

POTTER AND PERRY'S

Fundamentals of Nursing

4th edition

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Preface

To the student

Welcome to the fourth edition of the most successful fundamental text ever to be published for nursing students across Australia and New Zealand. Within this new edition we have maintained the core function of a fundamentals book: that of providing the next generation of nurses with crucial knowledge and skills related to your chosen profession and your practice. However, we have added a goal of supporting your development of a range of critical skills and understandings that will prepare you for the ever-changing and complex world of healthcare.

As editors, we began work on this new edition with the aim of emphasising the importance and complexity of *fundamental* nursing care. In our experience, many people confuse these complex nursing activities with kindness or niceness. Indeed, to the general public and those new to the profession, many of the topics covered in a textbook like

this may seem simple or trivial. They may even wonder why it takes an educated person to do them. We hope that as you work through these chapters, you come to realise why activities such as feeding, bathing, toileting, walking or turning patients are critically important aspects of care, recovery and rehabilitation. The clinical examples and critical thinking questions throughout this text underscore how putting this nursing knowledge and skill into practice can mean the difference between, on the one hand, patient recovery and independence—and, on the other, costly and life-threatening complications, functional decline and disability.

The profound impact of nurse staffing levels, education, workload, skill mix and the nursing work environment on patient outcomes has been well documented in a large and growing body of international research evidence over the past decade (see the box below). These results overwhelmingly support the position that the quality of

Nurse staffing	Nurse staffing levels of health care settings have a significant effect on morbidity and mortality and the occurrence of adverse events, with higher staffing levels associated with lower mortality, lower incidence of infections, decubitus ulcers, ⁶ postoperative pulmonary complications, pneumonia, and septicemia. ⁴
Nursing workload	Each additional patient allocated to nursing workload increases the likelihood of patient death; ⁷ increased overtime is associated with urinary tract infections, decubitus ulcers, ⁸ and increased workload with patient falls, respiratory infections, and patient complaints. ⁹ Nurses working shifts of 12.5 hours or more are three times more likely to make an error; and working more than 40 hours a week increases the risk of error. ¹⁰
Nursing skill-mix	An increase in registered nurse staffing is associated with decrease in pneumonia, ^{11,12} lower rates of "failure to rescue", and reduced incidence of death from shock or cardiac arrest, gastrointestinal bleeding, sepsis, deep vein thrombosis, or pneumonia. ¹³
Work environment	Each additional patient allocated to nursing workload is associated with a 23% increase in nurse burnout and a 15% increase in nurses' job dissatisfaction. ¹⁴ Insufficient resources, inadequate support and inadequate equipment are all associated with an increase in injuries to nurses, ¹⁵ higher nurse turnover, ¹⁶ and an increase in errors. ¹⁷

BOX 1 Effect of nursing interventions on quality and safety of health care.

From Australian Nursing Federation (ANF) 2009 Ensuring quality, safety and positive patient outcomes: why investing in nursing makes sense. ANF, Melbourne. Online. Available at http://anf.org.au/documents/reports/Issues_Ensuring_quality.pdf 27 Aug 2012.

nursing care matters—not because nurses are kind, sweet and selfless, but because appropriate nursing care saves lives and improves patient outcomes, as well as patients' experiences of their care.

As Aranda (2007) argues:

Herein lies the central point of our [nursing's] image and identity problem—basic nursing care is not understood as skilled practice by nurses themselves or by the public ... I point out that while yes we do bath and shower people and engage in work that is sometimes difficult and unpleasant, this work is a door to understanding human experiences of illness. It is through this door that opportunities to make a real difference in the quality of that experience occur.

Nurses themselves contribute to the invisibility and devaluing of nursing work when they sentimentalise and downplay their contribution to patient care. Consider the American journalist and author Suzanne Gordon's observation that nurses often refer to themselves and each other as 'just a nurse'. As part of a nurse-recruitment campaign, Gordon developed the idea of creating a poster that juxtaposed this phrase so that it illuminated the richness and importance of nursing (see the figure below).



FIGURE 1 Poster created by Suzanne Gordon for a nurse-recruitment campaign

Source: <http://suzannegordon.com/just-a-nurse-poster-bookmark>

We encourage you to embrace this concept of nursing as *knowledge work* and engage with the features of this text that aim to cultivate this approach to nursing practice.

The first part of this is to form a *critically reflective approach to self-care and development* throughout your nursing career, through supporting your insight into how your own thinking around the information discussed within each chapter is evolving. We are, therefore, seeking to engage your reflective processes to achieve deep understanding of 'so what do I think about this now?', and of the broader ideas around caring for self and others we work with in order to maximise the likelihood of effective workplace cultures and the best outcomes for patients/clients.

The second part is an extension of the above, and seeks to actively engage you in *thinking about the content* you encounter throughout the book, to facilitate deeper learning and memory and to resist the idea of rote learning. We know that one of the most effective ways of achieving this is to provide examples and stories that are meaningful, and we have taken this approach throughout the book by integrating clinical scenarios or practice examples and critical thinking questions throughout each chapter.

The third part of the approach focuses on ensuring that you are exposed to, and hopefully come to understand, the *similarities and differences in patient/client/family experiences and needs*, and how these vary across individuals, groups and in relation to environmental and other contextual factors. We have, therefore, moved away from a reliance on highlighting specific cultural issues or age/development stages to a more integrated approach to discussing and dealing with diversity in relation to the content of the specific chapter.

Last, we believe it is crucial that you see the *dynamic and evolving nature of evidence for nursing practice*—how thinking and knowledge evolve—and understand the need to see ongoing changes in practice as the norm. We also want you to see the need for all clinicians to actively engage in processes associated with their own learning, the learning of others, and the development of practice. We have continued to focus on evidence through the use of research highlights, but once again we have taken a more integrated approach to capture the most up-to-date knowledge/evidence and practices that we can.

Overall, we would like to dedicate this edition to all those students studying to become the best nurses they can be—we wish you well in your endeavours and hope this book provides a solid foundation on which to build the knowledge and expertise required to join one of the most highly regarded, and crucial, professions in the world.

REFERENCE

Aranda S 2007 Image, identity and voice—nursing in the public eye. 6th Vivian Bullwinkel Oration. Royal College of Nursing, Australia.

Chapter 30

Skin integrity and wound care

Michelle Gibb

KEY TERMS

Arterial leg ulcers, p. 805	Haemoserous, p. 774
Blanching, p. 794	Haemostasis, p. 765
Debridement, p. 776	Malignant wounds, p. 807
Dehiscence, p. 767	Moist wound environment, p. 777
Dermis, p. 758	Negative pressure wound therapy, p. 786
Diabetic foot ulcers, p. 806	Pressure injury, p. 793
Epidermis, p. 757	Primary intention, p. 766
Eschar, p. 776	Purulent, p. 774
Evisceration, p. 767	Sanguineous, p. 774
Exudate, p. 774	Secondary intention, p. 766
Fibroblasts, p. 758	Serous, p. 774
Fistula, p. 763	Shearing force, p. 793
Friction, p. 793	Skin tear, p. 786
Granulation tissue, p. 766	Venous leg ulcers, p. 804
Haematoma, p. 767	Wound, p. 762
Haemorrhage, p. 767	

LEARNING OUTCOMES

Mastery of content will enable you to:

- Describe the anatomy and physiology of the skin.
- Discuss normal phases of wound healing.
- Describe the modes of wound healing.
- Discuss abnormal wound healing.
- Outline the factors affecting wound healing.
- Conduct a head-to-toe skin assessment and pressure injury risk assessment
- Describe the differences between nursing care of acute and chronic wounds.
- Describe the principles of wound assessment and management.
- Discuss the assessment, management and prevention strategies for common wound types.

The skin, or the integumentary system, is the body's largest organ. It comprises 15% of the total body weight, has an area of approximately 7600 square centimetres and receives one third of circulating blood volume in the average adult (Shores, 2007).

Maintaining skin integrity is a complex process, one that is often taken for granted until damage occurs. As is shown in Table 30-1, the skin has to perform many different functions. Having a good understanding of the layers of the skin and the functions of normal skin is important so that you are able to recognise risk factors for poor skin integrity and undertake actions to prevent skin breakdown or to improve wound healing outcomes.

The following clinical example will be used throughout this chapter for you to reflect on the key concepts and how they apply to nursing practice.

• CRITICAL THINKING

What factors in this clinical scenario might have contributed to the development of this skin tear?

TABLE 30-1 FUNCTIONS OF THE SKIN

FUNCTION OF THE SKIN	EXPLANATION
Protection	The skin provides a covering that is designed to protect us from damage or injury
Temperature control (thermoregulation)	Sweat evaporates and cools the skin. Blood vessels also dilate and constrict to prevent heat loss and maintain a stable body temperature
Sensation and communication	Nerve endings and receptors are found in the skin and these help us to respond to touch, pain, heat or cold
Metabolism	The skin helps us to metabolise vitamin D through exposure of the skin to sunlight
Elimination	The skin helps us to eliminate waste through its function of excretion and secretion

CLINICAL EXAMPLE

Mr Bukowski, aged 78 years, is a widower who lives at home; his daughter lives nearby. Mr Bukowski usually uses a wheeled walker to mobilise because he often becomes unsteady on his feet. Since he was only going out to collect the mail he decided to leave it inside, feeling confident that he wouldn't be walking very far. On his way to the letter box he tripped and fell, sustaining a large skin tear on his left arm.

When he got back inside he applied some paper towel to stop the bleeding, knowing that his daughter was coming over for morning tea and would be able to fix it up then. A few hours later, Mr Bukowski's daughter arrived and decided to take her father to his general practice clinic because she wasn't sure what to do.

On arrival at the clinic, Mr Bukowski is taken straight through to the treatment room to be seen by the practice nurse. This is not the first time that he has sustained skin tears. On examination, the registered nurse notices that Mr Bukowski has multiple skin tears on the left forearm with extensive bruising (see Figure 30-1 below). She helps Mr Bukowski to lie down on the examination couch and goes to collect equipment and to take a look at his health records.

Mr Bukowski has a past medical history of heart failure, chronic obstructive pulmonary disease and hypertension and he has had a deep vein thrombosis (DVT) of his left leg. His medications include aspirin, salbutamol inhaler, lisinopril, carvedilol, furosemide and a multivitamin. Mr Bukowski currently smokes 15 cigarettes a day and has done so ever since leaving school at the age of 16.



FIGURE 30-1 Skin tear on Mr Bukowski's arm.

Courtesy Wound Healing Community Outreach Service, Queensland University of Technology.

Scientific knowledge base

Normal integument

The thickness of the skin varies depending on location, with skin thickness ranging from 0.05 to 0.3 mm. The thickest skin is on the soles of the feet and the palms of the hands. The thicker the skin, the better it is able to withstand injury. The skin consists of three layers (see Figure 30-2):

- epidermis (outermost layer of the skin)
- dermis (middle layer)
- subcutaneous layer (bottom layer of the skin).

The epidermis and dermis are separated by a basement membrane, which is often referred to as the *dermal-epidermal junction*. The **epidermis**, or outer layer, is avascular and approximately 0.04 mm thick, and has several layers depending on the body location. The *stratum corneum* is the thin, outermost layer of the epidermis. It consists of flattened,

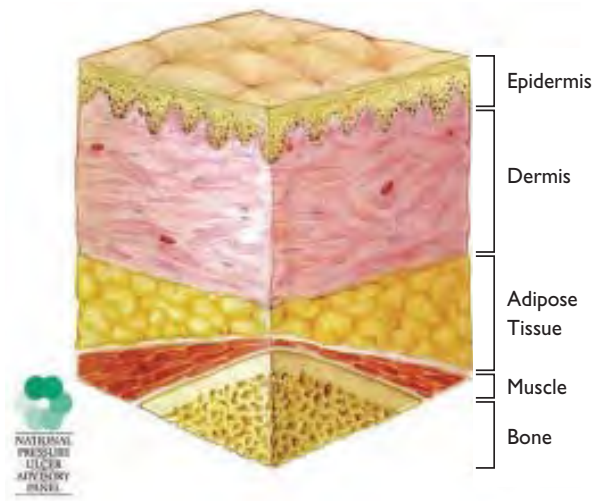


FIGURE 30-2 Layers of the skin.
Used with permission of the National Pressure Ulcer Advisory Panel Washing DC, 10/07/12.

dead, keratinised cells. The cells originate from the epidermal layer called the *stratum basale*. Cells in the stratum basale divide, proliferate and migrate towards the epidermal surface. After cells reach the stratum corneum, they flatten and die. This constant movement ensures replacement of surface cells sloughed off during normal desquamation. The thin stratum corneum protects underlying cells and tissues from dehydration and prevents entrance of certain chemical agents. However, the stratum corneum does allow evaporation of water from the skin and permits absorption of certain topically applied medications.

The **dermis** is the middle layer of the skin, which


provides the tensile strength, mechanical support and protection to the underlying muscles, bones and organs. It differs from the epidermis in that it contains mostly connective tissue and few skin cells. Collagen (a tough, fibrous protein), blood vessels and nerves are composed of it. **Fibroblasts**, which are responsible for collagen formation, are the only distinctive cell type within the dermis.



The *subcutaneous layer* is the thickest layer of the skin; it provides a supporting framework for the skin and is an attachment and protective layer for underlying organs and structures. It is made up of adipose and connective tissue and blood vessels. The subcutaneous layer of the skin helps to regulate the temperature of the skin and store lipids.

Understanding the integument's layers is essential in order to identify factors affecting the wound healing process. The epidermis functions to resurface wounds and restore the barrier against invading organisms. The dermis responds to restore the structural integrity (collagen) and the physical properties of the skin. Even though a wound may close in the upper epidermal layer, the patient is at risk of infection, circulatory impairment and tissue breakdown if the underlying dermis fails to heal.

Skin changes associated with ageing

Skin problems are common among older people, so it is important to be able to recognise the characteristics of ageing skin (Lawton, 2007). There are two types of skin ageing: *intrinsic ageing*—alterations in the structure and function of the skin due to normal maturity which occurs in all people; and *extrinsic ageing*—due to constant or repeated exposure to environmental elements such as the sun. A summary of the normal intrinsic changes in ageing skin can be found in Table 30-2.

TABLE 30-2 SKIN CHANGES ASSOCIATED WITH AGEING		
TYPE OF PROBLEM	EXPLANATION	EXAMPLE
Decreased sensory perception	This means when an older person injures their skin they may not be aware they have done so	When an older person gets a skin tear they may not realise that they have injured their skin until they see the injured body part  Skin tear
Increased dryness	The skin becomes drier and less supple because sebaceous and sweat gland activity decreases as you age	This is why many older people complain of dry, itchy skin

The skin becomes thinner and less elastic	<p>The skin decreases in turgor or thickness because of reduced collagen and elastic fibre production. The collagen present becomes thinner and, when combined with less adipose or fatty tissue, the skin support structure is compromised and skin wrinkling occurs. Such skin is subject to friction and shearing trauma</p> <p>The skin on the back of the hands becomes thin and transparent, while the skin on the back of the neck has a furrowed appearance</p>	<p>Ageing skin has more risk of skin tears and bruises and lesions as a result of thinner, less flexible skin and a lifetime of exposure to the sun.</p>  <p>Decreased tissue turgor</p>
Decreased vitamin D synthesis	This is often due to inadequate exposure to sunlight, decreased dietary intake or a medical condition	It may take longer for skin to repair and older people have an increased risk of fractures
Reduction in immune response	Cells which trigger the immune system are slower to respond and less effective	Increased risk of infection for even minor injuries to the skin
Decrease in temperature control or thermoregulatory functioning	Older people are less able to regulate their body temperature due to changes in environmental temperature	This is why some older people complain of being cold even on a hot day
Vascularity or blood supply of the skin is diminished	Blood vessels in the dermis become more fragile and there is decreased peripheral circulation	This is why older people bruise more easily and may explain why fingernails lose their lustre and toenails thicken
Hormonal changes	<p>Facial hair in males decreases and yet increases in females. Pubic and axillary hair thins, straightens, greys and lessens because of reduced hormonal functioning. Both males and females experience overall hair loss from the trunk and extremities. Hair loss on the lower limbs may also occur when peripheral vascular disease is present</p> <p>Hormonal changes also lead to drier skin</p>	
Changes in hair colour and balding	<p>Scalp hair greys and balding occurs because of a reduction in the number and functioning of melanocytes, the cells which give hair and skin their colour</p> <p>The density and rate of scalp hair growth also declines and the size of hair follicles change leading to baldness</p>	Hair colour and wrinkled skin
The amount of subcutaneous tissue decreases	The amount of subcutaneous tissue decreases, particularly in the extremities, giving joints and bony prominences a sharp, angular appearance. The hollows in the thoracic (chest), axillary (under the arms) and supraclavicular (collar bone) regions deepen	 <p>Loss of subcutaneous tissue</p>

Principles of skin assessment

A comprehensive assessment of the skin is essential, as a wide range of health conditions manifest in changes in the skin and can provide valuable diagnostic clues to the underlying disease process. Furthermore, recognising the characteristics of normal skin helps you to identify those at risk for compromised skin integrity. When undertaking a skin assessment, there are three important steps, outlined below.

Step 1. Prepare the environment

First, you need to create an environment that is suitable to conducting an assessment by ensuring:

- that the room is quiet, private and has a stable temperature; this helps to reduce anxiety
- adequate lighting so that you can see the colour of the skin or any skin changes
- adequate exposure of the skin, especially areas not usually inspected such as the buttocks, axillae, back of thighs or feet

Step 2. Gather relevant information

Second, you need to carefully explain what you are going to do and the purpose of assessing the skin. Typically, you obtain a history using a framework such as that shown in Table 30-3.

Step 3. Observe and feel the skin

The final step is to look at the skin (*inspection*) and feel (*palpation*) if there are any changes (Table 30-4). When conducting the physical assessment, proceed from head-to-toe and compare each body region for symmetry (i.e. right side with left side to differentiate structural from pathological changes). If lesions are identified, palpate them for density, induration (hardening or thickening of tissues) and tenderness.

Now that you have a better understanding of how to assess the skin, you are ready to learn more about some strategies you can use to maintain skin integrity and prevent many skin problems from occurring. Review the suggested evidence-based strategies summarised in Table 30-5.

TABLE 30-3 SKIN ASSESSMENT

INFORMATION REQUIRED	QUESTIONS THE NURSE MIGHT ASK THE PATIENT
Past medical history	<i>Tell me what other health conditions you may have.</i> When conducting the health assessment and a problem with the skin is identified, it is important to determine usual skin conditions, onset of any problems, changes since onset, specific known causes, alleviating factors, psychological reaction to skin changes, previous trauma and if the patient has had any surgery or prior disease that involves the skin
Medications (topical, systemic, over-the-counter)	<i>Are you taking any medications that might affect your skin?</i> For example, medications might include anticoagulants or steroids (taken for conditions such as rheumatoid arthritis)
Exposure to environmental or occupational hazards	<i>What sort of work do you do?</i> <i>Were you exposed to the sun a lot when you were younger?</i>
Substance abuse	<i>Do you smoke or have you ever smoked? How much did you smoke? When did you stop smoking?</i> <i>How much alcohol intake do you have?</i> <i>Have you ever used illicit drugs?</i> Example: Fingernails are often stained yellow by nicotine exposure.
Recent physiological or psychological stress	<i>Have you experienced a recent stressful event? Have you been unwell recently? How does this affect you?</i>
Hair, nail and skin care habits	<i>What methods do you use for cleansing your skin? How often do you moisturise? How do you dry your skin?</i> Example: Many soaps, oils, lotions, cosmetics and home remedies have preservatives that can irritate the skin and make it itchy or inflamed.
Skin self-examination	<i>How often do you look at your skin? Are you able to see your skin properly? Can you reach to dry between your toes?</i>
Problems with the skin	<i>Have you noticed any changes in your skin (e.g. dryness, rashes, lumps, amount of perspiration)? When did the symptoms occur? Are these symptoms new or an old problem? What area of the body is affected (i.e. skin folds, localised or generalised)?</i> <i>Are there any associated symptoms (e.g. fever, relationship to stress or leisure activities)? What have you been doing for the problem?</i> Example: Eczema is a common problem that is often made worse by some creams and may be a lifetime problem for that person. Careful questioning will help to determine what the person has been doing to treat the condition, what works for them and what doesn't work to treat the problem.

