Wound Management

10

Carina Bååth and Ami Hommel

10.1 Introduction

Wounds have a significant effect on patient experiences and their care. The management of wounds is a fundamental aspect of the management of the patient following a fragility fracture, especially following a hip fracture and associated surgery. Patients with a fragility fracture might not only have a surgical wound after the surgical procedure but may also have other wounds such as a leg ulcer, skin tears, diabetic foot ulcer, pressure ulcer or eczema as well as be at risk of incontinence-associated dermatitis. Nurses and other practitioners must check patients' skin from head to toe at admission. Ageing skin and multiple comorbidities are significant factors in skin injury and wound healing problems. All wounds require evidence-based intervention.

This chapter aims to provide an overview of skin and wound assessment and evidence-based nursing interventions that can optimise wound healing in older people with fragility fractures.

C. Bååth
Karlstad University, Karlstad, Sweden

Östfold University College, Halden, Norway
e-mail: carina.baath@kau.se

A. Hommel (✉)
Malmö University, Malmö, Sweden

Skåne University Hospital, Malmö, Sweden
e-mail: Ami.Hommel@mau.se

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10.2 Learning Outcomes

At the end of the chapter, and following further study, the nurse will be able to:

- Discuss the factors that inhibit and enhance wound healing.
- Assess older persons' risk for skin tears.
- Provide evidence-based care to fragility fracture patients with wounds.

10.3 Wound Healing Physiology

Wound healing is the process by which the function of damaged tissue is restored following surgery, trauma or other sources of tissue damage. It is a dynamic, complex process that is significantly affected by the nature of the wound, pre- and postoperative management, the patient's health status, the care environment and the care that is given. To understand what wound care is needed, what wound dressing should be used or why a wound is not healing, practitioners must understand the wound healing process.

Regardless of the aetiology of the wound or whether it is acute or chronic, the repair processes are similar. The wound healing process is a normal biological cascade. Although it is a complex biological process, it is classically divided into four phases: rapid haemostasis, appropriate inflammation, proliferation and remodelling [1, 2]:

Haemostasis: Haemostasis starts within the first 15 min after the injury/surgery. At this stage, bleeding is controlled with vascular constriction, forming a platelet thrombus, propagation of the coagulation cascade, termination of clotting and removal of the clot by fibrinolysis. This process prepares the wound for future stages of healing.

Inflammation: The inflammation phase begins immediately after the injury when the injured blood vessels leak transudate (consisting of water, salt and protein), causing localised swelling. Inflammation both controls bleeding and prevents infection so is an essential part of the initial healing process providing that it lasts for the right amount of time and does not become chronic. Following platelet activation, inflammatory cells migrate to the wound site during the first few days following the injury/surgery. Mast cells release vasoactive cytokines such as prostaglandins and histamine, which increase capillary permeability and promote local dilation to aid the migratory process; damaged cells, pathogens and bacteria are removed from the wound area. This process enables the cells and chemicals needed for wound healing to reach the wound site. White blood cells, growth factors, nutrients and enzymes create the classic signs of inflammation; swelling, heat, pain and redness are commonly observed during this phase.

Proliferation: The proliferative phase occurs 3–21 days after injury/surgery. The wound is rebuilt with new collagen and extracellular matrix tissue. This phase involves angiogenesis (growth of new capillary vessels), granulation tissue production, collagen deposition and epithelialisation. The primary outcome of this phase is the filling of the wound defect. Hypoxic conditions in the wound bed lead to nitric

oxide synthesis by endothelial cells, stimulating vascular endothelial growth factor to release and promote angiogenesis.

Remodelling: The remodelling phase is also called the maturation phase and includes collagen cross-linking, remodelling and wound contraction. The cells used to repair the wound but no longer needed are removed by apoptosis or programmed cell death. This process can continue for 1 year. A wound will regain 80% of its original strength 3 months after injury [1, 2].

There are many factors that can influence these processes, so individual patients' wound healing can progress or be delayed differently. The role of the practitioner in wound care is to optimise the factors, which support healing so that wounds can heal in a timely way, without complications.

