Guide to avoiding complications after Caesarean section

Lindsey Bullough
Tissue Viability Nurse, Wrightington, Wigan and Leigh NHS Foundation Trust
Reducing Caesarean section complications

The proportion of births delivered by Caesarean section (CS) in England has risen substantially over the past 30 years, from 9% in 1980 to 25% in 2009–2010 (Health Protection Agency (HPA), 2012). Following a study of 4107 women who had a CS, the HPA identified 394 surgical site infections (SSIs) (9.6%). Although the majority were minor (88%), they were seen primarily in overweight or obese women. The research also highlighted that the infection rate was greater than anticipated for what is considered a ‘clean operation’, with the percentage of SSIs following a comparative operation (hysterectomy) being 6.6% (HPA, 2012).

This guide describes how CS wounds heal and what can cause complications. It suggests how such wound complications can be avoided.

Wound healing

Wound healing is the process by which the body replaces and restores function to damaged tissues. Wounds heal by either primary, secondary or tertiary intention (Table 1).

Acute wound healing

Wounds that proceed normally through the repair process are usually referred to as acute wounds. An acute surgical wound progresses through the following phases of the wound healing process:

**Inflammation (day 0–5)**

This is an essential part of the process. Inflammation is a vascular and cellular

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response that serves to dispose of microbes, foreign material and dying tissue in the wound in preparation for tissue repair.

**Migration (day 3–14)**
This phase is characterised by:
- Formation of granulation tissue (collagen-rich tissue that forms at the wound site)

![Figure 1. Inflammation: inflamed wounds produce exudate containing growth factors and white blood cells that ingest bacteria and cellular debris](Image)

**Figure 1.** Inflammation: inflamed wounds produce exudate containing growth factors and white blood cells that ingest bacteria and cellular debris

![Figure 2. Migration: the arrival of blood, nutrients and proteins at the wound site results in the creation of granulation tissue, which begins to bridge the wounded area](Image)

**Figure 2.** Migration: the arrival of blood, nutrients and proteins at the wound site results in the creation of granulation tissue, which begins to bridge the wounded area

- Wound contraction
- Epithelialisation (migration of new tissue resulting in wound closure)

**Maturation (day 7–1 year)**
This is the final phase in wound healing. The original collagen is converted into a stronger collagen, which is laid down following the tension lines within the wound, and is also cross-linked to give strength to the scar tissue. During this final phase, scar contracture (tightening) may occur when the collagen reorganises itself in response to stretching and extension. This will continue long after the functional barrier of the skin has been restored. However, even at one year, the wound strength is never more than 80% of what it was before the injury/surgery and it will never fully regain its pre-injury/surgical tensile state (Haas, 1995).

![Figure 3. Migration and epithelialisation: collagen fibres originating from the granulation tissue criss-cross to form scar tissue. Meanwhile, epithelial cells at the wound edge migrate towards the wound centre, resulting in wound closure](Image)

**Figure 3.** Migration and epithelialisation: collagen fibres originating from the granulation tissue criss-cross to form scar tissue. Meanwhile, epithelial cells at the wound edge migrate towards the wound centre, resulting in wound closure
Management of the uncomplicated C-section
A wound healing by primary intention should be covered for a minimum of 48 hours, by which time it will normally have sealed (Dealey, 2005). If there is excessive wound drainage during the first 48 hours after surgery, the wound should be cleansed with sterile saline using an aseptic technique (National Institute for Health and Care Excellence (NICE), 2008). An acute CS normally heals in 8–14 days; healing should coincide with removal of clips or staples. NICE (2008) recommends use of advanced wound dressings, such as a semipermeable island film or a hydrocolloid, rather than low-adherent postoperative island dressings, on acute surgical wounds such as CSs.

Semipermeable dressings provide a waterproof and bacteria-proof barrier. Unlike low-adherent postoperative island dressings, film dressings tend to have a two-way stretch, making them an excellent choice for areas where postoperative blistering could occur.

Postoperative dressings also need to be absorbent and have a high moisture vapour transmission rate (MVTR). This allows excess moisture (exudate) to evaporate through the dressing, while

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maintaining a moist environment conducive to healing (Jones et al, 2006).

Exudate is produced as part of the inflammatory stage of the wound–healing process to stop the wound drying out. When a wound is healing normally, the volume of exudate decreases as the wound heals and it is usually clear and straw or amber coloured (Gardner, 2012).

Acute wounds healing by primary intention (sutured incisions) sometimes leak small amounts of exudate if closure is incomplete. This usually reduces quickly and they will heal without complication (Wounds UK, 2013).

Roberts et al (2011) identified the following properties of effective postoperative dressings. They:
- Allow postoperative inspection of the wound and periwound area in the first 24–48 hours without the need for removal
- Are low-adherent and so can be easily removed from the wound
- Maintain a moist wound environment
- Are waterproof/showerproof
- Can be left in place for up to 7 days
- Conform to the body’s contours and tend to be more stretchy, allowing the patient to move more freely and comfortably with less risk of blistering.

**The complicated wound**

Most CSs heal uneventfully within a predictable timeframe. However, for a small proportion of patients, the wound will develop complications.

**Infection**

Risk factors for SSIs and wound breakdown are not only intrinsic to the patient, but also relate to the surgery and use of anaesthetic (Table 2). Infection is a continuum ranging from contamination, colonisation, critical colonisation, to infection (Sibbald et al, 2003). The surface of all open wounds is contaminated with non-replicating organisms, which are usually cleared by the host. Colonisation occurs when organisms replicate, increase in number, and adhere to the wound bed without harming the host.