TABLE 30-4 OBSERVATION OF THE SKIN

OBSERVATION	EXPLANATION
Skin temperature	If the skin around a wound is very hot to touch compared with the surrounding skin, this may indicate an infection If the feet are abnormally cold to touch, this may indicate a problem with circulation
Skin texture	Texture of the skin may be described as <i>rough, coarse, fine, flaky, scaly</i> or <i>smooth</i> . Rough skin may indicate that the skin is very dry and may occur normally on exposed areas such as the elbows and soles of the feet
Skin colour	The colour of the skin can indicate a person's general wellbeing Changes in colour are best obtained from the lips, mucous membranes of the mouth, earlobes, finger and toe nails and the extremities The colour of the skin indicates the degree of blood supply and temperature of the skin, and oxygen and fluid supply to the skin. Colour of the skin varies depending on the amount of melanin in the cells and with blood supply. Skin colour can be masked by cosmetics or tattoos Colour changes associated with the skin can be described as: <i>erythema</i> (redness) due to vasodilation associated with blushing, heat, inflammation, fever, alcohol ingestion, extreme cold and heat and hot flushes <i>pallor</i> (whiteness) due to vasoconstriction associated with peripheral arterial disease, or due to decreased oxygenation of blood from decreased haemoglobin as seen in anaemia, or loss of melanin as in vitiligo <i>cyanosis</i> (bluish) due to deoxygenated haemoglobin noticed in earlobes, lips, mucous membranes of the mouth, nail beds; may be seen in cardiac or respiratory disease <i>jaundice</i> (yellow) due to increased bile pigment in the blood distributed in the skin and mucous membranes and sclera of the eye, as seen in liver disease, obstruction of bile ducts, chronic uraemia and rapid haemolysis <i>brownish</i> due to increased melanin deposits, which is normal in darker-skin-toned individuals and is also found in ageing, sunburn, anterior pituitary, adrenal cortex and liver diseases
Skin changes	The presence of growths, discolouration or changes in pigmentation, infections, broken areas, old scars, tattoos, rashes, eczema, dermatitis, senile purpura, cherry angiomas or thickened skin may be normal changes associated with ageing, indicate a person's risk of a wound recurring or indicate the presence of a clinical condition For example, changes in pigmentation may indicate a condition such as vitiligo, Addison's disease, arsenic toxicity or uraemia. Fungal infections such as tinea versicolor can cause pigmentation changes in the affected area. Pigmentation changes in naevi or moles may indicate the presence of skin cancers
Oedema	Assessment of swelling in the tissues can be assessed by location and degree. Oedema is graded as: + slight indentation with normal anatomical contours ++ deeper indentation which lasts longer than + with fairly normal contours +++ deep indentation which remains after several seconds with obvious swelling ++++ deep indentation that remains for minutes with frank swelling
Turgor (resilience and elasticity of tissue)	Skin turgor can give an indication of the person's nutrition and hydration status When pinched between the thumb and index finger for a few seconds, normal well-hydrated skin will snap back into place when released Dehydrated skin, particularly in an elderly patient, will form a small tent shape before gradually resuming its normal position
Hair distribution, colour and quantity (thick, thin, balding)	Uneven hair loss may indicate a person's psychological state For example, a person may unconsciously pull their hair out if they are traumatised. Excessive hair growth may be related to hormonal changes
Nail length, colour, configuration, symmetry and cleanliness	The colour of a person's fingernails may indicate certain problems For example fingernails stained yellow indicate nicotine use. Blue fingernails can indicate a problem with circulation such as cardiac or respiratory disease In addition to nail-bed colour, check for clubbing and assess capillary refill. Capillary refill time can be affected by environmental conditions, vasoconstriction from smoking or peripheral oedema. Finger clubbing can be an indication of chronic tissue hypoxia
Lesions of the skin	Lesions are classified by type, colour, size, shape and configuration, texture, effect of pressure, arrangement, distribution and variety

PREVENTION STRATEGIES	EXPLANATION
Assess skin regularly	The nurse should assess the skin regularly so that correct and suitable preventive measures can be put in place and evaluated
Use emollient soap substitutes for washing or cleansing	This reduces the drying effects of soap and water Emollients restore the natural barrier function of the skin by replacing lost water and provide a protective film over the surface of the skin. Emollients include creams, ointments, lotions, bath oils and soap substitutes
Avoid products that may irritate the skin	Products such as perfumes, bubble baths and talcum powder can irritate the skin and cause itching or discomfort
Dry the skin thoroughly	Drying should involve a light patting and not rubbing as this may lead to abrasion and/or weakening of the skin If skin is left damp, it is vulnerable to excess drying from the environment and at risk of fungal and bacterial contamination
Apply a pH-neutral moisturiser and/or barrier cream at least twice daily	This will help to prevent dry skin A pH-neutral moisturiser is one that is neither acid or alkaline; it has a pH between 6.5 and 7.5 A barrier preparation can be a cream, ointment or spray which contains substances that repel water, such as silicone or zinc oxide
When applying moisturiser and/or barrier cream, follow the direction of body hair and gently smooth into the skin	Rubbing can cause irritation. Rubbing moisturiser against the direction of hair growth increases the risk of an infection occurring in the hair follicles
Encourage patient to wear loose, cotton clothing where possible	This helps the skin to breathe better and reduces the risk of sweating from nylon fabrics The use of limb protectors can also protect fragile limbs

• CRITICAL THINKING

As you read the next section, think about Mr Bukowski's skin tear:

- Is this an acute or a chronic wound?
- How would you classify this skin tear?
- What is the phase of wound healing?
- Is this wound healing by primary or secondary intention?

Wound classification

A **wound** can be defined as an injury to the skin or underlying structures that may or may not result in a loss of skin integrity and whereby physiological function of the tissue is impaired (Carville, 2007). Although at first a wound may look like any other, it is imperative to know that *all wounds are not the same*. Understanding the aetiology of a wound is important, because the treatment varies depending on the underlying disease process (Ratliff, 2006). Common wound types are presented in Table 30-6.

There are many ways to classify wounds. Wound classification systems describe the status of skin integrity, cause of the wound, severity or extent of tissue injury or damage, cleanliness of the wound or descriptive qualities of the wound such as colour. Wound classifications help you to understand the risks associated with a wound and implications for its care.

Wounds can be classified as either *acute* (e.g. surgical incisions, lacerations, blisters, abrasions) or *chronic* (e.g. leg

ulcers, pressure ulcers, malignant or fungating wounds). Acute wounds heal fairly quickly (usually within 14 days), without complications and with limited interventions. They follow the normal healing process in an orderly and timely way (Celik, 2007). Examples of some acute wounds are those caused by trauma or surgery. A chronic wound is a wound that has failed to proceed through an orderly and timely process for healing and whereby healing is delayed, repair fails to occur, and return to normal function is slowed (Harvey, 2005).

Phases of wound healing

The wound healing process involves a complex series of cellular and biochemical events that act upon damaged tissues. These are interlinked and dependent on one another in a continuing process of regeneration and repair (Schultz and others, 2003). Wound healing tends to follow a well-defined process that involves four main stages:

1. haemostasis
2. inflammation
3. proliferation or reconstruction
4. maturation or remodelling of the scar tissue.

These stages of wound healing overlap and the entire process can last for many months.

Haemostasis

Immediately after injury, platelets initiate the wound-healing process by releasing a number of growth factors that rapidly disperse from the wound, drawing inflammatory

TABLE 30-6 COMMON WOUND TYPES

WOUND TYPE	CAUSES	EXAMPLES
<p>Traumatic wounds</p>	<p><i>Bruise or contusion:</i> injury to the underlying tissue but the skin remains intact. Usually caused by a blunt force against a body part</p> <p><i>Abrasion:</i> superficial damage to the epidermis and dermis involving scraping or rubbing of the skin's surface</p> <p><i>Laceration:</i> the tissues are torn with irregular wound edges</p>	<p>Blisters</p>  <p>Bruises</p>  <p>Abrasions</p>  <p>Lacerations</p>  <p>Bites</p>
<p>Thermal injuries</p>	<p><i>Burn:</i> an injury caused by thermal, electrical, chemical or radiation mechanism</p>	<p>Scald</p> 

continued

TABLE 30-6 **CONTINUED**



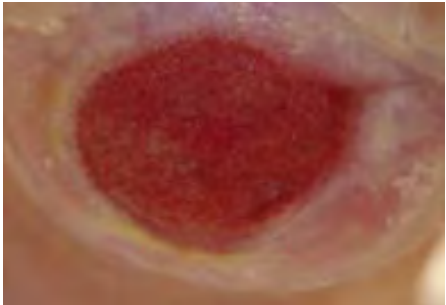
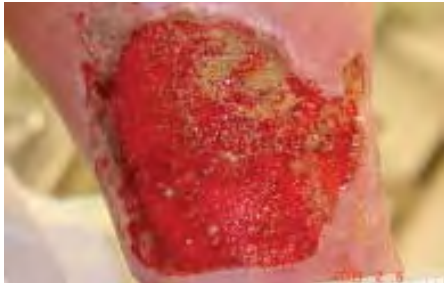
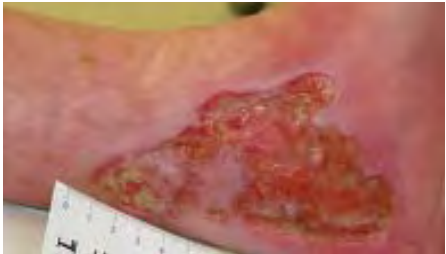
WOUND TYPE	CAUSES	EXAMPLES
Wounds inadvertently caused by a clinician, medical treatment or diagnostic procedure (iatrogenic)	<i>Incision:</i> caused by a cutting instrument	Surgical incisions  Biopsies Split skin grafts Radiation injury
Wounds caused by disease	<i>Tumour:</i> a malignant or benign growth	

TABLE 30-7 **PHASES OF WOUND HEALING**

PHASE	EXPLANATION
Vascular response	Initial bleeding, which should stop within 10 minutes
Inflammation	This stage lasts for around 3 days and is a normal process of wound healing. Signs include redness, heat, swelling, pain and functional disturbance 
Proliferation	This phase lasts for around 28 days. During this phase, the wound bed tissue experiences these states: 1. Granulation or new tissue growth occurs. Granulation tissue is characterised by the appearance of red, bumpy, shiny, granular and slightly uneven tissue in the wound bed as new blood vessels start to grow 2. Wound edges come together (i.e. contraction) 3. Epithelial tissue covers the wound bed or appears in patches throughout the wound bed as it starts to heal  Granulation tissue  Bumpy granulation tissue  Contraction of wound edges and islands of new epithelial tissue
Maturation	This is the final phase of wound healing and describes the process of the healed tissue regaining its previous levels of functional ability. This phase can last for longer than 1 year. Full return of strength in that tissue is never quite achieved. Complications such as contractures or excessive scar formation may occur during this phase

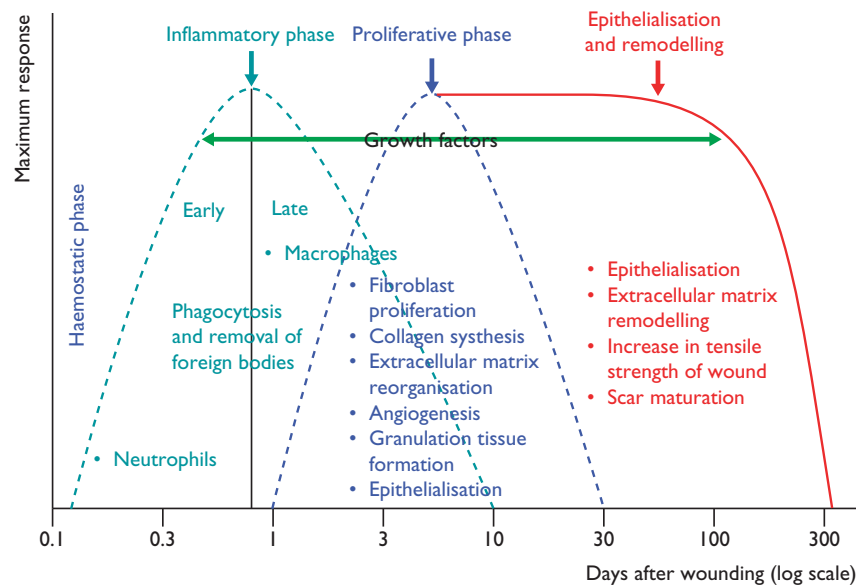


FIGURE 30-3 The four phases of wound healing.

Redrawn from Enoch S, Grey JE, Harding KG 2006 Recent advances and emerging treatments. *Br Med J* 332(7547):962–5.

cells to the area of injury. **Haemostasis** is comprised of three components:

1. *vasoconstriction* whereby bleeding is arrested by constriction of the arteries, arterioles and capillaries in or close to the wound
2. *formation of a platelet plug* whereby the damaged endothelium of vessels exposes collagen fibres causing the platelets to stick to the collagen fibres in the wall of the vessels and to each other, resulting in a mechanical plug by the process of aggregation. The platelets release chemicals, including serotonin and prostaglandins, which enhance the vascular constriction and further reduce blood flow. Phospholipids and adenosine diphosphate (ADP) are also released and attract more platelets to the area, which increases the size of the platelet plug
3. *a biochemical response* is then activated, initiating the *clotting cascade*. This a complex process which sees the development of a clot, the retraction and compaction of the clot which causes the wound edges to come together and the breakdown of the clot by fibrinolysis.

Inflammation (0–3 days)

The inflammation phase of wound healing is a vascular and cellular response that removes microbes, foreign bodies and dying tissue in preparation for wound healing (Flanagan, 1997). The inflammatory phase is characterised by vasodilation, increased capillary permeability, complement activation and polymorphonuclear leucocytes (PMN) and macrophage migration to the wound (Flanagan, 1997; Traversa and Sussman, 2001). The increase in blood flow

into the wounded area produces erythema, oedema, heat and discomfort such as a throbbing sensation.

Macrophages regulate the events in wound healing by attracting further macrophages and induce the proliferation of fibroblasts and endothelial cells. Macrophages release growth factors which stimulate endothelial cells lining the walls of capillaries to close the wounded area, and then divide and branch out to form new capillary loops (Flanagan, 1997). Fibroblasts migrate along fibrin threads and synthesise collagen and other extracellular matrix (ECM) molecules to support new cells and fragile capillary buds which appear during angiogenesis. This continues until newly formed granulation tissue joins up with intact blood vessels (arterioles) to form a network of vessels that fill the wound bed (Flanagan, 1997).

Proliferation (2–24 days)

The proliferation phase is characterised by extensive growth of epithelial cells, deposition by fibroblasts of collagen fibres in random patterns to form the ECM and ground substance and continued growth of blood vessels (Schulz and others, 2003). Fibroblasts and endothelial cells proliferate in response to growth factors, including platelet-derived growth factor (PDGF) and transforming growth factor B (TGF-B), and cytokines that are released from macrophages, platelets and mesenchymal cells or have been stored in the fibrin clot (Krishnamoorthy and others, 2001; Traversa and Sussman, 2001). Macrophage-released growth factors produce glycosaminoglycans (GAGs). These include hyaluronic acid, chondroitin-4-sulfate, dermatan sulfate and heparin sulfate, which cross-link to protein and are termed

proteoglycans. These form an amorphous gel where collagen fibres deposit and aggregate (Traversa and Sussman, 2001). The ground substance secreted by fibroblasts determines the compliance, flexibility and integrity of the dermis. It provides compressive strength and support and density to tissue, reduces friction between collagen fibres during tissue stress or strain and protects tissue from invasion by microorganisms (McCulloch and others, 1995).

During the proliferation phase, new capillary development is seen as ruddy, bumpy **granulation tissue** in the base of a wound, and wound contraction occurs. Epithelial cell migration occurs over the granulated wound bed. Epithelial cells migrate from surrounding wound edges or from hair follicles, sweat or sebaceous glands in the wound and appear as thin, translucent film across the wound bed. At this stage, the epithelial tissue is very fragile and easily removed even by gentle cleansing. Migration of epithelial cells ceases when the wound is covered; then mitosis thickens the epithelium to the four to five layers needed to form the epidermis.

Maturation (24 days to 1 year)

The combination of fibronectin and collagen forms the ECM essential for the development of granulation tissue that eventually fills the wound. The endothelial buds increase in vascularity in response to the large metabolic demand of the repair tissue (Traversa and Sussman, 2001). The arrangement of collagen fibres in the wound is random and disorganised, and has a gel-like consistency that gradually matures to form cross-links which provide tensile strength to the wound (Flanagan, 1997).

The remodelling of collagen fibres is regulated by growth factors including TGF- β , PDGF and fibroblast growth factor (FGF), interleukin-1 (IL-1) and interferon- γ (INF- γ). Depending on the type and severity of the wound, the maturation phase may take up to six months to a year (McCulloch and others, 1995). Collagen synthesis continues

after wound closure, but undergoes continual lysis to form a more organised lattice structure that gradually increases tensile strength of scar tissue, fibroblast numbers decrease and blood vessels are restored to normal (Traversa and Sussman, 2001). The tensile strength of scar tissue is never more than 80% of that of non-scar tissue (Flanagan, 1997).

Modes of wound healing

Wounds can be broadly characterised into two groups: those *with* and *without* loss of tissue. A clean surgical incision is an example of a wound with little tissue loss and where the edges of the wound are held in close apposition by sutures, staples or tape. The surgical wound heals by **primary intention**. However, if a wound is infected or contains foreign bodies, primary wound closure may be delayed for three to five days. This is known as *delayed primary intention*. A wound that involves extensive loss of tissue, such as a pressure ulcer or severe laceration, heals through a process of granulation, contraction and epithelialisation, and scarring may result. This is known as healing by **secondary intention**.

Skin grafting is another method to achieve wound healing. A skin graft is a segment of epidermis and dermis that is intentionally separated from one site (donor site) and transplanted to another site (recipient site) (Carville, 2007). Skin grafts depend on the in-growth of capillaries from the recipient site for their survival. A skin graft is selected as a method of wound closure when healing by secondary intention or primary closure is not a suitable option, to speed up the healing process and reduce the risk of infection. There are two types of skin grafts: *full-thickness grafts* that consist of the epidermis and the full thickness of the dermis, and *split-skin grafts* consisting of the epidermis and a variable proportion of the dermis. Split-skin grafts are described as *thin*, *intermediate* or *thick* according to the thickness of the graft.

A wound may also be closed by surgical relocation of tissue from one part of the body to another part in order to

RESEARCH HIGHLIGHT

Evidence-based practice

Much of our understanding about how wounds heal is derived from examination of the wound-healing process in acute wounds. It is widely accepted that acute wounds heal through an orderly process of haemostasis, inflammation, proliferation and maturation. However, chronic wounds such as leg ulcers and diabetic foot ulcers do not follow this trajectory and are often characterised by prolonged inflammation and, even if they do heal, frequently recur even with the highest standard of care.

The concept of wound-bed preparation has emerged as an important paradigm in the management of chronic wounds in order to identify factors that influence wound healing and to provide a framework for clinicians to maximise

the potential for wound healing. There are four main principles underpinning wound bed preparation—TIME:

- Tissue management
- Inflammation and infection
- Moisture balance, and
- Epithelial (edge) advancement.