10.4 Surgical Wounds

The definitive management of hip fracture and other significant fragility fractures almost always requires surgical fixation (see Chap. 7). Consequently, most patients require surgical site wound care during the hospital stay and following discharge. Surgical wounds occur under controlled circumstances, and surgeons try to ensure minimal tissue loss and a good approximation of the wound edges during wound closure. However surgical wounds are also an important source of potential complications due to the risk of infection, haematoma and wound healing problems such as dehiscence (wound breakdown).

Nurses and other practitioners have many clinical decisions to make about the management of surgical wounds. There is a lack of scientific evidence considering issues such as how long the dressing that is applied under sterile conditions after the operation should remain in place, although knowledge based on clinical experiences suggests that it should remain for at least the first 48 h, as most surgical wounds are then sealed.

The main aim of care of the wound is for it to heal rapidly without complications such as infection or dehiscence. However, for many patients who have surgery following a fragility fracture, their general health may be poor, they may have multiple pre-existing health problems and medications, they may be malnourished (see Chap. 11) and they may be frail (see Chap. 3), all of which can significantly affect healing.

10.4.1 Recognising and Preventing Surgical Site Wound Healing Problems

The complex wound healing process can be interrupted, delayed or halted due to extrinsic and intrinsic factors:

- *Extrinsic factors* may include smoking, medication, pain, illicit drug use and alcohol consumption, mechanical stress, moisture, infection and chemical stress.
- *Intrinsic factors* are multiple comorbidities, increased age, obesity, nutritional status and health status.

These factors affect the health of the cells involved in wound healing by disrupting blood supply to the tissues and can lead to disordered immune and inflammatory processes. To prevent delayed wound healing, practitioners must be able to apply a knowledge of the skin structure, phases of wound healing and wound types to be able to identify risk factors in healing and decide on the most appropriate evidence-based treatment and care to support the healing process. The prevalence of wound healing problems has not been extensively studied in older adults with hip fractures, even though age has been identified as a potential risk factor for delayed wound healing.

Some surgical wounds may be considered a short interruption in the continuity of protective properties of the skin resulting from surgery and can be expected to make rapid and predictable progress towards healing [3]. For the older person who has undergone surgery, however, numerous factors place them at greater risk of wound healing problems such as infection, haematoma, dehiscence, sepsis and death. To facilitate optimal wound healing, the general health and well-being of the patient must be optimised both pre- and post-operatively while considering the patient's past medical/surgical history, medications/polypharmacy and current health history, as discussed in Chap. 7. The following section provides an overview of the care priorities for supporting wound healing.

10.4.1.1 Optimum Nutrition

The patient's nutritional status can significantly influence wound healing. Poor nutrition is the most common reason for wound healing problems, and optimum nutritional intake is central to ensuring wound healing without complications. This is especially important given the prevalence of malnutrition in older hospitalised patients who may also have undergone prolonged fasting preoperatively. The best way to improve nutritional status is for the patient to consume a varied diet rich in necessary nutrients. If food or nutrient intake is inadequate, nutritional supplementation may be warranted [4]. Food contains calories, protein, fluid, vitamins, minerals, dietary fibre and a wide variety of potentially anti-inflammatory substances that could benefit wound healing [5]. Chap. 11 considers nutritional assessment and nutritional support in detail.

10.4.1.2 Stop Smoking

Smoking impairs wound healing through its effects on chemotaxis, migratory function and oxidative bactericidal mechanisms in the inflammatory phase as well as causing vascular diseases that affect blood supply to the tissues. It also reduces fibroblast migration and proliferation [6]. Smokers have been shown to have significantly worse outcomes than non-smokers following surgery, with a higher incidence of delirium and analgesia complications and greater consumption of post-operative opioids [7]. Supporting patients who smoke in smoking cessation is an important aspect of wound care.

10.4.1.3 Chronic Health Conditions

Chronic diseases that affect vascular flow and oxygen delivery to the tissues have a detrimental impact on healing. Many older people with a fragility fracture have diabetes, a common underlying cause of wound healing problems. Impaired wound healing for patients with diabetes is due to a constellation of structural, biochemical, cellular and microbial factors. Hyperglycaemia and its associated inflammation contribute to immune dysfunction, vascular damage, neuropathy, cellular senescence, impaired transition beyond the inflammatory stage, microbiome disruptions, failed extracellular matrix formation, growth factor and cytokine imbalance, limited re-epithelialisation, alterations in fibroblast migration and proliferation [8]. Optimising glycaemic control for patients with diabetes is a primary intervention for preventing comorbidities associated with poorly controlled diabetes and supporting wound healing.