However, these replicating organisms can cause changes that trigger the body’s immune response locally at the wound site only. This is known as critical colonisation, which may delay wound healing. If this process is unimpeded, the organisms in the wound and surrounding soft tissue can increase still more, and cause a host response, resulting in non-healing or the deterioration and breakdown of the wound (Sibbald et al, 2003) (Box 1).

<table>
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<td>Wound contamination: the presence of bacteria in a wound without any host reaction</td>
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<tr>
<td>Wound colonisation: the presence of bacteria in the wound that multiply but do not cause a host reaction</td>
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<tr>
<td>Critical colonisation: multiplication of bacteria causing a delay in wound healing. This is usually associated with the onset of pain but no overt host reaction</td>
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<td>Wound infection: the deposition and multiplication of bacteria in tissue with an associated host reaction</td>
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Friable granulation tissue, wound breakdown and wound malodour are now thought to be the most reliable indicators of wound infection, even more so than the classic signs, including pain, erythema, oedema, heat and purulence (Cutting et al, 2005; Gardner et al, 2012).

To swab or not to swab?
A wound can exhibit signs of inflammation for up to 7 days post-surgery. These can be confused with the signs of infection. A wound swab or sample of pus, therefore, should be taken only if any of the above clinical signs of infection are present.

Sibbald et al (2003) stated that microbiological investigations should only be used to aid diagnosis based on observation of clinical signs, and even then the results would only be able to identify the specific bacteria present in the wound and not whether they were causing a host reaction.

Management
Patients with a systemic wound infection should be treated with systemic antibiotics (Landis, 2008) and, where appropriate, topical antimicrobial dressings.

Haematoma
A haematoma is a collection of blood outside the vessels, and is usually the result of a haemorrhage or internal bleeding. The availability of nutrients and oxygen, and presence of devitalised tissue, makes this an ideal environment for bacterial multiplication, increasing the risk of malodour and infection (White and Cutting, 2005). Removing this tissue will reduce the bacterial burden within the wound (Vowden and Vowden, 1999). A postoperative haematoma can therefore result in wound dehiscence once the devitalised tissue has been removed.

Dehiscence
Dehisced surgical wounds are classified as wounds that were originally closed with sutures, staples/clips, tissue adhesives or adhesive paper strips, but then have opened up to reveal the wound cavity. These wounds may be re-sutured but are often treated conservatively and allowed to heal by secondary intention (Dealey, 2005).

Risk factors are:
- Infection
- Failure to achieve haemostasis with subsequent haematoma formation
- Poor nutritional status
- Excessive exudate caused by an infection or localised oedema
- Poor vascular supply caused by a chronic or acute medical condition, emboli, oedema, obesity, anaemia or smoking.

Figure 4. Caesarean section wound with PICO NPWT system in place
- Mechanical stress on the wound caused by movement, obesity, oedema or localised pressure (Burton, 2006).

**Obesity**

Obesity is strongly associated with SSIs, with the risk increasing with size (HPA, 2012). Overweight patients (body mass index (BMI) 25–30) are 1.6 times more likely to develop an infection than patients with a BMI of <25; women with a BMI of 30–35 or >35 are 2.4 and 3.7 times more likely to develop an infection, respectively, than their peers (HPA, 2012). Vuolo (2006) suggests this may be because:

- Technical difficulties occur when creating the incision, due to the mass of adipose tissue
- Adipose tissue, being an avascular mass, causes tissue hypofusion and decreased oxygen tension, leading to wound breakdown
- The overhang of tissue in obese patients can become overly moist, creating a breeding ground for bacteria
- Failure to adjust antibiotic prophylactic dosage for the increased volume of distribution. This leads to inadequate tissue dosage levels, which may predispose obese patients to SSI.

**Management**

Standard postoperative dressings for incisional wounds, such as CSs, are suitable for absorbing exudate but do not have healing properties. Negative pressure wound therapy (NPWT) is a therapeutic technique that uses a vacuum device to promote healing in acute and chronic wounds. The therapy involves the controlled application of sub-atmospheric pressure to the local wound environment, using a sealed wound dressing connected to a vacuum pump (Gupta et al, 2007). It removes excess fluid from the wound bed and enhances circulation. This creates a moist healing environment and reduces oedema (Ballard and Baxter, 2001).

Use of NPWT in wound management has increased dramatically in the past 20 years, and a large number of studies have been published on it. While NPWT for the treatment of open wounds is not uncommon, few studies have investigated its ability to prevent infection and/or wound breakdown in closed incisions.

PICO (Smith & Nephew) is a small, disposable and portable NPWT unit that:

- Maintains the negative pressure across the wound bed
- Removes exudate from the wound bed through absorption and evaporation.

**Clinical experience**

At Wrightington, Wigan and Leigh NHS Foundation Trust, due to the high rate of readmissions and wound infections following CS in women with a BMI >35 (12% in 2011–2012), it was decided to use PICO to assist with wound closure. The device was left in situ for one week and then managed by the midwife on discharge from hospital. A small evaluation of 50 patients with a BMI >35 who used the device post-CS was conducted to assess its potential benefits. The results showed that none of these patients developed an infection or an open wound at 30 days’ follow-
up (Bullough and Wilkinson, 2012). Following the evaluation, use of PICO is now standard practice for this patient group in the trust.

**Conclusion**

It is essential that we do all we can to minimise the risk of infection in patients undergoing CS. One way to do this is to identify criteria that may place a patient at higher risk of wound complications, either due to their body weight or their relative health at the time of surgery. NPWT may not be necessary for the majority of patients, but it may be a potential alternative to traditional dressings for high-risk patients, although more research is needed to confirm this.

**References**


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