The TIME framework is a dynamic concept that can be translated into practical management of different wound types by utilising a standardised framework.

Reference

Schultz G, Sibbald G, Falanga V and others 2003 Wound bed preparation: a systematic approach to wound management. *Wound Repair Regen* 11:1–28.

reconstruct a primary defect (*flap*). The relocation of tissue creates a secondary wound that will require skin grafting or primary closure.

Complications of wound healing

When a wound fails to heal properly, the layers of skin and tissue may separate. This most commonly occurs before collagen formation (3–11 days after injury). **Dehiscence** is the partial or total separation of wound layers. A patient who is at risk of poor wound healing (e.g. poor nutritional status, infection, obesity) is also at risk of wound dehiscence. However, obese patients have a higher risk because of the constant strain placed on their wounds and the poor healing qualities of fatty tissue. Dehiscence often involves abdominal surgical wounds and occurs after a sudden strain, such as coughing, vomiting or sitting up in bed. Patients often report feeling as though something has given way. An increase in the presence of haemorrhagic drainage from a wound may indicate wound dehiscence.

Hypergranulation

Hypergranulation is an accumulation of granulation tissue that extends beyond the wound surface and delays epithelialisation (Carville, 2007). Hypergranulation tissue may bleed easily; it may be seen in surgical incisions or around tubes and devices and can occur in some malignant tumours. Biopsy of the tissue is essential if malignancy is suspected.

Hypertrophic scars

Hypertrophic scars are characterised by an overabundant deposition of collagen in healed skin wounds and present as a re-epithelialised, red, raised and firm scar that may be itchy (Carville, 2007). Hypertrophic scars are usually contained within the original boundary of the wound, and are usually linear in appearance following a surgical scar or papular or nodular following inflammatory and ulcerating injuries (Gauglitz and others, 2011). Hypertrophic scarring may occur if there is excess tension on a healing wound. It can occur within 4–8 weeks following a wound injury such as a burn injury, laceration, abrasion, surgery, piercing or vaccination and usually regresses spontaneously. Scarring grows rapidly for up to 6 months and then gradually regresses over a period of a few years, resulting in a raised, flat scar with no further symptoms (Gauglitz and others, 2011).

Keloid scars

Keloid scars occur spontaneously to form firm, smooth, fibrous growths that result from abnormal connective tissue in response to trauma, inflammation, surgery or burns (Carville, 2007). Similar to hypertrophic scars, they are characterised by an overabundant deposition of collagen in healed wounds where the scar extends beyond the boundary of the original wound margin. The wound margins are usually well demarcated but irregular in outline (Gauglitz and others, 2011). They may be tender or painful with a

shiny surface and sometimes have telangiectasia (commonly known as spider veins) and a pink or purple appearance accompanied by hyperpigmentation. Keloids occur more frequently in darkly pigmented individuals and may be associated with a family history of keloids. While they may form on any part of the body, keloids appear more commonly on the upper chest and shoulders. Keloids may develop up to several years after even minor injuries and may even form spontaneously on the midchest in the absence of any known injury (Gauglitz and others, 2011). They usually persist for long periods of time and do not regress spontaneously.

Contractures

Contractures occur when soft tissue such as muscles become shortened and prevent the joint moving through a normal range of movement. Contraction of the wound edges is a normal process of wound healing, but when contracture is excessive it may cause cosmetic and functional deformity. The degree of contraction is influenced by the flexibility and mobility of the surrounding tissue structures.

Haemorrhage

Haemorrhage (bleeding) from a wound site is normal during and immediately after the initial trauma. Haemostasis occurs within several minutes unless large blood vessels are involved or the patient has poor clotting function. Haemorrhage occurring after haemostasis indicates a slipped surgical suture, a dislodged clot, an infection, or erosion of a blood vessel by a foreign object (e.g. a drain). Haemorrhage may occur externally or internally. For example, if a surgical suture slips off a blood vessel, bleeding occurs internally within the tissues and there are no visible signs of blood unless a surgical drain, which is inserted into tissues beneath a wound to remove fluid that collects in underlying tissues, is present. Internal bleeding may be detected by looking for distension or swelling of the affected body part, a change in the type and amount of drainage from a surgical drain or signs of hypovolaemic shock.

External haemorrhaging is more obvious. If bleeding is extensive, the dressing soon becomes saturated, and often blood escapes along the sides of the dressing and pools beneath the patient. The risk of haemorrhage is greatest during the first 24–48 hours after surgery.

Haematoma

A **haematoma** is a localised collection of blood underneath the tissues. It appears as a swelling or mass that often takes on a bluish discolouration. A haematoma near a major artery or vein is dangerous because pressure from the expanding haematoma may obstruct blood flow.

Evisceration

Evisceration is when there is total separation of wound layers or protrusion of visceral organs through a wound opening. The condition is a medical emergency that requires surgical repair and immediate patient support.

Fistula

A **fistula** is an abnormal passage between two organs or between an organ and the outside of the body. A surgeon may create a fistula for therapeutic purposes (e.g. making an opening between the stomach and the outer abdominal wall to insert a gastrostomy tube for feeding). Most fistulas, however, form as a result of poor wound healing or as a complication of disease, such as Crohn's disease or regional enteritis. Trauma, infection, radiation exposure and diseases such as cancer prevent tissue layers from closing properly and allow the fistula tract to form. Fistulas increase the risk of infection and fluid and electrolyte imbalances from fluid loss. Chronic drainage of fluids through a fistula can also predispose a person to skin breakdown.

Wound infection

Wound infection is defined as the clinical syndrome of bacteria and other microbial organisms impairing wound healing (Australian Wound Management Association, 2011). Wound infection is a serious problem in hospitals and the community. Clinically a wound can exhibit signs of local infection but a wound swab may show 'no growth'. Furthermore, positive culture findings do not always indicate an infection because many wounds contain colonies of non-infective resident bacteria. In fact, all chronic wounds are considered contaminated with bacteria. What differentiates *contaminated wounds* from *infected wounds* is the amount of bacteria present. There are several different classification systems used to categorise the impact of bacteria on a

wound and the patient. Some clinicians use the concept that $>10^5$ microorganisms per gram of tissue constitutes an infection (Australian Wound Management Association, 2011), although this is not always an accurate indicator of the presence of an infection. The effect of bacteria on wound healing is best conceptualised by the following algorithm:

$$\frac{\text{Number of bacteria} \times \text{Virulence}}{\text{Patient resistance}}$$

Table 30-8 outlines a classification system that can be used to assist clinicians to determine how bacteria might be affecting the wound healing process in wounds healing by secondary intention. This classification system considers the effect of bacteria on the wound and on the patient.

There are several broad indicators of infection available to assess the degree of bacterial impairment on wound healing. The clinical indicators of infection are outlined in Table 30-9.

It must be remembered that bacterial impairment of wound healing is a continuum, and worsening of infection may or may not include some or all of the factors outlined in Table 30-9. In some people, the traditional clinical signs of inflammation—erythema, oedema, pain, heat—may not be present due to suppression of the immune response as a result of ischaemia, neuropathy or immunosuppression which can result from age, poor nutrition, other comorbidities and medications.

The development of infection must be reported as a clinical indicator in most hospitals. Surgical site infections (SSIs) are defined as either:

LEVEL OF BACTERIAL IMPAIRMENT	BACTERIAL ACTIVITY	DEGREE OF IMPAIRMENT TO WOUND HEALING AND CLINICAL SIGNS
Contamination	Bacteria are on the wound surface No division is occurring	No impairment to healing No obvious clinical signs of infection
Colonisation	Bacteria are dividing	No impairment to healing No obvious clinical signs of infection (Clinical wound appearance does not usually differ from contamination)
Topical infection (critical colonisation)	Bacteria are dividing. Bacteria and/or their products have invaded the wound surface. There might be an increasing variety of bacteria present. Biofilm may be present	Impairment to healing Clinical signs of infection may not be obvious or are subtle (see Table 30.9)
Local infection	Bacteria and/or their products have invaded the local tissues	Impairment to healing Usually obvious clinical signs of infection localised to wound environment and immediate peri-wound tissue (see Table 30.9)
Regional/spreading infection/cellulitis	Bacteria and/or their products have invaded surrounding tissues	Impairment to healing Usually obvious clinical signs of infection. May have systemic signs
Sepsis	Bacteria and/or their products have entered the bloodstream and may spread to distant sites or organs	Impairment to healing Usually obvious systemic clinical signs: patient usually acutely unwell Damage to organs may occur

From Position Document of the Australian Wound Management Association: Bacterial impact on wound healing: From contamination to infection. Australian Wound Management Association Inc, July 2009, p. 5. www.awma.com.au/publications/2009/bacterial_impact_position_document_V_1_0.pdf. Reproduced with permission of AWMA. All rights reserved.

TABLE 30-9 INDICATORS OF INFECTION

LEVEL OF BACTERIAL IMPAIRMENT	CLINICAL INDICATORS OF BACTERIAL IMPAIRMENT TO WOUND HEALING
Topical infection/critical colonisation	Dull wound tissue—absence of vibrant granulation tissue Slough Failure of wound to decrease in size or increase in wound size Increased exudate Hypergranulation/friable tissue Demarcated and/or rolled and/or raised wound margins
Local infection	Erythema—usually localised to periwound tissue Increased pain or unexplained pain Oedema—usually localised to periwound tissue Purulent or discoloured, viscous exudate Malodour Bridging and/or pocketing within the tissue Increased temperature of periwound tissue Increase in wound size
Regional/spreading infection	Spreading erythema—more than 2 cm from wound margin Cellulitis Induration of regional tissues Fever Oedema of regional tissues Malaise and/or general feeling of unwellness
Sepsis	High fever or hypothermia Lymphangitis and regional lymphadenopathy Delirium Organ compromise or failure Septic shock—hypotension, tachypnoea, tachycardia

From Position Document of the Australian Wound Management Association: Bacterial impact on wound healing: From contamination to infection. Australian Wound Management Association Inc, July 2009, p. 7. www.awma.com.au/publications/2009/bacterial_impact_position_document_V_1_0.pdf. Reproduced with permission of AWMA. All rights reserved.

- a *superficial incision SSI* whereby infection involves only skin or subcutaneous tissue of the incision and occurs within 30 days after the operative procedure, or
- a *deep incisional/organ/space SSI* whereby infection involves deep soft tissues (e.g. fascial and muscle layers) and/or organs or spaces opened or manipulated during an operation, and occurs within 30 days after the operative procedure if an implant is not present or within 1 year if an implant is in situ (Australian Wound Management Association, 2011).

The chances of wound infection are greater when the wound contains dead or necrotic tissue, there are foreign bodies in or near the wound, and the blood supply and local tissue defences are reduced.

Bacterial wound infection inhibits wound healing. Now that you have a better understanding of how to recognise wound infection, you are ready to learn how to obtain a bacterial wound swab—see Skill 30-1.

Factors affecting wound healing

Being able to recognise factors that can affect the wound-healing process is essential so that you can take steps to either remove the factors slowing down this process or, if possible, minimise their impact. Some factors that may affect the wound-healing process are outlined in Table 30-10.

CRITICAL THINKING

Refer back to the photo of Mr Bukowski's skin tear.

- What characteristics would indicate whether this wound was infected?
- What is the predominant tissue type in the wound bed?
- How would you describe the wound edges?
- How would you describe the skin around the wound?

Wound assessment

Knowledge of different types of wounds, the wound-healing process and factors that affect wound healing informs the nurse's wound assessment. Key elements of a wound assessment include those outlined below.

Wound history

This includes a history of the present wound or symptoms. You might like to ask:

- How and when did the wound start?
- How long have you had it for and what does the current treatment involve? (i.e. who is treating the wound, with what, and how often)
- Is there any past history of wounds?
- Do you have any pain and how would you describe the pain?
- What provokes or relieves the pain?

SKILL 30-1

Performing a bacterial wound swab

DELEGATION CONSIDERATIONS

A bacterial wound swab can be undertaken by all healthcare professionals if infection is suspected. Check organisational policies regarding which wound care interventions can be delegated to health workers. The assessment of wound infection requires the problem-solving and knowledge-application skills of a registered nurse.

EQUIPMENT

- Examination gloves
- Apron
- Facemask and protective eyewear
- Sheet or towel for draping
- Contaminated-waste bag
- Normal saline
- Bacterial swab
- Specimen bag
- Dressing pack

STEPS	RATIONALE
1. Assess wound for suspected clinical signs and symptoms of wound infection, including quantity and type of exudate, presence of malodour, wound deterioration, increasing wound size and deterioration of periwound skin.	Helps to determine need for wound swab. Clinical signs of infection may be overt or subtle, and may be indicated by wound deterioration, increasing wound size or wound that fails to make satisfactory progress.
2. Assess patient's level of comfort and offer analgesia if appropriate.	Removal of dressing and the presence of a wound infection may be associated with pain requiring analgesia.
3. Explain procedure to patient.	Decreases anxiety.
4. Close room or cubicle curtains and windows.	Provides privacy and reduces airborne microorganisms.
5. Position patient comfortably and drape with a sheet or towel to expose only wound site.	Provides access to wound while minimising unnecessary exposure.
6. Place disposable contaminated-waste bag within reach of work area. Fold top of bag to make cuff.	Ensures easy disposal of soiled dressings.
7. Put on face mask and protective eyewear and wash hands thoroughly. Put on clean, disposable gloves.	Protects nurse from splashes and reduces risk of transfer of microorganisms.
8. Carefully remove dressings. If dressing is adhered, moisten to facilitate removal. Observe dressing for exudate, odour and colour. Remove gloves over contaminated dressings (see Skill 30-2) and discard into prepared bag. Perform hand hygiene.	Reduces transmission of microorganisms. Moistening dressing upon removal decreases pain and trauma to tissue. Glove removal prevents contact of nurse's hands with material on gloves.
9. Cleanse wound with normal saline or potable tap water.	Removes exudate, slough, necrotic tissue or dressing product from the wound bed to ensure a more accurate result.
10. Avoid touching the wound surface, sterile swab surface or swab container opening.	Reduces transmission of microorganisms.
11. Move swab across the surface of the wound in a zig-zag motion at the same time as rotating the swab between the fingers. A representative area of the wound should be sampled, i.e. at least 1 cm ² from the wound bed. Gentle downward pressure may be applied.	The Z-stroke technique involves rotating the swab in a 10-point zigzag fashion (side to side across the wound without touching the wound edges or periwound skin). Downward pressure helps to release fluid from the wound surface.
12. Immediately following collection, return the swab carefully to the specimen container and accurately label as per laboratory guidelines.	The specimen must be labelled to provide laboratory staff with information required to process results. It is important to transport the specimen to the laboratory as soon as possible for processing.
13. Put on clean disposable gloves. Cover wound with appropriate dressing (see Skill 30-2).	Provides a moist wound environment to facilitate wound healing, absorbs exudate, reduces risk of bacterial colonisation and pain.
14. Remove gloves by pulling them inside out. Dispose of in prepared bag.	Reduces transmission of microorganisms.
15. Assist patient to a comfortable position.	Promotes patient comfort.
<h2>RECORDING AND REPORTING</h2> <ul style="list-style-type: none"> • Document all relevant information in patient's chart, including the location the specimen was taken from and the date and time. In most organisations a bacterial wound swab will require prescription from a medical professional. 	

TABLE 30-10 FACTORS AFFECTING WOUND HEALING

FACTOR	EXPLANATION
Comorbidities	Illnesses such as renal failure, heart failure, stroke, diabetes, malignancy, rheumatoid arthritis and autoimmune disorders increase a person's risk of suffering impaired wound healing because of the way these diseases affect all body systems For example, poorly controlled diabetes can lead to neuropathy, ischaemia and infection, and anaemia reduces the supply of circulating red blood cells and the oxygen-carrying capacity of blood to the wound
Nutrition and hydration	Poor nutrition and hydration will slow down the wound-healing process because the body will not have enough nutrients to promote wound healing. A wound increases the body's need for nutrients, protein and energy Patients need to drink at least 6–8 glasses of fluid per day because a lack of fluids impairs the blood flow, which reduces oxygen and nutrients needed in the tissue to promote wound repair. Dry skin is less elastic and more likely to break down. Sources of fluid include water, juice, milk, jelly, ice cream, yoghurt, soup, tea and coffee
Medications	Some medications that make the blood less likely to clot (e.g. anticoagulants) or steroids (e.g. taken for conditions such as rheumatoid arthritis) make the skin thinner and more likely to tear and suppress the inflammatory phase of healing
Age	Blood flow decreases with age, and the older a person is the more likely they are to have problems with their skin
Obesity	Adipose tissue is poorly vascularised and can delay wound healing or lead to dehiscence of the wound edges
Psychological state	There is a link between high levels of stress and impaired wound healing The presence of a wound can affect a person's body image, self-concept and sexuality
Decreased blood supply	Hardened, narrowed or blocked arteries reduce blood supply to the skin. This slows down wound healing because blood carries nutrients and oxygen
Infection	The presence of a wound infection slows down healing
Foreign bodies	A foreign body such as wound debris, sutures, dirt, hair, dressing products or infection in a wound delays wound healing
Pressure, friction, shear	Dry skin is more likely to tear due to friction, shearing or pressure
Temperature	Wounds need a stable temperature, approximately 37°C, to heal more rapidly
Exudate and moisture	High volumes of wound exudate can delay wound healing and increase the risk of wound infection and breakdown of periwound tissue Wounds need a moist wound environment to heal so that epithelial cells can migrate across the wound surface. Achieving optimal moisture balance in the wound bed is a key goal of wound healing Scab formation in the wound bed delays epithelialisation because epithelial cells have to migrate under the scab
Loss of sensation	Decreased sensation, loss of consciousness, an injury to the central nervous system, a stroke, major surgery, spinal cord injury or medications such as steroids or anticoagulants increase the risk of skin damage. This is because the patient may not be aware that an injury to the skin has occurred
Smoking	Cigarette smoking is a well-known risk factor for impaired wound healing because it leads to atherosclerosis and coronary heart disease

It is also important to ask about any medical conditions the person may have, as well as their smoking history, mobility, medication and nutritional status.

Cause of the wound

It is important to determine the cause of the wound (e.g. due to an accident or surgery), the type of wound (e.g. skin tear, venous leg ulcer or pressure injury) and the classification of wound (e.g. the category of skin tear or the stage of pressure injury).

The extent of tissue loss can help to predict wound-healing outcomes. For example, a wound healing by primary intention where there is minimal loss of tissue and the edges of the wound can be reapproximated by sutures or staples will heal much more quickly than a wound healing by secondary intention.

The extent of tissue loss is often described using the following terminology.

- *superficial*: a wound involving the epidermis
- *partial-thickness*: a wound involving the epidermis and dermis

- *full-thickness*: a wound which involves the epidermis, dermis, subcutaneous tissue and may extend into the muscle, bone or tendon.

A wound may also be described using a classification system. Classification systems have been developed to assist clinicians to gather the appropriate information to identify risk factors for certain wound types. A classification system is useful in promoting a consistent approach to clinical examination and provides a common language to facilitate communication between clinicians. Classification systems have been developed for burns, pressure injuries, leg ulcers, diabetic foot ulcers and skin tears. The various classification systems for each wound type will be discussed later in this chapter.