10.4.1.4 Medication and Polypharmacy

Many older people are prescribed multiple medications which require review as part of the Comprehensive Geriatric Assessment (CGA) process (Chap. 6). Drugs that promote healing include insulin, vitamins, thyroid hormone and iron. Medications that can adversely affect healing include anticonvulsants, steroids, antibiotics, angiogenesis inhibitors and non-steroidal anti-inflammatory drugs (NSAIDs) [9]. Patients with rheumatoid arthritis (RA) who are treated with disease-modifying anti-rheumatic drugs (DMARDs) will have delayed wound healing when undergoing orthopaedic procedures. Additional risk factors have been shown to be advanced age, prolonged surgery and low preoperative white blood cell count [10], common factors for many older patients with a fragility fracture. In addition, DMARDs may increase skin-tear risk [11].

Effective pain management is essential following fracture, and NSAIDs are widely used. Because of their impact on wound healing, however, NSAIDs should be prescribed judiciously in post-operative care. There is an ongoing discussion of their possible role in decreasing both bone and wound healing, so it is recommended they are not used for more than a few days. However, NSAID use does not appear to decrease the wound healing rates of soft tissue wounds [12].

Anticoagulant medication is frequently needed following orthopaedic surgery in at-risk individuals (especially following hip fracture) to prevent thromboembolism. Around 30% of patients presenting with fragility fracture are already receiving anticoagulant treatment for various other reasons. Anticoagulant medications can present additional bleeding risks in the immediate post-operative period, so medical guidance needs to be considered. Platelet inhibitors need not be discontinued for acute hip fracture surgery. Vitamin K antagonist, e.g. warfarin, should, however, be reversed. Direct oral anticoagulants (DOACs) must be discontinued prior to surgery to prevent excessive perioperative bleeding [13]. However, patients with a hip fracture using DOAC have not been shown to have increased surgical delay, length of stay or risk of reported bleeding compared with patients without DOAC prior to surgery ([14]. None of these studies reported delayed wound healing.

10.4.2 Preventing Surgical Site Wound Infections

Understanding the factors that can lead to poor healing and, particularly, surgical site infection, as well as the best methods to facilitate healing and prevent infection, is an essential nursing activity both in the pre- and post-operative period. Even pre-operatively, a well-prepared patient can make a significant difference to avoid surgical complications and their consequences. It has been reported that the occurrence of deep infection following surgery for hip fracture is between 1.5% and 7.3% depending on comorbidities [15]. *Staphylococcus aureus* has been shown as the most common causative pathogen, either alone or as a mixed infection [16].

Orthopaedic surgery results in a wound that penetrates through all layers of soft tissue to bones and joints, and, often, a metal implant is involved. This makes infection a significant worry as deep surgical site infection can lead to implant site infection (where there has been surgical fracture fixation or hemi- or total arthroplasty), osteomyelitis and wound dehiscence, resulting in pain and discomfort, poor outcomes from surgery and delayed discharge. Using the most recent evidence-based guideline [17] for preventing hospital-acquired infections is central to preventing surgical site infection for all patients following fractures and surgery. Such guidelines tend to focus on careful attention to hand hygiene and hospital environmental hygiene.

