdown (Singer and Hollander, 2002)
- The patient may have undergone certain procedures, such as a fasciotomy for compartment syndrome (where the fascia is cut to release a build up of pressure in the muscle layers). To attempt primary closure in this situation would result in a further build up of pressure and subsequent necrosis (death of tissues) (*Figure 6*).

Dehiscence

If the patient has undergone surgery but in the post-operative phase the wound has spontaneously dehisced (opened up), it is usually due to one, or a combination of these reasons (see also *Table 1*):

- Presence of infection at the wound site. Postoperative wound infection can result in a small superficial dehiscence affecting only the superficial layers of the skin, right through to extensive dehiscence involving deeper tissue layers (Cooper et al, 2005)
- Haematoma (a collection of blood outside the blood vessels, generally the result of haemorrhage or internal bleeding). The development of a haematoma can often be identified by a hard raised area under a suture line. Haematomas can provide an ideal medium for bacteria to colonise and multiply (Pudner and Ramsden, 2000). Postoperative haematoma development can result in wound dehiscence. Removal of haematomas helps to reduce the chances of wound infection (Singer and Hollander, 2003)
- Poor nutrition, in particular a lack of collagen (a naturally occurring protein), will delay wound healing and increase the risk of wound dehiscence due to lack of strength within the wound (Gray and Cooper, 2001)
- Poor vascular supply to a wound can be caused by a chronic or acute condition such as peripheral vascular disease, oedema, anaemia or

Figure 3. Forefoot amputation dehiscence due to poor vascular supply.

Figure 4. Dehisced abdominal wound being cleaned showing healthy granulation (red) tissue.

Figure 5. Hallux amputation left open to heal by secondary intention due to inability to approximate wound edges for primary closure.

Figure 6. A healing fasciotomy wound left open intentionally to prevent deterioration of compartment syndrome (build up of pressure in the muscle tissue).

smoking. Wounds require a good quality of blood supply to facilitate the delivery of oxygen and essential nutrients to the wound bed (Miller and Glover, 1999). There is an increased risk of wound dehiscence if the blood supply is inadequate
- Mechanical stress on the wound can cause wound dehiscence due to a number of reasons, i.e. suturing being inappropriately tight, obesity, oedema, location of the wound and frequent movement of the affected area.

Holistic patient assessment

Before even considering the removal of a dressing that covers an open surgical wound, it is essential to undertake a holistic assessment of the patient to determine if their body has enough capacity to facilitate wound healing. Within that assessment the following key points should be assessed and actions implemented to try and improve the chances of successful wound healing:

- Current clinical situation: for example, the nurse needs to take note of any postoperative pain management regimens, i.e. anaelgesia, whether the patient is nil by mouth prior to surgery, if the patient is immobile postoperatively, the use of antibiotics, whether the patient is experiencing a lack of sleep/rest, and if the patient is experiencing any blood loss
- Patient's age
- Presence of any co-morbidities, e.g. diabetes, cancer, neuropathy, peripheral vascular disease, anaemia, palliative diagnosis, immunosuppressive conditions
- Malnutrition, e.g. dehydration, the patient's ability to buy/prepare nutritious food, ill-fitting dentures, swallowing difficulties, taste changes due to old age or medications, lack of nutritional knowledge, obesity, anorexia
- Medication, e.g. steroids, chemotherapy, inotropes (drugs that affect the strength of contraction of heart muscle)
- Social/psychological issues, e.g. motivation, attitude, body image, care environment, family/carer support, stress levels, compliance with treatment regimens, acceptance of the wound, financial concerns, occupation, cultural/religious beliefs, substance misuse.

Miller (1995) describes an approach to patient assessment where two questions are asked: 'What factors are interfering with wound healing?' and 'Which of these can be changed to help the wound to move on?'

It is essential that the factors above are recognised in order that the patient has an improved chance of wound healing.