Wound size

The size of a wound should be assessed when it first occurs. Measurement of a wound enables you to track progress over time. It is recommended that chronic wounds should be assessed at least monthly or whenever there is any significant change in wound progress (Grey and others, 2006). Wounds can be measured using two-dimensional methods such as by tracing the margins of the wound using a transparent acetate grid and marking pen. If a metric graph sheet is used for tracing the wound, the size can be determined by counting the number of squares on the graph paper. A ruler can also be used to measure the length and width of a wound. Assessment of the depth or length of a wound can be performed using a probe. It is preferable that wound depth is recorded using a probe with a rounded tip that has measurement calibrations along the length of the probe. In a cavity wound with undermining, tracking or sinus formation occurring, record the direction of the sinuses or tracking by drawing the direction using times on a clock face. In recent years, a number of computerised wound measurement systems have been developed.

Wound photography

Digital photography is becoming increasingly used in wound management. Wound photography provides an accurate and objective means of assessment and evaluation of wound treatments, can aid in diagnosis of a wound, reduces the risk of misinterpretation of wound assessment and progress between clinicians, provides a documented record for medicolegal purposes and assists in teaching, research and publication. It is essential that written consent is obtained from the patient/relative or carer prior to taking photographs.

Wound edge

The wound edge or border can give important clues as to the type of wound that you are treating:

- venous leg ulcers are characterised by a sloping wound edge (Figure 30-4)
- arterial leg ulcers have a punched-out wound edge (Figure 30-5)



FIGURE 30-4 Venous leg ulcer.

Courtesy Wound Healing Community Outreach Service, Queensland University of Technology.



FIGURE 30-5 Arterial leg ulcer.

Courtesy Wound Healing Community Outreach Service, Queensland University of Technology.

- undermining is a typical feature of a pressure injury (Figure 30-6)
- diabetic foot ulcers have a calloused wound edge (Figure 30-7)
- skin cancers have a raised wound edge (Figure 30-8).

Wound location

The location of the wound can aid diagnosis. For example:

- diabetic foot ulcers occur on the sole of the foot and toes
- venous ulcers occur on the lower third of the leg below the knee
- arterial leg ulcers occur on the top of the foot, toes or ankle bones
- pressure injuries occur over bony prominences such as the sacrum, hips or heels
- skin cancers tend to occur in sun-exposed areas.



FIGURE 30-6 Pressure injury located on right ischium.
Courtesy Wound Healing Community Outreach Service, Queensland University of Technology.



FIGURE 30-7 Diabetic ulcer on foot.
Courtesy Wound Healing Community Outreach Service, Queensland University of Technology.



FIGURE 30-8 Skin cancer.
Courtesy Wound Healing Community Outreach Service, Queensland University of Technology.

Clinical appearance

The colour of the tissue in the wound gives an indication of the health of the wound, and this guides treatment options. For example, healthy granulation tissue is beefy red in colour and is an indicator of healing. However, unhealthy granulation tissue appears darker in colour and bleeds easily, indicating that an infection may be present.

There are five main colours that you can use to describe the predominant type of tissue in the wound bed:

- black necrotic tissue (Figure 30-9)
- yellow sloughy tissue (Figure 30-10)
- red granulating tissue (Figure 30-11)
- pink epithelialising tissue (Figure 30-12)
- green infected tissue (Figure 30-13).



FIGURE 30-9 Necrotic tissue.
Courtesy Wound Healing Community Outreach Service, Queensland University of Technology.



FIGURE 30-10 Yellow sloughy tissue.
Courtesy Wound Healing Community Outreach Service, Queensland University of Technology.

Some wounds may have a component of each colour present (e.g. yellow sloughy and red granulating), but when doing a wound assessment, it is the *predominant* tissue colour present that you need to be concerned with.



FIGURE 30-11 Red granulating tissue.

Courtesy Wound Healing Community Outreach Service, Queensland University of Technology.



FIGURE 30-13 Green infected wound.

Courtesy Wound Healing Community Outreach Service, Queensland University of Technology.



FIGURE 30-12 Pink epithelialising wound.

Courtesy Wound Healing Community Outreach Service, Queensland University of Technology.



FIGURE 30-14 Infected leg ulcer.

Courtesy Wound Healing Community Outreach Service, Queensland University of Technology.

Wound exudate

The type, amount, colour, consistency and odour of wound leakage or **exudate** should be noted. Types of exudate include:

- **serous:** clear, straw-coloured fluid
- **haemoserous:** slightly blood-stained serous fluid
- **sanguineous:** frank or heavily blood-stained
- **purulent:** containing pus.

The amount of wound exudate is important to quantify, and is usually described as *light*, *moderate* or *heavy*. The colour relates to the type of exudate but may also indicate

the type of bacteria present in a wound. For example, the bacteria *Pseudomonas aeruginosa* has a blue-green colour. Consistency refers to the thickness or composition of exudate; for example, fistulae may produce a thick fluid. Odour emanating from a wound may indicate the presence of a wound infection or contamination by body fluids.

Surrounding skin

The condition of the surrounding skin is important to assess because this can assist you when selecting an appropriate wound dressing. The wound margin and surrounding skin should be assessed for callous formation, maceration, oedema or erythema (Schultz and others, 2003). In patients with diabetes, there may be a build-up of callus on the bottom of the foot which indicates higher plantar pressures and is a barrier to wound healing. If the skin around the wound is white and boggy (maceration, see Figure 30-15), this indicates that the wound is producing moderate to large amounts of leakage (exudate) and you need to select an absorbent dressing.



FIGURE 30-15 Maceration.

Courtesy Wound Healing Community Outreach Service, Queensland University of Technology.

Wound infection

If a patient has a wound, it may have the following clinical manifestations:

- heat in the skin around the wound or extending more than 2 cm beyond the wound margins
- redness (erythema) around the wound or extending more than 2 cm beyond the wound margins
- swelling (oedema) around the wound or extending more than 2 cm beyond the wound margins
- pain that has changed in intensity
- delayed healing
- wound tissue that bleeds easily on contact
- an offensive odour
- abnormal granulation tissue.

Pain

Pain is a characteristic of all wounds and it is important to routinely assess pain and attempt to determine its cause. Pain is often related to dressing removal, or the result of an underlying condition such as infection or poor blood supply (World Union of Wound Healing Societies, 2004).

The nature and type of pain should be identified and treated appropriately. Wound pain can be classified as *nociceptive* or *neuropathic*. Nociceptive pain is an appropriate physiological response to a painful stimulus and may involve acute or chronic inflammation. Acute nociceptive pain can occur as a result of tissue damage and is usually time-limited. In wounds that are slow to heal, prolonged inflammation may cause heightened sensitivity in the wound (primary hyperalgesia) and in the surrounding skin (secondary hyperalgesia).

Neuropathic pain is an inappropriate response caused by a primary lesion or dysfunction in the nervous system and can occur after surgical or traumatic wounds. Neuropathic pain is associated with altered or unpleasant sensations whereby any sensory stimulus such as light touch or pressure can cause intense pain (allodynia).

Chapter 41 provides an overview of useful pain assessment tools that should be incorporated into nursing assessment to provide measures of pain and the success of wound and analgesic choices.

Psychosocial impact of wounds

The presence of a wound can have a significant impact on an individual's psychosocial functioning. Factors such as social isolation, gender, economic status and pain affect wound healing. Stress, anxiety and depression have been linked to alterations in immune function which can negatively affect wound healing (European Wound Management Association, 2008).

Wound documentation

Recording the wound assessment and evaluating the effectiveness of the wound management plan is essential. The information captured from a wound assessment is commonly documented using a wound assessment tool. Wound assessment tools facilitate communication and continuity of care between clinicians and fulfil legal requirements (Hess, 2005). Risk assessment tools are often used in wound management as a tool to predict a patient's level of risk of developing a wound such as a pressure injury or diabetic foot ulcer.

• CRITICAL THINKING

As you read the next section, think about how you would decide on the management of Mr Bukowski's skin tear:

- How would you cleanse this wound?
- What type of management strategies would you employ for a skin tear?
- What dressing regimen would you choose at this point, and why?
- How would you manage the skin around the wound?

Principles of wound management

Many factors affect the wound-healing process. Therefore, wound management strategies must be tailored to meet the individual holistic needs of the patient, their wound and their environment.

Assess and correct cause of tissue damage

The health status of the patient has a significant impact on the wound-healing process; therefore, a general health history including a medication history is essential in order to identify factors that may affect wound healing. There are many medications that can impair wound healing, including systemic steroids, immunosuppressive drugs and non-steroidal anti-inflammatories (Schultz and others, 2003). Chronic diseases such as diabetes mellitus and rheumatoid arthritis and autoimmune disorders such as systemic lupus erythematosus, vasculitis and pyoderma gangrenosum also delay wound healing.

Assess wound history and characteristics

Ongoing assessment and evaluation of the wound is an essential step in promoting wound healing.

Ensure adequate tissue perfusion

It is essential that the tissue is well perfused, as a well-vascularised wound bed provides nutrients and oxygen to promote granulation tissue formation and to maintain active immunological response to bacteria. Decreased oxygen levels impair the ability of leucocytes to kill bacteria, lower production of collagen and reduce epithelialisation (Schultz and others, 2003).

Wound-bed preparation

Wound-bed preparation is the management of the wound to promote wound healing or to facilitate the effectiveness of other therapeutic measures (Schultz and others, 2003). Wound-bed preparation involves four fundamental principles which provide a systematic approach to the management of wounds by focusing on each stage of wound healing:

1. *Tissue*: removal of non-viable tissue or replacement of deficient tissue
2. Control of *infection* or *inflammation*
3. *Moisture imbalance*: correction of excessive moisture and prevention of desiccation
4. Revision of the *edge of wound* to stimulate healing.

These principles will now be explored in further detail.

Wound cleansing

Wounds should be cleaned with a neutral, non-irritating, non-toxic solution such as clean tap-water or normal saline

(Whitney and others, 2006). Cleaning should be undertaken with minimal chemical or mechanical trauma. The ultimate aim of wound cleansing is to remove both organic and inorganic debris while maintaining the optimum local environment to facilitate wound healing (Fernandez and Griffiths, 2012). Before performing wound cleansing, consider the purpose of wound cleansing and whether the advantages of cleansing outweigh the disadvantages; the most appropriate method of wound cleansing; whether the wound requires cleansing at each dressing change; and the type of wound-cleansing product that is most appropriate.

Common reasons for cleansing a wound are to help prevent wound infection and remove excess debris or foreign bodies from the wound; to rehydrate the wound to provide a moist environment; to make wound assessment easier so that the size and extent of the wound can be visualised; before applying a dressing, to minimise trauma when removing adherent dressings; and to promote patient comfort and psychological wellbeing.

The decision to cleanse a wound should be based on the shape, size and location of the wound; condition of the wound bed and stage of healing; availability and effectiveness of different methods of cleansing; availability and effectiveness of different cleansing agents; and the patient's perceptions and needs.

WOUND-CLEANSING SOLUTIONS AND TECHNIQUES

The decision to use tap-water to cleanse wounds should be based on clinical judgment and take into account the quality of water, the nature of the wound and the patient's general condition (Fernandez and Griffiths, 2012). It is recommended that tap-water should not be used if it is not suitable for drinking and the tap should be run for 15 seconds prior to use (Joanna Briggs Institute, 2006). If potable tap-water or normal saline is not available, cooled boiled water is an effective wound-cleansing solution (Joanna Briggs Institute, 2006). In wounds that are contaminated or infected, irrigation with 1% povidone-iodine is effective at reducing the infection rate, although there is no evidence of the optimal time that povidone-iodine should be left in situ (Joanna Briggs Institute, 2006).

Gentle irrigation is effective at reducing infection and inflammation in patients with lacerations and traumatic wounds without causing tissue trauma (Joanna Briggs Institute, 2006). There is no evidence to support or refute swabbing and scrubbing as effective wound-cleansing techniques (Fernandez and Griffiths, 2012). When considering the method of wound cleansing, evidence suggests that showering patients does not affect infection and healing rates of postoperative wounds and may benefit patients with a feeling of wellbeing and health associated with cleanliness (Joanna Briggs Institute, 2006). Showering for cleansing other wounds should be undertaken with caution.

Wound debridement

Wound debridement is an essential component of optimal wound management. **Debridement** describes any method

that facilitates the removal of dead or devitalised tissue, metabolic waste, fibrin and foreign material from a wound (Gethin and others, 2010). Removal of necrotic and devitalised tissue can be undertaken through surgical, sharp, mechanical, autolytic, biological or enzymatic debridement techniques (Hopf and others, 2006; World Union of Wound Healing Societies, 2007). If dry gangrene or **eschar** (leathery brown or black necrotic tissue) is present, however, debridement should not be undertaken until arterial flow has been re-established (Whitney and others, 2006). There is insufficient evidence to conclude that any one debriding agent is more effective than another (Gethin and others, 2010; Williams and others, 2005).

When selecting an appropriate method of debridement a number of factors must be considered, including the patient's individual wishes and concerns, medical history, factors affecting the wound-healing process, pain, wound characteristics, skill and knowledge of the clinician and available resources (Kirshen and others, 2006). Specific wound characteristics that influence debridement decisions include size, depth and amount of exudate, as well as the characteristics of wound tissue, potential for bleeding, and infection. Methods of debridement that are selective are generally preferred because they remove only necrotic tissue.

- *Autolytic debridement* is the most frequently used method of debridement whereby there is breakdown and removal of devitalised tissue by the body's own cells and enzymes, and this is facilitated through the provision of a moist wound environment (Royal College of Nursing, 1998; Ayello and Cuddigan, 2004). Maceration of periwound tissue may be problematic. For autolytic debridement to be effective the wound requires some level of exudate, and it is a slow method of debridement. It is not recommended for clinically infected wounds and in those with a high potential for anaerobic infection, or if there is ischaemia of the limb or digits (Gethin and others, 2010).
- *Sharp debridement* may be performed at the bedside and involves selective removal of dead or devitalised tissue from within and around the wound to expose healthy tissue using sterile instruments such as scalpel, scissors or curette. This procedure involves similar risk factors to surgical debridement, although it is less aggressive, and must be performed by a skilled and experienced clinician.
- *Surgical debridement* is performed in an operating theatre usually under regional or general anaesthetic. It is indicated if there is extensive necrotic tissue, advancing cellulitis, infected bone or sepsis. This method of debridement is the most rapid and highly selective; however, the number of personnel and degree of expertise required increase cost and limit the availability of the procedure. There is also an increased risk of pain, bleeding, transient bacteraemia, damage to vital structures, tendon sheaths and nerves and anaesthesia

risks. Surgical debridement must be used with caution in patients with clotting disorders or on anticoagulant therapy and in patients with diabetes and peripheral vascular disease.

- *Mechanical debridement* is the process of physically removing debris from the wound bed. The most commonly used methods of mechanical debridement include wet-to-dry dressings, whirlpool therapy, pulsed lavage and ultrasound. Mechanical debridement is non-selective, time-consuming, frequently painful and associated with an increased risk of infection, damage to granulation tissue, prolonged inflammation and periwound maceration.
- *Biological debridement* involves the application of sterile maggots, specifically the larvae of the green bottle fly (*Lucilia sericata*), to the wound bed.
- *Enzymatic debridement* is the topical application of an exogenous enzyme to the wound bed to facilitate a host response. Topical enzymatic agents may be plant-, animal- or microbe-derived. They are not commercially available in Australia or New Zealand at present.

When selecting the most appropriate method of debridement, the indications and contraindications for the different types of debridement options must be considered. Evidence supports that debridement is an important step in preparing the wound bed for healing (Ayello and Cuddigan, 2004; Kirshen and others, 2006; Moffatt and others, 2008).

Provision of a moist wound environment

A **moist wound environment** is essential to promote wound healing because cells need moisture to be able to migrate across a wound bed. Extreme wetness or dryness may delay healing. Application of dressings to a wound may help to facilitate wound healing by providing the optimal wound environment. Wound dressings may also be applied to:

- provide rapid and cosmetically acceptable healing
 - remove or contain odour
 - reduce pain
 - prevent or treat infection
 - contain exudate
 - cause minimum distress or disturbance to the patient.
- Before applying a dressing, it is essential that you know:
- the action of the dressing
 - when it should be used
 - the limitations or contraindications to its use, and
 - the correct method of application and removal.

There are two different categories of wound dressings: *primary dressings*—those in direct contact with a wound; and *secondary dressings*—those not in contact with a wound but covering the primary dressing (Xue, 2008). When selecting a secondary dressing, it is important to ensure that it is compatible with the primary wound-contact layer.

Multiple factors inform the selection of a wound dressing: the type or aetiology of the wound, location or position of the wound, extent of tissue damage and size of the wound,

phase of wound healing, presence of debris or infection, level of exudate, odour, pain, patient-centred concerns, cost-effectiveness, the indication/contraindication of the dressing, condition of the surrounding skin and desired patient outcomes (Xue, 2008).

Evidence suggests that dressings should:

- maintain a moist wound healing environment (Griggs, 2008; Whitney and others, 2006; Xue, 2008)
- manage wound exudate and protect the skin surrounding the wound (Whitney and others, 2006; Xue, 2008)
- remain in place if possible and minimise shear, friction, skin irritation and pressure (Whitney and others, 2006)
- be non-adherent to reduce trauma on removal (World Union of Wound Healing Societies, 2004)

- be cost-effective, acceptable to the client and changed less often where possible (Hopf and others, 2006; World Union of Wound Healing Societies, 2004).

Topical antimicrobial dressings may be beneficial when wounds are infected (Hopf and others, 2006).

Unfortunately there is no one dressing that is ideal for every wound. Dressings are classified according to their properties into generic groups. The main classes of wound dressing products and their properties are outlined in Table 30-11.

Now that you have a better understanding of the principles of wound assessment, wound cleansing and wound dressings, you are ready to learn how to perform a simple wound dressing—see Skill 30-2.