According to the US Centers for Disease Control and Prevention and the Healthcare Infection Control Practices Advisory Committee Guideline for the Prevention of Surgical Site Infection published in 2017 and updated in 2018 [18], measures to prevent wound infection should include:

- *Parenteral antimicrobial prophylaxis*: Administer antimicrobial agents only when indicated based on published guidelines. Time administration so that bactericidal concentration is established in serum and tissues at the initial incision. Multiple guidelines exist globally for antimicrobial/antibiotic prophylaxis for hip fracture surgery, so local practice will be guided by this.
- *Glycaemic control:* Implement perioperative glycaemic control using blood glucose target levels <200 mg/dL in patients with and without diabetes.
- *Normothermia:* Maintain perioperative normothermia. The temperature of the patient's tissues can drop significantly during the perioperative phase, leading to poor perfusion. A central activity for perioperative care is to ensure that the patient is kept warm with the use of warming devices and blankets as needed.
- *Oxygenation:* To maximise tissue perfusion, administer an increased fraction of inspired oxygen intraoperatively and in the immediate post-operative period following extubating for all patients with normal pulmonary function undergoing general anaesthesia with endotracheal intubation.
- *Antiseptic prophylaxis*: If possible, patients should have a full-body shower or bath the night before surgery (with either soap or an antiseptic agent) to reduce the number of skin commensal organisms. This may not be possible in the case of many fragility fracture patients. Intraoperative skin preparation should be performed with an antiseptic agent containing alcohol unless contraindicated.

Consider intraoperative irrigation of deep or subcutaneous tissues with an aqueous iodophor solution.

Paying attention to the above guidance is more vital than consideration of wound dressing and cleansing. Surgical drains are now rarely used as they increase the risk of infection, and wound closure practices have altered to incorporate dissolvable suture materials, which decrease the risk of infection compared to, for example, removable staples. Wound cleansing has been shown to be unnecessary in clean wounds such as surgical sites.

Following surgery, patients and their wounds should be closely monitored for signs of surgical site/deep wound infections. Identifying and treating infections early are central to preventing superficial infections deteriorating and affecting the deep implant site. Orthopaedic surgery site infections can become evident up to 1 year after surgery. On wound observation, the main signs that an infection may be present are:

- Pain at the wound/deep surgical site that appears not to be improving or worsening
- Slow wound healing and dehiscence of the wound
- Wounds showing signs of an intense inflammatory response such as redness, heat, swelling and discharge: not all wounds that are infected produce purulent discharge
- Pyrexia

Many surgical site infections do not become evident until after discharge from hospital; patients and their caregivers should be educated about the signs of surgical site infections and advised how to contact the team, while impressing on them the importance of seeking treatment if an infection is suspected.

10.5 Assessing and Managing Skin Tears

Skin tears are one of the most common types of skin breakdown in older people. According to the International Skin Tear Advisory Panel (ISTAP), a skin tear is a traumatic wound caused by mechanical forces, including the removal of adhesives (e.g. from wound dressings and other devices). Severity may vary by depth, not extending through the subcutaneous layers [19, 20]. Many skin tears involve a flap of skin defined as a portion of the skin (epidermis/dermis) that is unintentionally separated (partially or fully) from its original place due to shear, friction and/or blunt force [21].

Skin tears have been sparsely studied following hip fracture, but elective orthopaedic surgical patients have been shown to be at high risk of skin tears due to their age, mobility issues, mechanical and assistive devices, surgery and pharmacological interventions. Many patients who are admitted to hospital with a significant fragility fracture have fallen and they may have an associated skin tear on admission, often on the legs and arms—the pre-tibial area (on the front of the shin) and forearms are

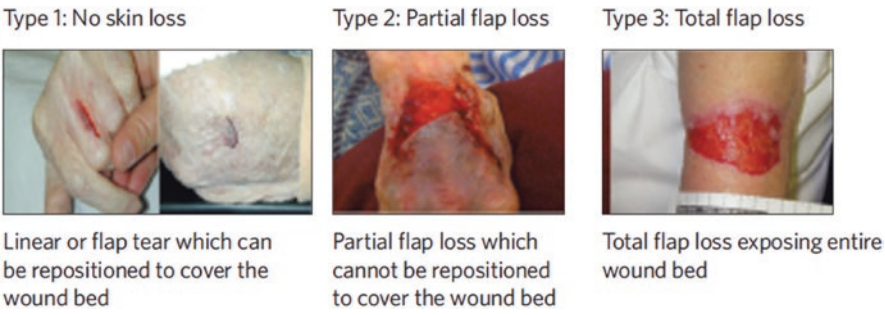

Fig. 10.1 The ISTAP classification tool, reproduced with permission [21]

particularly vulnerable. Subsequently, patients also remain at risk of new skin tears during the recovery and rehabilitation process. Guidance recommends identifying patients at risk of skin tears on admission to hospital [22].