Wound assessment

Once the patient assessment has been undertaken it is time to look at the signs and symptoms of the wound and determine a plan of care based on all of the information gathered.

Documentation

Documentation of the wound assessment is as essential as the assessment itself (Miller and Glover, 1999; Eagle, 2009). Without documentation there is no evidence to prove that the wound was assessed at all. Similarly, there is no information for colleagues to compare against when they perform subsequent assessments — this means it will be impossible for them to determine whether any progress has been made.

Table 1.

Reasons for wound dehiscence (Burton, 2006)

- Infection
- Failure to achieve haemostasis with subsequent haematoma development
- Poor nutritional intake
- Excessive exudate caused by an infection or localised oedema
- Poor vascular supply caused by a chronic or acute medical condition, emboli, oedema, anaemia, obesity or smoking
- Mechanical stress on the wound caused by patient movement, obesity, oedema or localised pressure

Most clinical areas will have a wound assessment form. The use of this form is an ideal way to ensure that no aspect of any assessment is forgotten. It provides a quick and easy way of documenting wounds and often has a body map to show the precise location of the wound.

This is especially useful if there are multiple wounds to chart. In addition, the wound assessment serves as a legal document should the need arise to prove that a care plan was documented and appropriate care delivered (Eagle, 2009).

If a wound assessment form is not used in the nurse's clinical area, the following factors should be recorded in the patient's notes to ensure a clear, concise record and a continuity of care (Nursing and Midwifery Council [NMC], 2008). Photographs of a wound (taken with the patient's consent) can be helpful when there are multiple wounds that are in very close proximity to each other.

The following elements should be included in any wound assessment documentation.

Figure 7. Forefoot amputation showing why depth measurement is vitally important. This wound swab has been probed to a depth of 8cm.

Aetiology

The aetiology represents the cause of the wound. Before thinking about how to progress any wound the aetiology should be identified. In the case of the open surgical wound, the type of surgery undertaken and the reason the wound is now open should be determined as this will influence the plan of care. For example, if the wound has dehisced due to poor nutrition, the priority for ensuring the wound now progresses is to improve the patient's nutritional status.

Anatomical location of the wound

The correct anatomical location of the wound is important as, for example surgical wounds over the plantar (bottom) surface of the foot will be more difficult to heal than those on the dorsum (top) of the foot due to the pressure from walking and standing. Similarly, a surgical wound at the top of the leg near the groin is more likely to become contaminated than one on the leg over the knee.

Wound size

The dimensions of the wound should be measured and recorded, including the presence of any sinuses (sacs or cavities in any organ or tissue), fistulae (abnormal connection between two organs or vessels that normally do not connect), or undermining (an area of tissue death underneath intact skin).

In UK health centres it is normal to use centimetres as the unit of measurement. The maximum length, width and depth of the wound should be recorded as a minimum, using tape measures and wound probes (*Figure 7*). A measurement of surface area using tracings, telemedicine or Visitrak® (Smith and Nephew) (a digital wound measurement device) can often provide a more accurate evaluation of the wound dimensions. However, in practice it is often difficult to obtain the necessary equipment and accuracy varies depending on the practitioner.

Figure 8. Forefoot amputation showing 40% necrotic (black); 35% sloughy (yellow); and 25% granulating (red) tissue.

Ideally, a photograph or series of photographs should be taken of the wound if the patient consents to this. Photographs are particularly useful if the wound is large and difficult to describe (for example a circumferential wound around a leg) or if there are multiple wounds.

Tissue type

The different tissue types covering the wound bed should be measured in percentages (*Figure 8*). This allows nurses to compare the progress of the wound at each assessment and determine if it is improving, static or deteriorating.

The most common types of tissue seen in the wound bed are:

- Necrosis: black/brown-coloured, dehydrated, dead tissue
- Slough: yellow-coloured, fibrous stringy tissue
- Granulation: red-coloured, lumpy bright vibrant tissue
- Epithelialisation: pink/silvery-coloured tissue representing the final stage of wound healing.