TABLE 30-11 **WOUND DRESSINGS**

CLASSIFICATION	PROPERTIES	CLINICAL CONSIDERATIONS	EXAMPLES
Semi-permeable film	Made from a thin sheet of polyurethane coated with a layer of adhesive Permeable to moisture, vapour and gases but impermeable to liquids Different types of film dressings differ in their moisture/vapour permeability (MVP), method of application, extensibility, weight and thickness	Excessive exudate may pool under the dressing and result in maceration Care must be taken when removing film dressings. Many have a specific method to break the adhesive bond to ensure atraumatic removal Reaction/sensitivity to adhesive may occur If used on thin, fragile skin, damage can occur on removal	OpSite (Smith & Nephew) Tegaderm (3M)
Tulle gras non-medicated dressings and medicated dressings	Open mesh, cotton, rayon, viscose or gauze impregnated with white or yellow soft paraffin and/or medicated antiseptic	Few indications for use as a primary wound dressing—often fail to meet the criteria of an ideal dressing Low to moderate exuding wounds, i.e. clean superficial wounds, split-thickness skin grafts, minor burns Reduces adhesion and allows non-traumatic removal Provides a moist environment that facilitates epithelial cell migration Does not absorb exudate Requires a secondary dressing Cotton products can shed fibres into the wound Synthetic fabric or paraffin products can cause allergic reactions in sensitive people Requires frequent dressing changes to avoid drying out and damage to granulation tissue Ineffective release of antimicrobials from the paraffin base has been reported Antiseptic may cause allergic reaction in some people	Jelonet (Smith & Nephew) Adaptic (Johnson & Johnson) Xeroform (contains bismuth) (Kendall) Bactigras (contains chlorhexidine) (Smith & Nephew)
Alginate	Derived from seaweed Produce a moist gel in the presence of exudate Highly absorbent Facilitate autolytic debridement of moist slough and necrotic tissue Act as a haemostat Reduce pain by keeping nerve endings moist Mostly insoluble Available as a rope or pad Conformable	Useful for filling irregularly shaped wounds such as cavities, abscesses and sinuses Used on moderate to heavily exuding wounds—pressure sores, leg ulcers, graft donor sites Can be used on infected wounds Useful for debriding moist devitalised tissue Requires a secondary dressing	Kaltostat (ConvaTec) Algisite M (Smith & Nephew)

Hydrofibre	<p>Synthetic fibre composed of 100% carboxymethylcellulose</p> <p>Available as sheet or ribbon</p> <p>Absorb exudate vertically, resulting in moisture being drawn up and away thus preventing its spread to surrounding skin</p> <p>Highly absorbent</p> <p>Conformable</p> <p>Facilitate autolytic debridement of slough and necrotic tissue</p> <p>Promote pain relief by keeping nerve endings moist</p>	<p>Moderate to heavily exuding wounds—pressure sores, leg ulcers</p> <p>Can be used on infected wounds</p> <p>Can be used at all stages of healing, from debridement to protection of granulation tissue</p> <p>Requires a secondary dressing</p>	Aquacel (ConvaTec)
Hydrocolloid	<p>Occlusive or semi-occlusive</p> <p>Contain gelatine, pectin and sodium carboxymethylcellulose in a polymer matrix</p> <p>Provide a moist healing environment and facilitate autolytic debridement</p> <p>Available in all shapes, sizes, adhesive properties and forms including wafers, pastes and powders</p> <p>Absorbent—low to high levels of exudate</p> <p>Promote pain relief by keeping nerve endings moist</p> <p>Impermeable to bacteria and other contaminants</p>	<p>May be used as a primary or secondary dressing to manage select pressure ulcers and wounds with necrosis or slough</p> <p>Produce a liquid that resembles pus and may have a strong smell</p> <p>Not recommended for wounds with heavy exudate, sinus tracts or infections, wounds surrounded by fragile skin or wounds with exposed tendon or bone</p> <p>May curl at the edges</p> <p>May injure fragile skin upon removal</p>	<p>Duoderm (ConvaTec)</p> <p>Comfeel (Coloplast)</p> <p>Replicare (Smith & Nephew)</p>
Hydrogel	<p>Have a high water content and contain insoluble polymers</p> <p>Designed to hydrate wounds and promote autolytic debridement</p> <p>Promote pain relief</p>	<p><i>Sheet gels</i> have a solid shape and can be placed on top of the wound without being cut to size—low to moderately exuding flat wounds, i.e. pressure sores, leg ulcers, minor burns, traumatic wounds</p> <p><i>Amorphous (no shape) gels</i>—low to moderately exuding wounds, necrotic or sloughy wounds, i.e. pressure sores, sinuses, cavity wounds</p> <p><i>Hydrogel-impregnated dressings</i> are non-woven gauze impregnated with amorphous gel—good for packing low-exudate cavity wounds</p> <p>Useful for rapid debridement of both dry and moist devitalised tissue</p> <p>Sometimes associated with increased skin maceration at wound edges, especially if exudate levels are high.</p> <p>Should not be used in blind sinuses where extent of tracking cannot be identified</p> <p>Some people have experienced sensitivity to the preservative agents in some products</p> <p>Used for low to moderate levels of exudate and require a secondary dressing. As hydrogels release water to any dry surface, the use of secondary dressings that are dry or high-absorbency, such as polyurethane foam, is not recommended</p>	<p><i>Amorphous gels:</i></p> <p>Intrasite Gel (Smith and Nephew)</p> <p>SoloSite Gel (Smith and Nephew)</p> <p><i>Gel sheets:</i></p> <p>Aquaclear (Hartmann)</p> <p>Curagel (Kendall)</p> <p><i>Gel-impregnated:</i></p> <p>Curafil (Kendall)</p> <p>IntraSite Conformable (Smith and Nephew)</p>

continued

CLASSIFICATION	PROPERTIES	CLINICAL CONSIDERATIONS	EXAMPLES
Low-adherent, absorbent dressings and non-absorbent dressings	Made from a variety of materials such as cotton/acrylic fibres and knitted viscose Some are coated with low-adherent materials, e.g. aluminium or perforated films Some have an absorbent layer Some are composed of non-adherent materials such as silicone and polyamide net	Dry to medium exuding wounds, i.e. surgical wounds healing by primary intention, superficial wounds Can be used to protect surgical incisions and recently healed wounds Remove carefully—low-adherent not non-adherent Skin maceration may occur Not suitable for highly exuding wounds unless specified	<i>Low-absorbent:</i> Melonin (Smith & Nephew) Release (Johnson & Johnson) <i>Absorbent:</i> Exu-Dry (Smith & Nephew) Mesorb (Mölnlycke)
Foam dressings	Mostly polyurethane foams with a hydrophilic action Low-adherent Absorbent dressings for low to high levels of exudate Good thermal insulating properties Permeable to water vapour, preventing the wound from drying out Available as non-adherent and adherent, occlusive and semi-occlusive Conform to body shape Protect and cushion	Low to heavily exuding wounds—pressure sores, leg ulcers, burns, graft donor sites Moist wound environment may not be enough to allow autolysis to occur May macerate periwound skin if they become saturated	Allevyn or Allevyn adhesive (Smith & Nephew) Biatain (Coloplast)
Silicone dressings	Polymer with a structure that consists of alternate atoms of silicon and oxygen with organic groups attached to the silicon atoms A soft silicone dressing is one coated with soft silicone as an adhesive or wound-contact layer The intrinsic properties of the soft silicone mean that they can be removed without causing trauma to the skin	Suitable where it is important to prevent trauma to the wound and the surrounding skin and pain to the patient There are a number of different types of soft silicone dressings that meet different clinical needs—skin grafts, skin tears, prophylaxis of skin during radiotherapy, burns, donor sites, leg ulcers, pressure ulcers, traumatic wounds All of the dressings help to maintain a moist environment May require a secondary dressing	Mepilex (Mölnlycke) Allevyn Gentle (Smith & Nephew) Biatain Silicone (Coloplast)
Hypertonic saline dressings	100% cotton gauze impregnated with crystalline (dry) or solution (wet) saline When placed into a wound the exudate releases the sodium chloride from the dressing, creating a hypertonic environment, absorbing exudate, bacteria and necrotic tissue, reducing oedema and permitting the formation of granulation tissue Technically hypertonic saline does not actually absorb exudate, but rather draws out fluid and debris via a steep osmotic gradient	Moist necrotic, draining and infected wounds Needs to be changed at least daily May cause discomfort or stinging Not recommended for wounds with actual or potential bleeding Not recommended on exposed tendon, muscle or bone Should be discontinued in the presence of healthy granulating or epithelialising wounds	Mesalt (Mölnlycke) Curasalt (Kendall)

Cadexomer iodine	<p>Made up of starch micro-beads that contain 0.9% iodine</p> <p>The cadexomer base absorbs exudate, swells and forms a gel</p> <p>Iodine is released progressively into the wound</p> <p>Iodine exerts an antimicrobial effect and bacteria are removed from the wound surface by the process of capillary action</p> <p>Available as a powder, paste or ointment</p>	<p>Low to heavily exuding, sloughy wounds</p> <p>Can be used on infected wounds</p> <p>Changes colour from brown to white when the iodine has been absorbed, indicating the need for a dressing change</p> <p>Not for use during pregnancy or with thyroid disease or suspected iodine sensitivities owing to the risk of systemic absorption</p> <p>Some patients report slight discomfort when dressing first applied</p> <p>The maximum single application is 50 g and weekly maximum must not exceed 150 g</p> <p>Treatment duration should not exceed 3 months in a single course of treatment</p> <p>Will require a secondary dressing</p>	Iodosorb powder, Iodosorb paste, Iodoflex (Smith & Nephew)
Silver dressings	<p>All silver-based dressings, whether alginates, foams, films, hydrofibres or other materials, achieve their antimicrobial action by generating and releasing silver into the wound</p> <p>Silver is a potent antimicrobial; bactericidal mechanisms of action of silver are not fully understood</p> <p>Silver dressings are active against a variety of micro-organisms including <i>Staphylococcus aureus</i>, methicillin-resistant <i>S. aureus</i> (MRSA), <i>Pseudomonas aeruginosa</i> and vancomycin-resistant enterococci (VRE)</p>	<p>To reduce the risk of wound infection and to treat infected wounds; provide sustained antimicrobial activity</p> <p>Can dry and adhere if minimal exudate</p> <p>Should not be used with other antimicrobials</p> <p>Do not dilute with saline (deactivates silver)</p> <p>Should not be used with zinc- or oil-based emollients</p> <p>Very expensive</p> <p>May mask host response to infection</p> <p>Should be used for short periods of time, i.e. 3–4 weeks, and the effectiveness re-evaluated</p> <p>Contraindicated in patients with known hypersensitivity to any of the components of the product. If signs of a sensitivity reaction develop during use, treatment should be discontinued</p>	Acticoat (Smith & Nephew) Aquacel-Ag (ConvaTec) Biatain Ag (Coloplast) Actisorb Silver (Johnson & Johnson) Atraumann-Ag (Hartmann) Mepilex Ag (Mölnlycke)
Medicated honey	<p>Comprised of 82% carbohydrate, enzymes and amino acids</p> <p>Acidic pH between 3.2 and 4.5; low enough to be inhibitory to many pathogens</p> <p>Possesses natural anti-inflammatory effects and stimulates granulation tissue</p> <p>Antimicrobial activity mainly through component of hydrogen peroxide</p> <p>Reduces odour</p> <p>Provides a moist environment and produces rapid tissue regeneration and debridement of non-viable tissue</p>	<p>For use on infected or highly contaminated wounds, malodorous wounds</p> <p>Apply honey liberally to either the surface of the wound or a dressing</p> <p>Frequency of dressing changes depends on how rapidly the gel is diluted by exudate</p> <p>Honey is not sterile and there is a perceived risk of wound contamination from the presence of <i>Clostridium botulinum</i> spores and <i>Bacillus</i> spp. in honey</p> <p>Only honey that has been sterilised/treated by gamma irradiation should be used on wounds</p> <p>Contraindications:</p> <ul style="list-style-type: none"> Allergies to bees Hypersensitivity reactions Transient stinging/burning on application 	Medihony (Comvita)
Odour-absorbing dressings	Contain activated charcoal to absorb odour, bacteria and exudate	<p>Infected or malodorous wounds</p> <p>Malignant or fungating wounds</p> <p>May need a secondary dressing</p>	Actisorb Plus (Johnson and Johnson) Carbonet (Smith and Nephew) CarboFlex (ConvaTec)

SKILL 30-2

Performing a wound dressing

DELEGATION CONSIDERATIONS

A wound dressing can be undertaken by all healthcare professionals. Check organisational policies regarding which wound care interventions can be delegated to health workers. The assessment of a wound requires the problem-solving and knowledge-application skills of a registered nurse.

EQUIPMENT

- Examination gloves
- Apron
- Facemask and protective eyewear
- Sheet or towel for draping
- Normal saline
- Contaminated-waste bag
- Acetate grid for wound tracing
- Black fine-tip permanent marker
- Sterile wound probe
- Adhesive remover (optional)
- Wound dressing (choice is dependent on wound characteristics including level of exudate, condition of wound bed, location of wound, mobility, etc)

STEPS	RATIONALE
1. Assess size and location of wound.	Helps to plan for type and amount of supplies required.
2. Assess patient's level of comfort.	Removal of dressing may cause pain and discomfort requiring pain medication.
3. Explain procedure to patient.	Decreases anxiety.
4. Close room or cubicle curtains and windows.	Provides privacy and reduces airborne microorganisms.
5. Position patient comfortably and drape with sheet or towel to expose only wound site.	Provides access to wound while minimising unnecessary exposure.
6. Place disposable contaminated-waste bag within reach of work area. Fold top of bag to make cuff.	Ensures easy disposal of soiled dressings.
7. Put on face mask and protective eyewear, if required, and wash hands thoroughly. Put on clean, disposable gloves.	Protects nurse from splashes and reduces risk of transfer of infection between patients.
8. Carefully remove dressing. If dressing is adhered, moisten to facilitate removal. Note the amount of exudate present on the dressing removed, any odour and condition of periwound skin. Remove gloves over contaminated dressing (see illustration) and discard gloves and dressing into prepared bag.	Moistening dressing upon removal decreases pain and trauma to tissue. Observing the dressing as it is being removed helps to determine the capacity of the current dressing to contain exudate, odour and its impact on the periwound skin. Removal of gloves over dressing reduces transmission of pathogens.



Step 8 Remove gloves over contaminated dressing

- | | |
|--|---|
| <p>9. Cleanse wound with normal saline or potable tap water. The decision to cleanse the wound should be based on the following:</p> <ul style="list-style-type: none"> • The shape, size and location of the wound • Condition of the wound bed and stage of healing • Availability and effectiveness of different methods of cleansing • The patient's perceptions and needs. | <p>The aim of wound cleansing is to remove both organic and inorganic debris from the wound and periwound skin to facilitate wound healing, and to make wound assessment easier so that the size and extent of the wound can be visualised.</p> |
| <p>10. Perform wound assessment.</p> <ul style="list-style-type: none"> • Wound aetiology • Wound location • Wound dimensions and extent of tissue loss. Apply acetate grid to wound and trace the wound margin with the felt pen. If the wound is a cavity or there is undermining of the wound margins, gently insert a sterile wound probe to measure the depth of the wound. • Evaluate the clinical appearance of the wound bed by estimating the percentages of tissue type in the wound bed (yellow/sloughy, red/granulating, black/necrotic, pink/epithelialising, green/infected tissue). • Wound edge (sloping, punched-out, undermining, calloused, raised or rolled) • Exudate (type, amount, colour, consistency and odour) • Condition of surrounding skin (maceration, erythema, oedema, warmth, capillary refill time) • Pain (amount, character, quality, relieving or exacerbating factors). | <p>Provides a combination of subjective and objective data to assess effectiveness of wound management plan and to plan appropriate interventions.</p> |
| <p>11. Put on clean gloves. Cover wound with appropriate dressing to provide a moist wound-healing environment. Dressing selection is based on the following factors:</p> <ul style="list-style-type: none"> • Aetiology of the wound • Characteristics of the wound: <ul style="list-style-type: none"> — Location — Extent of tissue damage — Wound size — Phase of healing (epithelialising, granulating, sloughy, necrotic) — Level of exudate — Pain — Odour — Presence of infection • Factors affecting wound healing • Cost-effectiveness • Ease of application and removal • Dressing should cause minimum distress or disturbance to the patient • Awareness of the limitations/contraindications of dressings. | <p>Provides a moist wound environment to facilitate wound healing, absorbs exudate, reduces risk of bacterial colonisation and pain.</p> |
| <p>12. Remove gloves by pulling them inside out. Dispose of in prepared bag.</p> | <p>Prevents contact of nurse's hands with material on gloves.</p> |
| <p>13. Assist patient to a comfortable position.</p> | <p>Promotes patient comfort.</p> |
| <p>14. Document all relevant information in patient's chart.</p> | <p>Provides relevant information about the patient and the wound, monitors healing process, guides wound management of the person as a whole, evaluates the success of management and fulfils legal requirement.</p> |

• CRITICAL THINKING

As you read the next section, consider the following questions:

- What self-help advice would you give to Mr Bukowski?
- What strategies would you recommend to prevent skin tear recurrence in the future?
- Are there any other healthcare professionals that you would liaise with in this case?

Assessment, management and prevention strategies for common wound types

Now that you have a better understanding of how to assess the skin and wounds, you are ready to learn more about assessing, managing and preventing conditions such as skin tears, leg ulcers, diabetic foot ulcers and pressure ulcers.

Acute wounds

Acute wounds are those that proceed through an orderly and timely reparative process to establish sustained anatomical and functional integrity (Franz and others, 2008). Acute wounds are the most commonly encountered wound type, and healing of the acute wound is often taken for granted as it is expected to heal within a 'normal' wound-healing trajectory.

Acute surgical wounds healing by primary intention require minimal intervention apart from observation for complications as the wound edges are brought together (apposed) and then held in place by mechanical means (adhesive strips, staples or sutures). A wound dressing may be required in the first 24–48 hours postoperatively to protect the wound from physical or pathogenic invasion, to absorb exudate and to maintain wound temperature. Most incisions closed by primary intention are resurfaced within 2–3 days after surgery. A *healing ridge* is often palpable approximately 5–9 days after surgical incision; this is an area of induration beneath the skin extending to about 1 cm on either side of the wound. Lack of the healing ridge may indicate dehiscence.

CLOSURE OF SURGICAL WOUNDS

Surgical wounds are closed with staples or sutures. *Sutures* are available in a variety of materials, including silk, steel, cotton, linen, wire, nylon and Dacron. Sutures come with or without sharp surgical needles attached. Sutures are placed within tissue layers in deep wounds and superficially as the final means of wound closure. The deeper sutures are usually an absorbable material that disappears in several days. Sutures are foreign bodies and thus are capable of causing local inflammation. The surgeon can minimise tissue injury by using the finest suture possible and the smallest number necessary. Stainless-steel *staples* may also be used (Figure 30-16); these provide more strength than nylon or silk sutures and tends to cause less irritation to the skin.

Normally, for the first 2–3 days after surgery the skin around sutures or staples is swollen. Continued swelling



FIGURE 30-16 Incision closed by wire staples.

From Potter PA, Perry AG 2004 *Fundamentals of Nursing*, ed 6. St Louis, Mosby.

may indicate that the closures are too tight. The skin can be cut by overly tight suture material, leading to wound separation. Sutures that are too tight are a common cause of wound dehiscence. Early suture removal reduces formation of defects along the suture line and minimises chances of unattractive scar formation.

REMOVAL OF WOUND CLOSURES

Policies vary within institutions as to who may remove sutures or staples, but usually a medical order is required. An order for suture removal is not written until the wound has closed (usually in 7–10 days). Usually the number of sutures or staples to be removed is indicated. If the suture line appears to be healing in certain locations better than in others, only some sutures may be removed (e.g. every second one).

To remove staples, the tip of the staple remover is inserted under each wire staple and then squeezed freeing the staple from the skin (Figure 30-17).

To remove sutures, the type of suturing used must first be identified (Figure 30-18). With *intermittent suturing*, the surgeon ties each individual suture made in the skin. *Continuous suturing*, as the name implies, is a series of sutures with only two knots, one at the beginning and one at the



FIGURE 30-17 Staple remover.

From Potter PA, Perry AG 2004 *Fundamentals of Nursing*, ed 6. St Louis, Mosby.

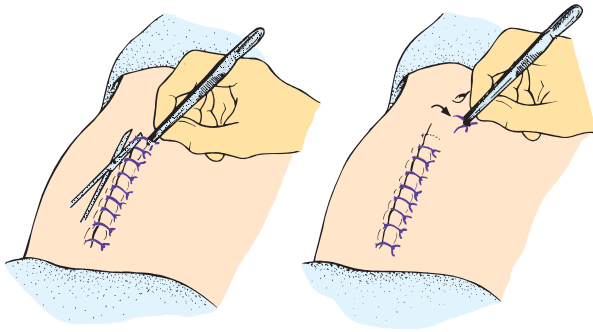


FIGURE 30-18 Examples of suturing methods. A, Intermittent. B, Continuous. C, Blanket continuous. D, Retention.

From Potter PA, Perry AG 2004 *Fundamentals of Nursing*, ed 6. St Louis, Mosby.

end of the suture line. *Retention sutures* are placed more deeply than *skin sutures* and may or may not be removed by the nurse, depending on agency policy. The manner in which the suture crosses and penetrates the skin determines the method for removal.

The most important principle in suture removal is never to pull the visible portion of a suture through underlying tissue. Sutures on the skin's surface harbour microorganisms and debris; the portion of the suture beneath the skin is considered sterile. Pulling the contaminated (external) portion of the suture through tissues may lead to infection. The suture material is cut as close to the skin edge on one side as possible and then the suture is pulled through from the other end.

Every second suture or staple is removed first, and the wound edges are then inspected for healing. The remaining sutures or staples are removed if the wound edges have adhered.