Skin tears are classified according to ISTAP:

- *Type 1*: No tissue loss (linear or flap tear which can be repositioned to cover the wound bed): skin tears
- *Type 2*: Partial flap loss (partial flap loss which cannot be repositioned to cover the wound bed): skin tears
- *Type 3*: Total flap loss (total flap loss exposing the entire wound bed; see Fig. 10.1).

Early assessment of the patient's skin to identify the risk of skin tears or any existing tears is essential. A comprehensive skin assessment should also be conducted on admission to healthcare settings, or when visiting healthcare facilities [23] (also see Chap. 9). When patients are identified to be at risk, it is crucial to implement interventions concerning their skin condition, especially if they have a previous history of skin tears and/or have dry, fragile skin. For patients with limited mobility, such as those with a hip fracture, friction and shear on the skin should be avoided. General health status should be optimised including a focus on nutrition and hydration [21]. If a skin tear has been identified, it is important to classify it correctly and use generic language for describing and documenting its state and progress. The ISTAP Skin Tears Classification Instrument (Fig. 10.1) has been translated into six different languages and is a useful way to describe the wound [22, 24, 25].

The most common risk factors for skin tears are age-related skin changes, dehydration, malnutrition, sensory changes, mobility limitations, pharmacologic therapies and mechanical factors related to skin care practices [23]. Skin tears occur anywhere on the body but are most often found on the arms, legs and back of the hands of older people following trauma, for example, when bumping into an object or sustaining a fall.

Because of the fragility of the skin in those with and at risk of skin tears, the choice of dressing is paramount. This should also be considered for surgical wounds

in at-risk patients as the peri-wound skin is liable to damage if an inappropriate dressing is chosen. Careful consideration should, therefore, be given to wound dressing selection in skin tear management. The ISTAP panel [21] recommended choosing dressings that will promote the maintenance of moisture balance, suit the local wound environment, protect peri-wound skin, control or manage exudate and infection and optimise caregiver time [26]. It has been shown that silicone dressings are the best option for the treatment of skin tears, facilitating faster complete wound closure times compared with non-silicone dressing. The findings support expert opinion [21] that silicone-based dressings should be used in managing skin tears in place of traditional dressings. However, further research is required [27]. A recent systematic review [28] highlights the relationship between skin care bundles (a set of evidence-based interventions) and decreasing skin tears among the older population. In the same review, the authors care staff education, as this appears to be successful in enhancing competence in assessing and categorising skin tears. Healthcare staff could prioritise using skin care bundles by focusing on preventing skin tears in the ageing population.

A recent study [29] concluded that the skin is an important indicator of overall health and well-being. Therefore, improving skin integrity in individuals with skin frailty is a fundamental and holistic, person-centred approach to skin healthcare and improved skin integrity outcomes and quality of life in ageing populations [29, 30].

Summary of Key Points for Learning

- The effective evidence-based management of surgical wounds following surgery after a fragility fracture can be challenging as ageing and comorbidities affect wound healing.
- Skin and wound care involves careful skin and wound assessment and attention to infection prevention measures while managing the factors affecting wound healing.
- Clinical considerations in wound management also include maintaining adequate moisture, treating oedema and preventing further injury.

10.6 Suggested Further Study

Further study needs to address older persons' skin health as an opportunity to prevent several complications that may otherwise go unaddressed during hospital care. Here are some options:

- Find out where you can access data about wound infection rates nationally and in your unit. How does your unit compare to the national rates?
- Think about how wound care is practised in your unit compared to the recommendations presented in this chapter, national and local guidelines.

- Find out whether skin tears' knowledge translates into improved practice and patient outcomes.
- Write a reflection that includes recommendations for at least one improvement in practice, and develop an action plan.

10.7 Suggested Further Reading

- https://www.skintears.org/resources
- https://ewma.org/
- https://www.rch.org.au/rchcpg/hospital_clinical_guideline_index/Wound_assessment_and_management/
- https://www.woundsinternational.com/resources/all/0/date/desc/cont_type/45

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