Less common tissues/structures that may be seen in a surgical wound and should be noted include:

- Metal work
- Bone (*Figure 9*)
- Tendon (*Figure 10*)
- Sutures (*Figure 11*)
- Over-granulation.

Pain

Pain can be a very distressing feature of wound care. Price et al (2008) reported that 40% of patients rated pain at dressing change as the worst part of having a wound. Taylor and Jeffrey (2009) describe pain as being non-conducive to wound healing when managing extensive acute traumatic injuries as it can result in a non-compliant and exhausted patients. The pain experienced in acute surgical wounds

Figure 9. Forefoot amputation covered in slough (yellow) and with exposed bone.

should lessen as wound healing progresses (Bowers and Barrett, 2009) and therefore a sudden increase in pain should alert the clinician to a potential problem.

The World Union of Wound Healing Societies (WUWHS) classify wound pain into sections (WUWHS, 2004) (*Figure 12*), including:

- Operative pain (i.e. the cutting of tissue as in sharp debridement)
- Procedural pain (e.g. dressing changes; exposure to the air; use of cool irrigation fluids)
- Incident pain (i.e. dressing slippage)
- Background pain (e.g. ischaemic, neuropathic or infection-related pain).

Alongside these factors are the environmental considerations (e.g. level of noise; positioning of the patient; distraction techniques; preparation for a procedure), and psychological factors (e.g. knowledge and education of the patient; fear; age of the patient; confidence in the healthcare professional) that can all influence how the patient deals with pain. For this reason, pain should be assessed before, during and after dressing changes and appropriate action implemented to ensure the patient remains as pain-free as possible.

Formal assessment and documentation of pain is highly recommended and should ideally be carried out using an appropriate pain scale (WUWHS, 2004). There are a number of different scales available — these are usually locally chosen to ensure continuity within the trust

Figure 10. Surgically debrided de-gloving injury with tendon exposed. This type of wound is left open to heal by secondary intention or with skin graft/muscle flap coverage.

Figure 11. Dehisced abdominal wound with deep tension sutures visible.

and differ for use in specialist areas such as paediatrics.

Exudate

The presence of exudate in a wound during the healing process is normal and its role should not be underestimated. However, too much or too little exudate will hinder the wound healing process. Winter (1962) described how epithelisation occurred much faster under moist healing conditions and this forms the basis of modern wound healing. The exudate in acute wounds is vital as it is rich in growth factors essential for wound healing (Cameron, 2006).

However, excessively high exudate levels can indicate problems such as infection, sinus or fistula and poor choice of