Drains

Drains may be inserted into a surgical wound if a large amount of drainage is expected and if keeping wound layers closed is especially important. Some drains are sutured in place. Caution should be exercised when changing the dressing over drains that are not sutured in place to prevent their being accidentally removed. A drain such as a Penrose drain may lie under a dressing, extend through a dressing or be connected to a drainage bag or a suction apparatus. The surgeon often places a pin or clip through the drain to prevent it from slipping further into a wound. It is usually a medical responsibility to pull or advance the drain as drainage decreases to permit healing deep within the drain site.

The nurse assesses the number of drains, drain placement, the character of drainage and the condition of collecting apparatus. The security of the drain and its location with respect to the wound are observed, and the character of the drainage noted. If there is a collecting device, the drainage volume is measured. Because a drainage system must be patent, drainage flow through

the tubing as well as around the tubing should be looked for. A sudden decrease in drainage through the tubing may indicate a blocked drain, and the surgeon should be notified. When a drain is connected to suction, the system is assessed to ensure that the pressure ordered is being exerted. Evacuators such as a Hemovac or Jackson-Pratt exert a constant low pressure as long as the suction device (bladder or bag) is fully compressed. These types of drainage devices are often referred to as *self-suction*. When the evacuator device is unable to maintain a vacuum on its own, the surgeon is notified, who can then order a secondary vacuum system (such as wall suction). If fluid is allowed to accumulate within the tissues, wound healing will not progress at an optimal rate, and the risk of infection is increased.

When drainage interferes with healing, drainage evacuation can be achieved by using either a drain alone or a drainage tube with continuous suction. Barrier preparations must be applied to protect the skin surrounding drain sites: drainage then flows on the barrier but not directly on the skin. Drainage evacuators are convenient, portable units that connect to tubular drains lying in a wound bed and exert a safe, constant, low-pressure vacuum to remove and collect drainage. The nurse ensures that suction is exerted and connection points between the evacuator and tubing are intact. The evacuator collects drainage, which is assessed for volume and character every shift and as needed. When the evacuator fills, the output is measured by emptying the contents into a graduated cylinder and immediately resetting the evacuator to apply suction.

Skin grafts

Ideally, wounds heal by primary intention. However, large, surgically created wounds and traumatic and chronic wounds can cause extensive tissue destruction, making primary intention healing impossible. Skin grafts may then be necessary to protect underlying structures or to reconstruct areas for cosmetic or functional purposes. Survival of skin grafts relies on revascularisation of the grafted skin (Beldon, 2007).

Skin-graft take is the process by which the donor site is incorporated into a recipient or host bed. Successful graft take requires an unhindered process of restoration of vascular perfusion to the donor skin. A graft will take better if the donor site, the area from where the skin is harvested, is highly vascularised.

For a skin graft to take, it must be closely applied to the recipient bed. Any accumulation of oedema, haematoma or seroma between the skin graft and the recipient bed will prevent the skin graft taking. Movement between the graft and the recipient bed damages the in-growth of capillaries and prevents revascularisation. When skin grafts are applied to movable body parts, splinting is used to immobilise adjacent joints. Bed rest and positioning of the patient to prevent distortion or tension and shearing forces between the graft and the wound bed is essential. Tie-over dressings

that immobilise skin grafts, particularly on the face, may be sufficient to immobilise problematic areas.

Several methods are used to fixate the graft, including the open method, the closed method and topical negative pressure wound therapy. The *open method* is where the graft is laid onto the recipient site and left open to the air. Initially the graft is pricked every hour with a sterile needle to express any seroma or haematoma that has built up under the graft. As the wound exudate decreases, the procedure is reduced to every few hours. The *closed method* of skin grafting is where a pressure dressing is applied over the skin to keep it well approximated to the recipient bed (Terrill, 2003). There are many different techniques to achieve this; most involve using a non-adherent dressing on the surface of the graft, such as tulle gras or paraffin-impregnated gauze, and a stack of cotton gauze cut to fit within the defect or a foam sutured/stapled onto the wound margins or a flexible polyamide net coated with soft silicone against the graft with a secondary absorbent dressing secured with sutures or staples (Terrill, 2003; Young and Fowler, 1998). Sutures or staples are not used if the skin graft is applied in the operating theatre. The fibrin that forms between the skin graft and the recipient bed binds the two surfaces together.

Topical **negative-pressure wound therapy** is utilised for skin grafts in complex anatomical areas where the base is irregular (Banwell and Teot, 2003). A topical negative-pressure dressing achieves good apposition of the skin graft to the recipient site, absorbs exudate, reduces oedema, stimulates granulation-tissue formation and decreases bacterial colonisation (Banwell and Teot, 2003). Excellent graft take (>95%) has been reported in the literature with this technique for graft fixation (Banwell and Teot, 2003).

With the closed or topical negative-pressure wound therapy techniques, the skin grafts are usually reviewed after 5 days and assessed for graft take. A graft that has taken has a purple-pink hue and has adhered to the wound bed. The graft usually needs protection for at least 2 weeks or 3 months if located on the lower limbs. Any graft that has not taken is dressed using normal moist wound-healing principles. After 4–6 weeks the graft is usually pale pink and the skin depression should be filling in. Further cosmetic improvement can continue with graft maturation over 6–12 months. Cosmesis can be improved using pressure therapy and silicone gel sheeting to soften scars and reduce erythema.

Skin flaps have their own blood supply, and the ability to monitor the status of the flap perfusion or its viability is essential in the prevention, recognition and treatment of complications. A healthy skin flap is similar in colour and texture to the donor site. The colour, temperature, capillary refill time, tissue turgor, dermal bleeding and quantity of exudate are techniques used to assess tissue flap viability.

Donor sites are frequently painful. Factors that affect the healing rate of donor sites are the site, size and depth of tissue excised (Beldon, 2007). Healing of donor sites

is primarily through re-epithelialisation of the exposed dermis. The sites tend to produce moderate amounts of exudate, and epithelial cells in the hair follicles, sebaceous and sweat glands migrate across the wound bed to form a new layer of epithelium. This process takes approximately 10–21 days. The ideal donor-site dressing should be easy to apply, reduce pain, minimise leakage of exudate, promote rapid wound healing and be inexpensive and acceptable to the patient (Beldon, 2007).

Skin tears

A **skin tear** is a traumatic injury to the skin that occurs as a result of friction alone, or shearing and friction. It separates the epidermis from the dermis (known as a *partial-thickness wound*) or separates both the epidermis and the dermis from the underlying structures (known as a *full-thickness wound*). Most skin tears occur on the arms and hands. Other common sites are the lower legs, feet or the head, although they can occur anywhere on the body. Skin tears are the most common type of wound in older people, so it is important to understand why this is so and to be able to identify those most at risk. Most skin tears occur when the person accidentally bumps into an object such as a wheelchair or furniture, when being transferred, or following a fall.

There are many risk factors for skin tears. These are explained in Table 30-12.

CLASSIFICATION OF SKIN TEARS

Skin tears vary in size, location and the amount of tissue loss. It is important that you know how to classify the type of skin tear so that you can determine the appropriate management options.

The STAR Skin Tear Classification System (see Figure 30-19) was developed by the Silver Chain Nursing Association and the Curtin University of Technology (2007) to provide an evidence-based consensus on skin tear classification. This means that if you use this system, you are more likely to be able to identify the type of skin tear and be able to select the correct treatment and prevention strategies. Skill 30-3 explains the assessment and management of a skin tear.


Sinus

A sinus is a cavity or a track that extends from the skin surface to underlying tissue. A sinus may be the result of an infection, ulceration or necrosis of the dermis and underlying tissue, or a surgical wound dehiscence. The goal of management is to gently pack the sinus from the base upwards to eliminate dead space in the wound, prevent abscess formation and facilitate granulation tissue formation (Joanna Briggs Institute, 2011).


Fistula

A fistula is an abnormal passage between two or more structures or spaces. This can involve a communication tract from one body cavity or organ to another organ or to the skin. The goal of management is closure of the fistula, either

RISK FACTOR	EXPLANATION
History of previous skin tears	If an older person has had one skin tear, they are more likely to have another one because their skin is more fragile.
Presence of bruising or discoloured skin (i.e. ecchymosis)	Skin that is bruised or discoloured is likely to tear more easily. This is because the dermis is thinner and there is less connective tissue to support blood vessels. It then takes very little trauma to cause a tear in the skin.
Advanced age	With an increase in age, the skin becomes thinner and less elastic because of reduced collagen and elastic fibre production. Collagen provides the strength and structure to the skin. When the skin of an older person is put under pressure, such as when the person is being moved, the small force applied to the skin can cause the layers of the skin to separate or tear apart resulting in a skin flap with jagged edges.
Poor nutritional status	Older people are more likely to be malnourished and dehydrated because of reduced oral intake or other health conditions. Dehydrated skin is less elastic, more fragile and more likely to break down.
Cognitive impairment or dementia	Lack of awareness of the environment may mean that the person is more likely to bump into an object, resulting in a skin tear.
Dependency	Patients who are dependent (i.e. require care for all activities of daily living) are at greatest risk for skin tears. They tend to frequently acquire skin tears from the mechanical trauma involved from the routine activities of bathing, dressing, positioning and transferring.
Multiple medications	Some medications that make the blood less likely to clot (e.g. anticoagulants) or steroids (e.g. taken for conditions such as rheumatoid arthritis) make the skin thinner and more likely to tear.
Presence of friction or shearing	Dry skin is more likely to tear due to friction and shearing.
Impaired mobility	Poor mobility means that the person is more likely to fall and sustain a skin tear.
Disease processes	Illnesses such as renal failure, heart failure, a cerebral vascular accident and diabetes increase a person's risk of suffering a skin tear because of the way these diseases affect all body systems.




STAR Skin Tear Classification System




STAR Skin Tear Classification System Guidelines

1. Control bleeding and clean the wound according to protocol.
2. Realign (if possible) any skin or flap.
3. Assess degree of tissue loss and skin or flap colour using the STAR Classification System.
4. Assess the surrounding skin condition for fragility, swelling, discoloration or bruising.
5. Assess the person, their wound and their healing environment as per protocol.
6. If skin or flap colour is pale, dusky or darkened reassess in 24–48 hours or at the first dressing change.


STAR Classification System



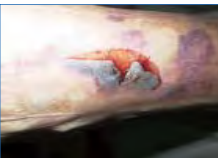
Category 1a
A skin tear where the edges **can** be realigned to the normal anatomical position (without undue stretching) and the skin or flap colour **is not** pale, dusky or darkened.




Category 1b
A skin tear where the edges **can** be realigned to the normal anatomical position (without undue stretching) and the skin or flap colour **is** pale, dusky or darkened.



Category 2a
A skin tear where the edges **cannot** be realigned to the normal anatomical position and the skin or flap colour **is not** pale, dusky or darkened.



Category 2b
A skin tear where the edges **cannot** be realigned to the normal anatomical position and the skin or flap colour **is** pale, dusky or darkened.



Category 3
A skin tear where the skin flap is completely absent.

Skin Tear Audit Research (STAR). Silver Chain Nursing Association and School of Nursing and Midwifery, Curtin University of Technology. Revised 4/2/2010.

FIGURE 30-19 STAR (Skin Tear Audit Research) skin tear classification system.

Source: Silver Chain Nursing Association and Curtin University of Technology (School of Nursing and Midwifery) 2007 (revised 2010).
Online. Available at www.silverchain.org.au/assets/Group/research/STAR-Skin-Tear-tool-04022010.pdf 20 Apr 2011.

SKILL 30-3

Assessment, management and prevention of skin tears

DELEGATION CONSIDERATIONS

The management and prevention of skin tears can be undertaken by all healthcare professionals. Check organisational policies regarding which wound care interventions can be delegated to health workers. The assessment of a person with or at risk of skin tears requires the problem-solving and knowledge-application skills of a registered nurse.

EQUIPMENT

- Examination gloves
- Apron
- Facemask and protective eyewear (optional)
- Normal saline
- Sterile cotton tip
- Contaminated-waste bag
- Black fine-tip permanent marker
- Limb protector
- Wound dressing (choice is dependent on wound characteristics including level of exudate, condition of wound bed, location and size of wound, condition of periwound skin, mobility, etc)

STEPS	RATIONALE
1. Explain procedure to patient.	Decreases anxiety.
2. Assess size and location of wound.	Helps to plan for type and amount of supplies required.
3. Position patient comfortably.	
4. Place disposable contaminated-waste bag within reach of work area. Fold top of bag to make cuff.	Ensures easy disposal of soiled dressings.
5. Put on face mask and protective eyewear, if required, and wash hands thoroughly.	Protects nurse from splashes and reduces risk of transfer of infection between patients.
6. Control bleeding and clean the wound: <ol style="list-style-type: none"> a. Stop bleeding by applying firm pressure. Elevate the limb, if applicable, above heart level. b. Clean the wound by gently irrigating with warm normal saline. Carefully clean under the skin flap to remove foreign debris or blood clots. c. Pat dry the surrounding skin. 	The aim of wound cleansing is to remove both organic and inorganic debris from the wound and periwound skin to facilitate wound healing, and to make wound assessment easier so that the size and extent of the wound can be visualised.
7. Realign (if possible) any skin or flap. <ol style="list-style-type: none"> a. Carefully realign by rolling the skin flap with a moist, sterile cotton bud. The use of a moistened cotton bud assists with approximation of the flap edge. b. Do not stretch the skin to 'make it fit'. Otherwise, the skin flap will shrink back on itself or it may tear off completely. c. If the skin flap cannot be realigned, apply moist wound-dressing principles to promote wound healing. 	
8. Assess the degree of tissue loss and skin or flap colour: <ol style="list-style-type: none"> a. Using the STAR Skin Tear Classification System (see Figure 30-19), select the skin tear category that best describes the type of skin tear you are treating. b. Note the colour of the skin flap. If the skin or flap colour is pale, dusky or darkened when compared with the person's normal surrounding skin, this may indicate reduced blood flow (ischaemia) or the presence of a blood clot (haematoma), which may affect the skin or flap viability. c. If the skin or flap colour is pale, dusky or darkened, reassess in 24–48 hours or during the first dressing change. 	Provides a combination of subjective and objective data to assess effectiveness of wound management plan and to plan appropriate interventions.
9. Assess the surrounding skin condition for fragility, swelling, discolouration or bruising. This information will assist you when selecting an appropriate dressing.	

<p>10. Assess the person, their wound and their healing environment.</p> <p>11. Apply a dressing. Regardless of what type of dressing you select, you should follow these principles:</p> <ul style="list-style-type: none"> • Ensure the dressing extends over the wound edge by at least 1.5–2 cm. • Before applying the dressing, draw arrows on top of the dressing with a felt pen to indicate the direction of the skin flap and write the due date for removal. When removing the dressing, ensure that you remove it in the direction of the arrow to avoid pulling back the skin flap. • Leave in place for 5–7 days. Change earlier only if there is 75% leakage on the dressing. • Reapply a new dressing if healing is not established and leave the dressing intact for 5–7 days. • If the wound is healed, leave it open and moisturise twice daily with a pH-neutral emollient. <p>12. Protect limbs: Apply a limb protector or tubular retention bandage to prevent further damage or to hold any dressing in situ.</p> <p>13. Document the skin tear:</p> <ol style="list-style-type: none"> a. Document the skin tear category and location in the patient's record and wound-care assessment chart. b. Submit an incident report as required. <p>14. Monitor the healing of the wound:</p> <ol style="list-style-type: none"> a. Check the dressing and surrounding skin regularly for signs of complications or infection, but leave the dressing intact unless an inspection is clinically indicated. b. Educate the patient about the signs and symptoms of complications or infection. Advise them to report problems, especially any increase in pain, warmth, odour, redness, purulent exudate or fever. <p>15. Implement skin-tear prevention strategies, including the following:</p> <ul style="list-style-type: none"> • Assess and recognise risk. • Use extreme caution and a gentle touch. • Avoid direct contact with the skin: use slide sheets where possible to reduce the risk of friction or shearing forces on the skin, especially when transferring someone. • Protect fragile skin: if a person has fragile skin or has had repeated skin tears, encourage them to wear long sleeves and long trousers to protect their skin. • Apply a pH-neutral moisturiser and/or barrier cream at least twice daily. This will help to prevent dry skin. • Use soap-free alternatives; avoid using soaps and perfumed lotions as these can dry the skin. Instead, use a pH-neutral cleanser or moisturiser. • Avoid using adhesives. Adhesives may increase the risk of tearing the skin when they are removed. It is advisable to use a limb protector instead. • Use protective padding on furniture and equipment: pad bed rails, wheelchair arms and leg supports to reduce the risk of skin injuries. • Ensure adequate lighting. A well-lit environment helps to reduce risk of people bumping into furniture, doors or equipment. <p>16. Provide continuing education: Help other staff members, patients and their family members understand the importance of identifying those at risk for skin tears, appropriate treatment and prevention strategies.</p> <p>17. Document all relevant information in patient's chart.</p>	<p>A person's overall medical condition may affect how quickly the wound is likely to heal. This will guide the management and preventive strategies you decide to use.</p> <p>Reduces the risk of trauma on removal of the dressing and increases the ability of the dressing to absorb any leakage from the wound.</p> <p>Provides relevant information about the patient and the wound, monitors healing process, guides wound management of the person as a whole, evaluates the success of management and fulfils legal requirements.</p> <p>People with fragile, thin, bruised or discoloured skin are at a high risk for further skin tears.</p> <p>Many skin tears occur when performing normal daily activities such as bathing, dressing and transferring individuals at risk. Avoid wearing jewellery or a watch.</p> <p>Provides relevant information about the patient and the wound, monitors healing process, guides wound management of the person as a whole, evaluates the success of management and fulfils legal requirement.</p>
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spontaneously or surgically. Fistulae may be internal or external and are often associated with inflammatory diseases or a postoperative complication. External fistulae may be the result of trauma, infection, malignancy, obstruction, surgery or radiation damage. Management of patient with a fistula requires complex, multidisciplinary care.

Burns

The initial assessment of a burn injury informs the plan of care. Burn injury assessment is notoriously difficult, and therefore access to specialist services for guidance to appropriate assessment, definition/classification and treatment is essential. Types of burn injury include damage to the skin caused by heat (thermal), chemical, electrical or radiation sources. *Thermal burns* are the most frequent type of burn; severity is related to temperature and duration of contact. *Chemical burns* are more likely to be full-thickness in depth and it may take several days for the severity of burn injury to develop or 'declare' the extent of tissue injury. The severity depends on the manner and duration of contact, the amount of skin and area of body involved, the concentration of the chemical and how the incidence occurred. *Electrical burn injury* is most commonly caused by alternating current; severity is due to the voltage (force) and amperage (strength). Tissue injury occurs when electrical energy is converted to heat. Electrical burns have a point of entrance and exit, and the depth of injury can be difficult to determine.

Burn injury is classified according to the mechanism of injury, depth of injury and extent of total body surface area involved (see Table 30-13 and Figure 30-20).

There are several techniques for assessing the amount of tissue damage in relation to total body surface area (TBSA), which is important for clinical management (Joanna Briggs Institute, 2010). Wallace's 'rule of nines' tool divides the body surface of adults into areas of 9% (or multiples of

9%), with the exception that the perineum is estimated at 1% (Figure 30-21). This allows the extent of the burn to be estimated with reproducible accuracy. Children have different body surface area (BSA) proportions, and the paediatric rule of nines is adjusted for age by taking 1% BSA from the head and adding 0.5% BSA to each leg for each year of life after 1 year of age, until age 10 years where adult proportions are reached.

Age-dependent burn graphs such as the Lund and Browder chart is the preferred method to estimate BSA burn, especially in children and neonates (Figure 30-22) (Joanna Briggs Institute, 2010).

Small burns may be estimated using the area of the palmar surface (fingers and palm) of the patient's hand, which approximates to 1% BSA.

Chronic wounds

In Australia it is estimated that more than 433,000 people suffer from chronic wounds such as leg ulcers, pressure ulcers or non-healing surgical wounds at any one time, although the actual incidence is unknown as many people never seek treatment for their wound problems (Australian Institute of Health and Welfare, 2008). Chronic wounds are frequently long-term, painful and debilitating, resulting in reduced quality of life for sufferers. They can affect people of any age, although prevalence increases with age and wounds are estimated to affect up to 5–10% of people aged over 80 years in Australia (Australian Bureau of Statistics, 2008). Studies on individuals with chronic leg ulcers reveal the average duration is approximately 1 year, 60–70% have recurrent ulcers and most people suffer from the condition for an average of 15 years or more (Araujo, 2003; Bergqvist and others, 1999; Lindholm and others, 1992). Studies with residents in aged-care facilities have reported that 25% suffer from a wound (Australian Bureau of Statistics, 2008).

TABLE 30-13 CLASSIFICATION OF BURN INJURY

CLASSIFICATION	DEGREE OF TISSUE LOSS
Superficial	Involves the epidermis and is red in appearance with no blisters Usually heals within 7 days with no scarring
Superficial partial-thickness	Involves the epidermis and extends into the papillary or superficial layer of the dermis, and is red or pale pink in appearance with small blisters Usually heals within 14 days with no scarring, but there may be slight pigmentation changes
Deep partial-thickness	Extends into the reticular or deeper layer of the dermis and is dark pink in appearance with blisters present Usually takes 2–3 weeks to heal and grafting may be required; scarring may result
Full-thickness	Involves the epidermis, dermis and subcutaneous tissue and appears blotchy red or white in colour with or without blisters Grafting is required and scarring is likely
Subdermal	Involves the muscle, bone, tendon and interstitial tissue Appears as white, brown, black (charred) or deep red with no blisters. Grafting is required and scarring will occur.

Adapted from Carville K 2007 Wound care manual, ed 5. Osborne Park, WA, Silver Chain Foundation; NSW Severe Burn Injury Service 2009 Clinical Practice Guidelines: Burn Wound Management, NSW Health, p. 51.



Recognising Burn Depths

Epidermal Burn (Erythema)



- Skin intact, blanch to pressure
- **Erythema not included in % TBSA assessment**
- Heal spontaneously within 3–7 days with moisturiser or protective dressing

Superficial Dermal Burn (Superficial Partial Thickness)



- Blisters present or denuded
- Blanch to pressure (under blister)
- Should heal within 7–10 days with minimal dressing requirements

Mid Dermal Burn (Mid Partial Thickness)



- Heterogeneous, variable depths
- Blanch to pressure may have slow capillary return
- Should heal within 14 days
- Deeper areas or over a joint may need surgical intervention and referral to a specialist unit

Deep Dermal Burn (Deep Partial Thickness)



- Heterogeneous, variable depths
- Deeper areas may not blanch
- Generally need surgical intervention
- Refer to specialist unit

Full Thickness Burn



- Outer skin, and some underlying tissue dead
- Present as white, brick red, brown/black, **non-blanching**
- Surgical intervention and long-term scar management required
- Refer to specialist unit

For transfer criteria to a Severe Burn Unit and further information see NSW Burn Transfer Guidelines http://www.health.nsw.gov.au/policies/gl/2008/GL2008_012.html

Contacts for NSW Burn Units:

CHW 9845 1114 kidsburns@chw.edu.au	RNSH 9926 8940 burnsconsult@nscchs.health.nsw.gov.au	CRGH 9767 7776 crghburns@email.cs.nsw.gov.au
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ACI Statewide Burn Injury Service Website
www.aci.health.nsw.gov.au

FIGURE 30-20 Recognising burn depths.

From New South Wales Agency for Clinical Innovation (ACI) n.d. Recognising burns depths. Sydney, ACI.
Online. Available at www.aci.health.nsw.gov.au/_data/assets/pdf_file/0006/162636/Recognising_Burn_Depths_Chart_A3_11_10_28.pdf 7 Jun 2012.

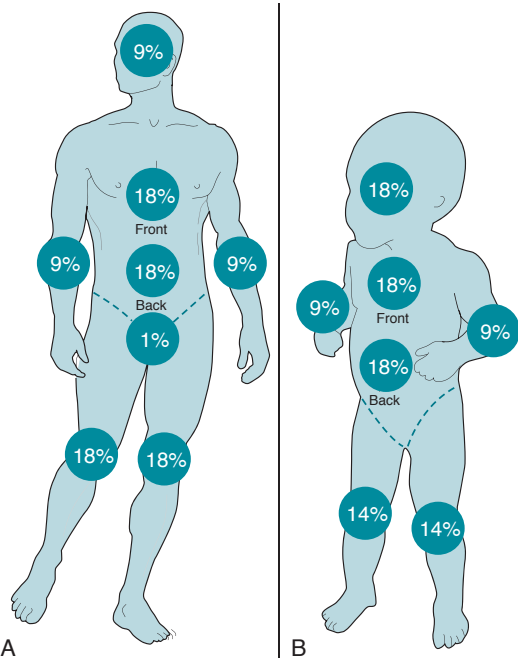


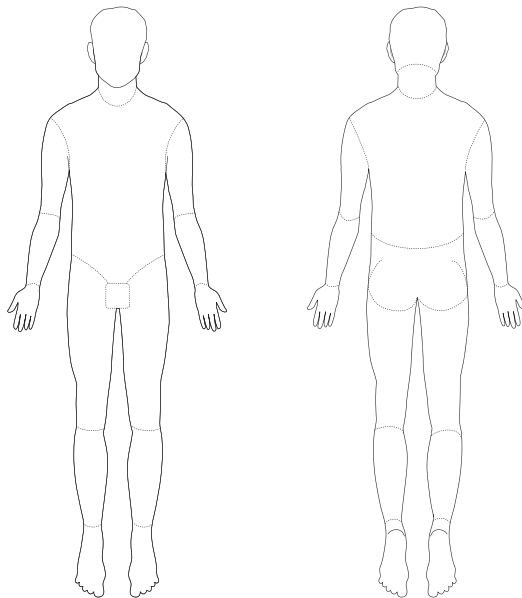
FIGURE 30-21 Wallace's rule of nines tool. A, Adult; B, Child. From Elliot D, Aitken L, Chaboyer W, editors 2006 ACCCN's Critical care nursing. Sydney, Elsevier.

Pressure injuries are considered to be largely preventable and yet they are a significant health problem. The prevalence of pressure ulcers in Australia in the acute care hospital setting ranges from 5.4% to 15.6% (Australian Wound Management Association, 2001). Foot ulceration affects 15–20% of all individuals with diabetes and precedes up to 85% of amputations in this patient group, and is the most common cause of non-traumatic lower-limb amputation (Australian Centre for Diabetes Strategies, 2005). The annual incidence of foot ulcers in people with diabetes is estimated to be 2.5–10.7% in Australia, Finland, the United Kingdom and the United States, and the average age for lower-limb amputation in Australia is 65–79 years (Australian Centre for Diabetes Strategies, 2005). The 5-year recurrence rate for ulceration is 70%, and for those undergoing a lower-limb amputation there is a 50% chance of losing the remaining limb within 3 years (Australian Centre for Diabetes Strategies, 2005).

Wounds commonly affect disadvantaged groups with the least resources to deal with the condition, such as the elderly, disabled and those in lower socioeconomic groups and with poor social support. Unfortunately, the burden of chronic wounds is rapidly growing globally (Harding, 2010). In Australia it is conservatively estimated that the problem of wounds costs the healthcare system more than \$A2.6 billion per year (Australian Institute of Health and Welfare, 2008).

Therapeutic Guidelines

Lund and Browder chart for calculating the percentage of total body surface area burnt (Fig 14.19)



Region	Partial thickness (%) [NB1]	Full thickness (%)
head		
neck		
anterior trunk		
posterior trunk		
right arm		
left arm		
buttocks		
genitalia		
right leg		
left leg		
Total burn		

NB1: Do not include erythema

Area	Age 0	1	5	10	15	Adult
A = half of head	9½	8½	6½	5½	4½	3½
B = half of one thigh	2¾	3¼	4	4½	4½	4¾
C = half of one lower leg	2½	2½	2¾	3	3¼	3½

Therapeutic Guidelines Limited is an independent not-for-profit organisation dedicated to deriving guidelines for therapy from the latest world literature, interpreted and distilled by Australia's most eminent and respected experts.

FIGURE 30-22 Lund and Browder chart for estimating and documenting the severity and extent of burn wounds in adults and children (revised Feb 2008)

From Therapeutic Guidelines Limited 2012 (Jul) eTG complete. www.tg.org.au

Assessment is the key to effective prevention and management of chronic wounds. Studies demonstrate that significant improvements in healing rates can occur when assessments are rationalised and based on research-based protocols (Carville and Smith, 2004; Mulligan and others, 2009). Many patients, however, have never been referred for specialist opinion despite suffering from ulceration for many years, and consequently may not have had the aetiology of the wound correctly diagnosed.

It must be recognised that there are many factors which need to be considered when caring for patients with or at risk for a chronic wound, including other long-term, chronic health conditions affecting many wound sufferers, and psychosocial and quality-of-life issues affecting many individuals.

Pressure injuries

Pressure ulcer, pressure sore, decubitus ulcer and bed sore are terms commonly used to describe pressure injuries. A **pressure injury** is an injury to the skin and/or underlying tissue, usually over a bony prominence. It occurs as a result of pressure alone, or pressure in combination with shear and/or friction.

Shearing forces usually occur as a result of sliding or dragging the skin across a support surface such as a mattress. **Friction** is the abrasion of the epithelial surface of the skin by rubbing against an abrasive or resistant surface. Friction may occur if the patient repeatedly rubs their heels on their mattress or on wheelchair foot plates. The presence of

constant moisture from perspiration, urinary and/or faecal incontinence or wound leakage affects the ability of the skin to resist this type of damage.

Pressure injuries can occur in any location, but are most commonly found on the sacrum or coccyx and heels. They may also occur on other bony prominences, including the ischium, toes, elbows, ears, ankles, nose or other areas of the body. All patients are at risk of developing a pressure injury. Table 30-14 reviews some key risk factors for the development of pressure injuries.

Pressure is the major cause of tissue injury and is related to the intensity and duration of pressure and the ability of the tissue to tolerate pressure. Sustained pressure on a localised area of tissue results in occlusion of blood flow to the vascular and lymph vessels that supply oxygen and nutrients to the tissues. This results in tissue ischaemia and reperfusion injury, leading to cell destruction and tissue death (Queensland Health, 2009).

The likelihood of developing a pressure injury is dependent on a number of factors which affect tissue tolerance (see Table 30-12). The intensity and duration of pressure in combination with other risk factors determine a patient's capacity to tolerate pressure (Queensland Health, 2009).

STAGES OF PRESSURE INJURIES

Pressure injuries are staged to help determine how severe the damage to the skin and underlying tissue structures might be. The *Pan Pacific clinical practice guidelines for the prevention and management of pressure injury* (Australian

RESEARCH HIGHLIGHT

Research focus

Venous leg ulcers are slow to heal, frequently recur and are associated with pain, restricted mobility and decreased quality of life. Although chronic wound care consumes a large proportion of community nursing time and healthcare resources, there is little evidence available on the effectiveness of differing models of community care for this population.

Research abstract

The aim of this study was to determine the effectiveness of a new community nursing model of care on quality of life, morale, depression, self-esteem, social support, healing, pain and functional ability of clients with chronic venous leg ulcers. The investigators recruited a sample of 67 participants with venous leg ulcers referred for care to a community nursing organisation in Queensland, Australia, after obtaining informed consent. Participants were randomised to either the Lindsay Leg Club model of care ($n = 34$), emphasising socialisation and peer support; or the traditional community nursing model ($n = 33$) consisting of individual home visits by a registered nurse. Participants in both groups were treated

by a core team of nurses using identical research protocols based on short-stretch compression bandage treatment. Data were collected at baseline, at 12 and at 24 weeks from commencement. Participants who received care under the Leg Club model demonstrated significantly improved outcomes in quality of life ($p = 0.014$), morale ($p < 0.001$), self-esteem ($p = 0.006$), healing ($p = 0.004$), pain ($p = 0.003$) and functional ability ($p = 0.044$).

Evidence-based practice

In this sample, the evaluation of the Leg Club model of care shows potential to improve the health and well-being of clients who have chronic leg ulcers. These results suggest that further evaluation and implementation of this model is warranted by community health organisations involved in the care of this population.

Reference

Edwards H, Courtney M, Finlayson K and others 2009. A randomised controlled trial of a community nursing intervention: improved quality of life and healing for patients with chronic leg ulcers. *J Clin Nurs* 18:1541-9.

RISK FACTOR	EXPLANATION
Alteration in mobility or physical activity	Reduced mobility or physical activity due to contractures, fractures, injury, neurological disease or pain increase the risk of pressure injury developing. This is because the patient is unable to independently reposition themselves to off-load or relieve pressure
Malnutrition and dehydration	Malnutrition and dehydration increase the risk of pressure injury. The skin is much drier and less able to withstand the effects of pressure damage
Moisture	The presence of constant moisture from wound leakage, urinary or faecal incontinence and perspiration increases the risk of pressure damage. This is because the skin is less able to resist friction or shearing forces
Alteration in sensation and consciousness	Decreased sensation or loss of consciousness because of cognitive impairment such as a central nervous system injury, a cerebrovascular accident, degeneration, major surgery, spinal cord injury or medications which increases the risk of pressure damage. This is because the patient may not be aware that an injury to the skin has occurred
Other health conditions	Health conditions such as heart disease, diabetes, circulation disorders and a history of smoking can increase the risk of pressure injury

Wound Management Association, 2012) have recently been released and recommend the use of a pressure injury classification system to provide a consistent and accurate means by which the severity of a pressure injury can be communicated and documented. Presently there are four stages of pressure damage. The higher the stage, the deeper the tissue involvement.

STAGE 1 pressure injuries present as areas of persistent, non-blanchable redness when compared with the surrounding skin. The skin around the wound may be painful or itchy, firm or boggy, and warmer or cooler to the touch when compared with the surrounding skin.

Stage 1 pressure injury may be difficult to detect in individuals with dark skin tones. In lighter skin-toned individuals, if you press on the skin for a few seconds, normal skin typically goes white in colour (**blanching**) and then returns to a normal pink colour when the pressure is released. However, patients with more darkly pigmented skin may not have visible blanching and skin colour may differ from the surrounding area. This means that when

you press on the skin, changes in skin colour are difficult to detect.

STAGE 2 pressure injuries represent partial-thickness loss of the dermis, and present as shallow open ulcers with a red or pink wound bed; they may also present as an intact or open/ruptured fluid-filled blister. If a blister is found with clear fluid present and the epidermis is clearly separated from the dermis, this is recorded as a Stage 2 pressure injury.

Stage 2 pressure injuries present as shiny or dry shallow ulcers without any bruising present, since bruising represents suspected deep-tissue damage.

STAGE 3 pressure injuries represent full-thickness skin loss. Subcutaneous fat may be visible but bone, tendons or muscle are not exposed. Thick yellow tissue (slough) may be present but this does not obscure the depth of tissue loss. There may be undermining and tunnelling of the wound (i.e. the wound is deeper than it appears on the surface of the skin).

The depth of a Stage 3 pressure injury varies depending on where it is located anatomically. A pressure injury on the bridge of the nose, ear, scalp and ankle does not have subcutaneous tissue and Stage 3 pressure injuries can be shallow. In contrast, areas of significant adiposity or fatty tissue can develop extremely deep Stage 3 pressure injuries, although bone and/or tendon is not visible or directly palpable.

STAGE 4 pressure injuries are the most severe, and represent full-thickness tissue loss with exposed bone, tendon or muscle. Thick yellow tissue (slough) or black necrotic tissue may be present on some parts of the wound bed. Often there is undermining and tunnelling of the adjacent tissue.

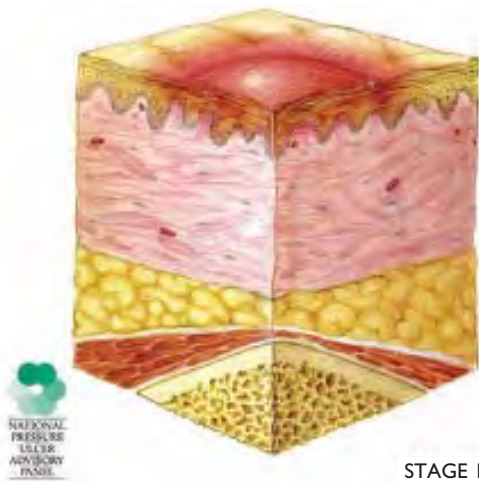
The depth of a Stage 4 pressure injury varies by anatomical location. The bridge of the nose, ear, scalp and ankles do not have subcutaneous tissue, so ulcers in these locations can be shallow. Stage 4 pressure injuries can

BOX 30-1 SKIN ASSESSMENT FOR PRESSURE INJURY

Inspect the skin of all patients on admission and at each repositioning to identify indications of pressure injury including:

- erythema
- blanching response
- localised heat
- oedema
- induration
- skin breakdown.

From Australian Wound Management Association (AWMA) 2012 Pan Pacific clinical practice guideline for the prevention and management of pressure injury. Osborne Park, WA, Cambridge Media. Reproduced with permission of AWMA. All rights reserved.

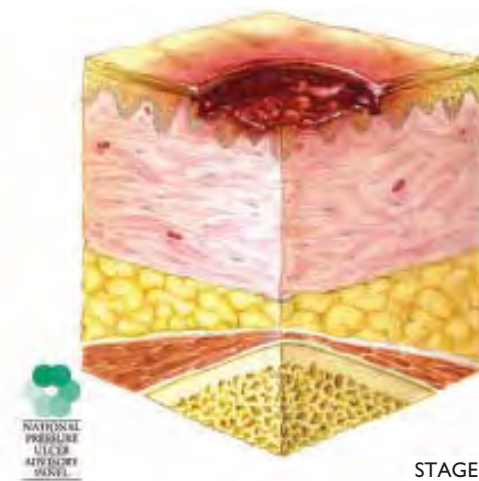


STAGE 1



FIGURE 30-23 Stage 1 pressure injury.

Diagram used with permission of the National Pressure Ulcer Advisory Panel, Washington DC, 10/07/12. Image courtesy Wound Healing Community Outreach Service, Queensland University of Technology.



STAGE 2



FIGURE 30-24 Stage 2 pressure injury.

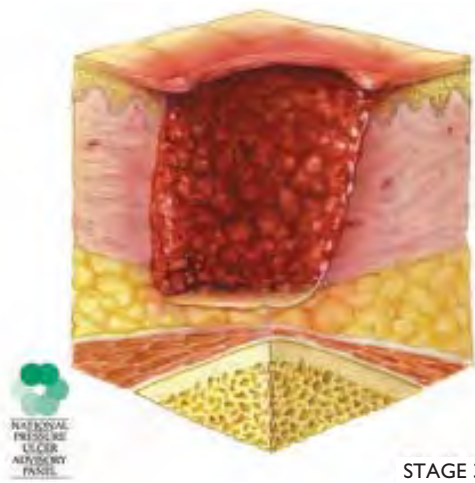
Diagram used with permission of the National Pressure Ulcer Advisory Panel, Washington DC, 10/07/12. Image courtesy Wound Healing Community Outreach Service, Queensland University of Technology.

extend into muscle and/or supporting structures (e.g. fascia, tendon or joint capsule), making osteomyelitis (infection in the bone) possible. Exposed bone/tendon is visible or directly palpable.