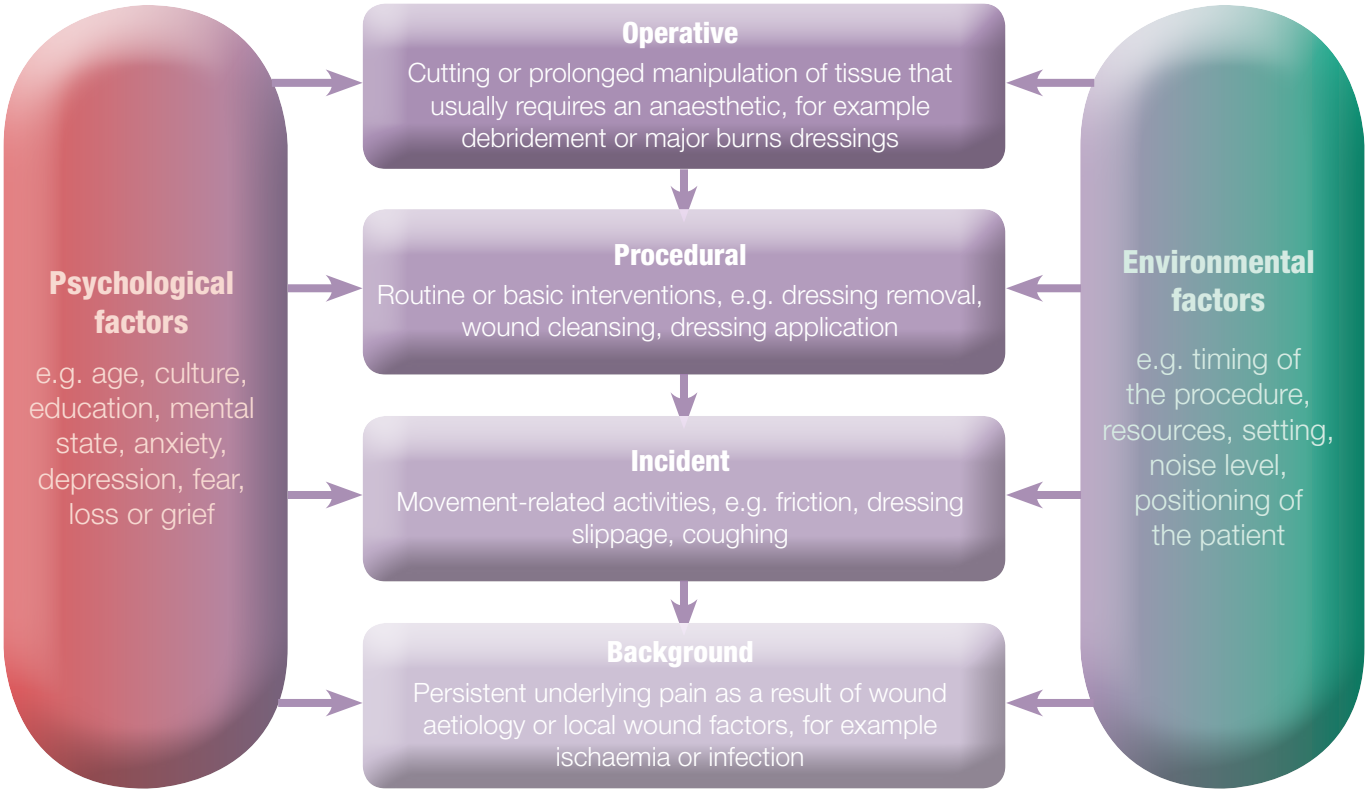

Figure 12. Causes of wound pain (WUWHS, 2004)

dressing, whereas excessively low exudate levels are often a sign of ischaemia or dehydration.

Measurement of exudate is often very subjective with terms such as 'low', 'moderate' and 'heavy' used to describe how much exudate is present in a wound. As such, the amount of exudate can be miscalculated by nurses when reviewing the progress of the wound. The level of exudate production should in the main be related to the size of the wound, i.e. the larger the surface area, the higher the exudate level.

Thomas et al (1996) describe performing an assessment of exudate levels by weighing dressings after removal, however although useful for research purposes, replicating this in clinical areas would be very impractical.

Bale et al (2000) also discuss the difficulties of measuring exudate levels. They suggest determining the level of exudate by frequency of dressing change, i.e. if the dressing requires daily changes this would equate to a heavily exuding wound; those needing three or four changes per week are classified as moderately exuding; and those requiring weekly changes are classified as low exuding wounds. All of this is based on the use of an appropriate modern wound care product.

In addition to the level of exudate, the consistency and colour are also important descriptors to note. Normal exudate should be a serous (clear, yellow/straw coloured) fluid with a thin watery consistency. Postoperatively, however the exudate can be blood-stained and would be described as haemoserous (orange/red in colour). This should not be confused with frank blood (bright red), which should not be expected postoperatively. Thick creamy offensively odorous exudate may indicate inflammation, infection or less commonly the presence of a fistula, i.e. into the bowel (*Figure 13*).

Odour

Most wounds will produce little or no odour and this is

Figure 13. Green exudate suggestive of Pseudomonas aeruginosa *infection.*

perfectly normal. Offensive odour produced by a wound can be distressing for the patient/carers and relatives and can result in social isolation.

When carrying out a wound assessment, any new odour should be documented and reported and actions implemented to try and reduce it. However, odour, like exudate, is difficult to quantify. The patient is often the best judge of whether the odour is offensive as they are the one living with the wound. One way of classifying odour is to take note of whether it is present when dressings are in place or when they are removed — some odour may be due to stale dressings, which will require more frequent changes.

Odour is typically caused by infection and an increase in bacteria within the wound bed, which requires appropriate treatment. It can also result from the presence of necrotic tissue, which unless contraindicated will require debridement.

Surrounding skin

The assessment of the skin surrounding a wound can provide clues to the success of the wound management regime and the progress being made. Maceration, excoriation, dry scaly skin, oedema and allergic reactions are all signs that the current care plan is not effective and that adverse effects are occurring.

If there are signs of maceration (white soggy wet tissue), the exudate is uncontrolled and requires absorbent dressings that are changed more frequently. If the skin is dry and scaly, the appropriate use of emollients to improve the overall condition of the skin is essential. Excoriated skin indicates that the exudate is not being adequately controlled and the skin needs protection before it becomes severely damaged. Barrier films such as Cavilon™ (3M) are useful, as are high-absorbency dressings.

In the case of oedema (fluid retention in the body's tissues), encouraging mobility, limb elevation and joint exercises are all useful adjuncts to the mopping up of exudate.

If the nurse suspects that the patient may be allergic to a particular wound care product, that particular product should be discontinued and the patient referred to a dermatologist for patch testing in order to identify any allergens.

Table 2.

Clinical signs of wound infection (Cutting and Harding, 1994)

- Abscess
- Cellulitis (redness, heat, swelling, pain)
- Discharge (serous, seropurelent, pus)
- Delayed healing (compared with normal rate for site/condition)
- Discolouration
- Friable, bleeding, granulation tissue
- Unexpected pain/ tenderness
- Pocketing/ bridging at the base of the wound
- Abnormal smell
- Wound breakdown

Infection

For up to seven days after an operation, any new surgical wound will exhibit signs of postoperative inflammation. However, it is important that the nurse observes for signs of wound infection (*Table 2*), as these can easily be confused with inflammation.

Wounds swabs should only be taken in wounds that are showing signs of infection. The routine swabbing of wounds will inevitably uncover bacteria, however many wounds will continue to progress unhindered (Bale et al, 2000; Kingsley, 2001).

Care objectives/plan of care

Once a holistic patient and wound assessment has been carried out, achievable objectives should be set by the patient and nurse in collaboration. This partnership is essential as the patient will often have differing views of their aims and objectives for the wound.

While the nurse may have a short-term goal of extending the wear time of the dressing and a longer-term aim of healing the wound, the patient may simply be striving for a pain-free and dry dressing over a 24-hour period.

Any plan of care and objectives should be reassessed frequently and in partnership with the patient. This ongoing collaboration will facilitate greater

concordance with any care plan (Eagle, 2009).

Conclusion

Assessment of the open surgical wound follows the key principles of any wound assessment. The first priority is to understand the mechanism that has resulted in the patient having an open wound, i.e. the type and complexity of the surgery. Secondly, the nurse needs to use the principles of holistic wound assessment to identify if the patient has the physical and psychological ability to heal the wound. Thirdly, objective measurements should be used to monitor the progress of the wound, thereby ensuring that colleagues can follow the plan of care. Lastly, nurses should ensure that the patient is involved. WE

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Key points

- There are many types of surgery that will result in the patient being left with a surgical wound.
- However, for a small proportion of these patients complications will arise and their surgical wound will not heal as planned.
- For some, the wound may dehisce spontaneously due to a variety of reasons, other patients may have their wounds left open intentionally, with some having primary closure achieved at a later date.
- Assessment of the open surgical wound follows key principles of any wound assessment.