In addition to the above stages of pressure injuries there are two other categories of tissue damage. *Suspected deep tissue injury* presents as purple or maroon discoloured intact skin or a blood-filled blister due to damage of the underlying soft tissue from pressure and/or shear. The area may be preceded by tissue that is painful, firm, mushy, boggy, or warmer or cooler as compared with adjacent tissue.

Deep-tissue injury may be difficult to detect in individuals with dark skin tones. The tissue injury may develop into a thin blister over a dark wound bed. The wound may further evolve and become covered by thin eschar. Changes may develop rapidly, exposing additional layers of tissue, even with optimal treatment.

Unstageable pressure injuries present as full-thickness tissue loss in which the base of the wound is covered by thick yellow, tan, grey, green or brown tissue and/or eschar (tan, brown or black) in the wound bed. Until enough slough and/or eschar is removed to expose the base of the wound, the true depth, and therefore stage, cannot be determined. Stable (i.e. dry, adherent, intact

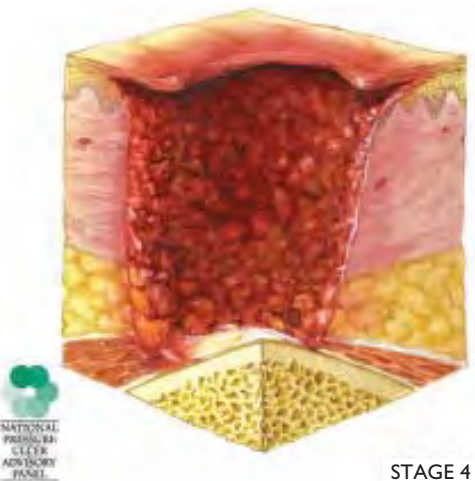


STAGE 3



FIGURE 30-25 Stage 3 pressure injury.

Diagram used with permission of the National Pressure Ulcer Advisory Panel, Washington DC, 10/07/12.
Image courtesy Wound Healing Community Outreach Service, Queensland University of Technology.



STAGE 4



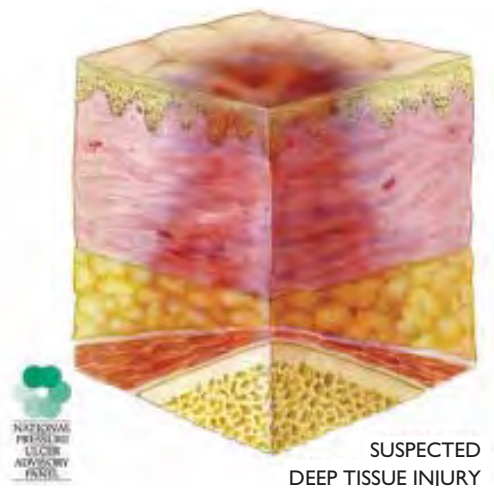
FIGURE 30-26 Stage 4 pressure injury.

Diagram used with permission of the National Pressure Ulcer Advisory Panel, Washington DC, 10/07/12.
Image courtesy Wound Healing Community Outreach Service, Queensland University of Technology.

without erythema/redness) eschar on the heels serves as 'the body's natural (biological) cover' and should not be removed.

There are limitations to the staging system for pressure injuries, including the following:

- Reactive hyperaemia may be mistaken for a Stage 1 pressure injury. The presence of non-blanching erythema requires the patient to be repositioned off the area of redness and reassessed in 30 minutes before diagnosing a Stage 1 pressure injury (Queensland Health, 2009).
- Stage 1 pressure injury can be difficult to identify in patients with dark-coloured skin (see Figure 30-29).
- Necrotic tissue (eschar or slough) can conceal the extent of tissue injury, so should be debrided where possible to correctly stage the degree of pressure injury and then be reclassified once debridement has occurred.
- Reverse staging of a healing injury is not generally acceptable.
- The progress of pressure-injury healing should be documented using objective parameters such as size, depth, amount of necrotic tissue, amount of exudate and presence of granulation and epithelial tissue.
- The staging system depends on visual observation of tissue involvement. Factors such as location, wound dimensions, description of wound bed, edge of the



SUSPECTED
DEEP TISSUE INJURY



FIGURE 30-27 Suspected deep-tissue injury.

Diagram used with permission of the National Pressure Ulcer Advisory Panel, Washington DC, 10/07/12.
Image courtesy Wound Healing Community Outreach Service, Queensland University of Technology.



UNSTAGEABLE



FIGURE 30-28 Unstageable pressure injury.

Diagram used with permission of the National Pressure Ulcer Advisory Panel, Washington DC, 10/07/12.
Image courtesy Wound Healing Community Outreach Service, Queensland University of Technology.

wound, condition of periwound skin, pain and other factors which may delay wound healing should also be assessed (Australian Wound Management Association, 2012).

SITES OF PRESSURE INJURIES

All parts of the body are at risk of pressure injury. The most common sites are those over bony prominences, as shown in Figure 30-30.

RISK ASSESSMENT

In order to identify patients at risk of pressure injury, patients must all be screened for risk using an acceptable pressure ulcer risk assessment tool, on admission and regularly throughout their episode of care (Queensland



FIGURE 30-29 Comparison of stage I pressure sores in patients with lightly and darkly pigmented skin.

Courtesy ConvaTec. Modified from Gaskin FC 1986 Detection of cyanosis in the person with dark skin. J Nat Black Nurses Assoc 1:52; Henderson CT and others 1997 Draft definition of stage I pressure ulcers: inclusion of persons with darkly pigmented skin. Adv Wound Care 10(5):16.

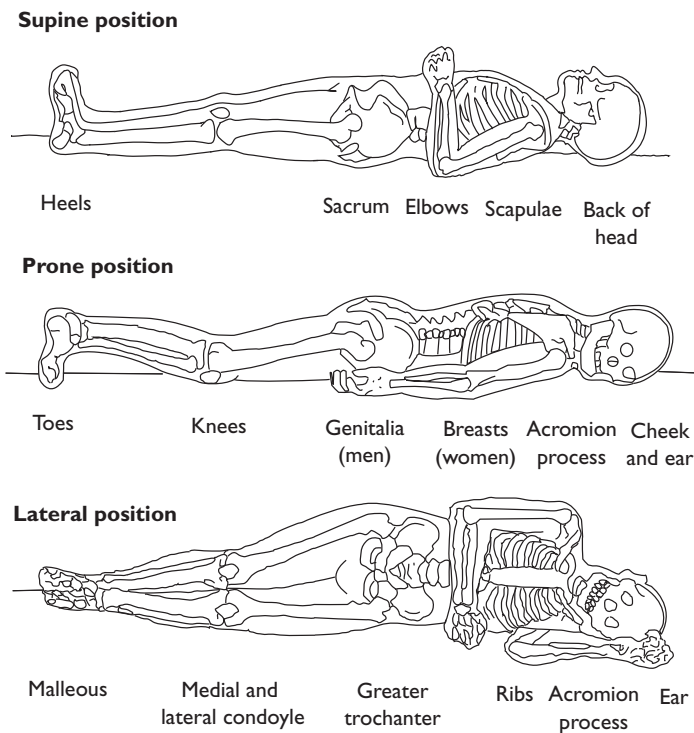


FIGURE 30-30 Bony prominences most frequently underlying pressure ulcer.

From Grey J, Enoch S 2006 Pressure ulcers. *Br Med J* 332(7539):472–75.

Health, 2009). Pressure ulcer risk assessment tools have been developed to assist in the identification and assessment of patients at risk for pressure injury. Examples of risk assessment tools include the Waterlow, Braden and Norton tools (copies of each of these tools are available from the Australian Wound Management Association guidelines; see *Online resources*). Risk assessment tools commonly use a rating scale to weight the severity of risk as *no risk*, *low*, *medium* or *high risk* (Queensland Health, 2009). Risk assessment tools also commonly address risk factors such as mobility, nutritional status, sensory impairment, level of consciousness, neurological status and incontinence (Queensland Health, 2009). The presence of any condition that limits mobility to the point where a patient is unable to move independently or change position to relieve pressure means that the patient is automatically 'at risk'.

Skill 30-4 demonstrates how to perform an assessment to identify patients at risk of pressure injury; this risk assessment is part of the admission process and ongoing preventative management for each patient (Australian Wound Management Association, 2012). An assessment to determine risk for pressure injury should be performed (Queensland Health, 2009):

- On admission to the healthcare facility and regularly throughout the length of stay or episode of care. For

patients in acute care it is recommended that assessment is performed on admission and at least every 24 hours, or sooner if a patient's condition changes. In long-term care, assessment should be performed on admission, weekly for 4 weeks, and then quarterly and whenever the patient's condition changes. Patients in the community should be assessed on admission and at every nurse visit.

- Following any changes in a patient's condition which places that person at risk, for example a sudden deterioration in health condition.
- Prior to, during and following prolonged procedures which involve reduced mobility and hardened surfaces.

All patients identified at risk of developing a pressure injury should have a comprehensive preventative management plan in place which aims to maintain tissue tolerance to pressure and protect the individual against the forces of pressure, shear and friction.

PREVENTION STRATEGIES

The Australian Wound Management Association (AWMA, 2012) has recently released clinical guidelines to guide clinicians in identifying patients at risk and in selecting appropriate preventive interventions (see Figure 30-31). These guidelines are freely available online (see *Online resources*).

SKILL 30-4

Assessment for risk of pressure injury

DELEGATION CONSIDERATIONS

The management and prevention of pressure injuries can be undertaken by all healthcare professionals. Check organisational policies regarding which wound care interventions can be delegated to health workers. The assessment of a person with or at risk for or with a pressure injury requires the problem-solving and knowledge-application skills of a registered nurse.

EQUIPMENT

- Pressure injury risk assessment tool

STEPS	RATIONALE
<p>1 A comprehensive risk assessment for pressure injuries should be completed on admission for every patient using a risk assessment tool. Reassessment should be performed at the following intervals:</p> <ul style="list-style-type: none"> • Acute care—at least every 24 hours or sooner if the patient's health condition changes • Long-term care—weekly for 4 weeks, then monthly in high care and quarterly in low care or whenever the patient's condition changes • Home-care—weekly or at every nurse visit (if visiting less than weekly) and in response to changes in the patient's condition. <p>2. Identify patient's risk of pressure injury including:</p> <ul style="list-style-type: none"> • Alteration in mobility and activity <ul style="list-style-type: none"> — Contractures — Fractures — Injury — Neurological disease/deficit — Pain • Malnutrition <ul style="list-style-type: none"> — Dehydration — Oedema — Protein insufficiency — Weight loss — Obesity • Moisture <ul style="list-style-type: none"> — Drainage (fistulae, wounds) — Incontinence (urine, faeces) — Perspiration • Alteration in sensation and consciousness <ul style="list-style-type: none"> — Central nervous system injury — Cerebrovascular disease — Degenerative neurological disease — Drugs e.g. steroids, cytotoxics — Major surgery — Spinal cord injury • Comorbid conditions <ul style="list-style-type: none"> — Chronic heart failure — Chronic respiratory disease — Circulatory disease — Diabetes — Immune deficiency states — Impaired tissue oxygenation e.g. anaemia, smoking — Metastatic carcinoma — Peripheral arterial disease. <p>Record the patient's level of risk (no risk/at risk/high risk/very high risk) on the risk assessment chart, patient's care plan and in the medical record.</p>	<p>Document all skin assessments using a validated risk assessment tool to aid communication between professionals.</p> <p>Ongoing assessment of the skin is necessary to detect early signs of pressure damage.</p>

STEPS	RATIONALE
<p>3. Skin assessment includes:</p> <ol style="list-style-type: none"> Prepare the environment e.g. close curtains. Explain procedure to patient. Position patient comfortably to enable inspection of skin and ensure adequate lighting. Remove clothing as necessary to fully expose each area of skin being inspected. Begin assessment with questioning and inspection to identify any existing wounds (refer to Table 30-4). Conduct a head-to-toe skin assessment with particular focus on skin covering bony prominences, e.g. sacrum, heels and greater trochanters (hips). Inspection involves observation of the skin and palpation with hands to detect the presence of moisture and colour changes and temperature differences in areas of the skin being inspected. Check parts of the body covered by anti-embolic stockings, areas of the body where pressure, friction and shearing is exerted in the course of daily activities and other areas affected by equipment, footwear and clothing, i.e. skin around or under prosthetics, orthotics, skin traction, oxygen appliances, intravenous access, tapes and other objects in contact with the skin. Look for the following characteristics: <ul style="list-style-type: none"> — Reactive hyperaemia: when a red mark is found, relieve the pressure, check for blanching (the skin whitens under light finger pressure, which indicates the microcirculation is intact). Review in 30 minutes and the redness should have faded substantially. If the skin does not blanch or the hyperaemia (redness) does not fade, then a stage 1 pressure injury has been identified. — Localised heat, oedema and induration. Ask patient to identify any area of discomfort or pain. 	<p>Ensures privacy and patient comfort. Reduces anxiety.</p> <p>Many different types of medical devices have been reported as having caused pressure injury.</p> <p>Localised heat, oedema or induration (hardness), especially in darkly pigmented individuals, are early warning signs for pressure-injury development.</p>
<p>4. Reposition patient comfortably following procedure.</p>	<p>Promotes patient comfort.</p>
<p>5. Document all skin assessments using a validated risk assessment tool.</p>	<p>Documentation and communication allows for the timely intervention of preventive and therapeutic measures. This minimises the frequency of occurrence and the severity of pressure damage.</p>
<p>6. If evidence of pressure damage is noted, implement appropriate pressure off-loading and management strategies.</p>	<p>Timely implementation of pressure off-loading and management strategies is essential. Patients identified at risk for or with a pressure injury benefit from pressure off-loading strategies and a pressure injury prevention plan to reduce the risk of further tissue damage.</p>
<p>7. Document all relevant information in patient's chart.</p>	<p>Provides relevant information about the patient and the wound, monitors healing process, guides wound management of the person as a whole, evaluates the success of management and fulfils legal requirement.</p>

BOX 30-2 THE BRADEN SCALE FOR PREDICTING PRESSURE SORE RISK

PATIENT'S NAME	EVALUATOR'S NAME			DATE OF ASSESSMENT
<i>Sensory perception</i> Ability to respond meaningfully to pressure-related discomfort	1. <i>Completely limited</i> Unresponsive (does not moan, flinch or grasp) to painful stimuli due to diminished level of consciousness or sedation OR Limited ability to feel pain over most of body surface	2. <i>Very limited</i> Responds only to painful stimuli Cannot communicate discomfort except by moaning or restlessness OR Has a sensory impairment which limits the ability to feel pain or discomfort over half of body	3. <i>Slightly limited</i> Responds to verbal commands, but cannot always communicate discomfort or need to be turned OR Has some sensory impairment that limits ability to feel pain or discomfort in 1 or 2 extremities	4. <i>No impairment</i> Responds to verbal commands Has no sensory deficit that would limit ability to feel or voice pain or discomfort
<i>Moisture</i> Degree to which skin is exposed to moisture	1. <i>Constantly moist</i> Skin is kept moist almost constantly by perspiration, urine, etc. Dampness is detected every time patient is moved or turned	2. <i>Very moist</i> Skin is often, but not always, moist Sheets must be changed at least once a shift	3. <i>Occasionally moist</i> Skin is occasionally moist, requiring an extra sheet change approximately once a day	4. <i>Rarely moist</i> Skin is usually dry, sheets require changing only at routine intervals
<i>Activity</i> Degree of physical activity	1. <i>Bedfast</i> Confined to bed	2. <i>Chairfast</i> Ability to walk severely limited or non-existent. Cannot bear own weight and/or must be assisted into chair or wheelchair	3. <i>Walks occasionally</i> Walks occasionally during day, but for very short distances, with or without assistance. Spends majority of each shift in bed or chair	4. <i>Walks frequently</i> Walks outside the room at least twice a day and inside room at least once every 2 hours during waking hours
<i>Mobility</i> Ability to change and control body position	1. <i>Completely immobile</i> Does not make even slight changes in body or extremity position without assistance	2. <i>Very limited</i> Makes occasional slight changes in body or extremity position but unable to make frequent or significant changes independently	3. <i>Slightly limited</i> Makes frequent though slight changes in body or extremity position independently	4. <i>No limitations</i> Makes major and frequent changes in position without assistance
<i>Nutrition</i> Usual food intake pattern	1. <i>Very poor</i> Never eats a complete meal. Rarely eats more than one-third of any food offered. Eats 2 servings or less of protein (meat or dairy products) per day. Takes fluids poorly. Does not take a liquid dietary supplement OR Is nil by mouth and/or maintained on clear liquids or intravenous fluids for more than 5 days.	2. <i>Probably inadequate</i> Rarely eats a complete meal and generally eats only about half of any food offered. Protein intake includes only 3 servings of meat or dairy products per day. Occasionally will take a dietary supplement OR Receives less than optimum amount of liquid diet or tube feeding	3. <i>Adequate</i> Eats over half of most meals. Eats a total of 4 servings of protein (meat, dairy products) each day. Occasionally will refuse a meal, but will usually take a supplement if offered OR Is on a tube feeding or total parenteral nutrition regimen that probably meets most nutritional needs	4. <i>Excellent</i> Eats most of every meal. Never refuses a meal. Usually eats a total of 4 or more servings of meat and dairy products. Occasionally eats between meals. Does not require supplementation

continued

BOX 30-2 CONTINUED

Friction and shear	<p>1. Problem Requires moderate to maximum assistance in moving. Complete lifting without sliding against sheets is impossible. Frequently slides down in bed or chair, requiring frequent repositioning with maximum assistance. Spasticity, contractures or agitation leads to almost constant friction</p>	<p>2. Potential problem Moves feebly or requires minimum assistance. During a move skin probably slides to some extent against sheets, chair, restraints or other devices. Maintains relatively good position in chair or bed most of the time but occasionally slides down</p>	<p>3. No apparent problem Moves in bed and in chair independently and has sufficient muscle strength to lift up completely during move. Maintains good position in bed or chair at all times</p>		
TOTAL SCORE					
© Barbara Braden and Nancy Bergstrom 1988. Reprinted with permission. All rights reserved.					

There are many strategies that can be implemented to prevent pressure injuries.

- *Maintain regular skin inspections every day and with each repositioning or turn for signs of pressure injury.* On inspection, particular attention should be given to skin over bony prominences, for example the sacral area, heels and greater trochanters, areas of the body where pressure, friction and shearing is exerted during normal daily activities, and areas affected by equipment, footwear and clothing.
- *Skin hygiene should be maintained to preserve skin integrity.* The normal pH of the skin is between 4 and 6.8; maintaining a stable skin pH reduces the risk of infection and skin breakdown. Use of soap-free, pH-neutral cleansers and emollients keep the skin in better condition. Skin that is dry is less likely to be able to withstand the effects of friction and shear. Providing a stable environmental temperature and avoiding extremes of hot and cold decreases the risk of pressure injuries. Limit the patient's exposure to moisture. Ensure limited or no exposure to excessive moisture such as perspiration, urinary and/or faecal incontinence or wound fluid.
- *Avoid rubbing or massaging bony prominences.* Massaging or rubbing bony prominences increases the risk of tissue damage. Pillows and foam wedges can be used to reduce pressure on bony prominences if positioned correctly. Avoid using foam rings or donuts, as these increase the risk of pressure damage by pushing or forcing the tissue through a narrow opening. Discourage patients from sitting or lying in

one position. Repositioning should occur every 15 to 60 minutes if possible. Use positioning and turning schedules where possible, and consider the patient's medical condition, comfort and overall plan of care as well as the support surface used.

- *Prevent shear and friction.* Elevate the foot of the bed 20 degrees when sitting to prevent the patient from sliding; also, limit the amount of time patients spend with the head of the bed elevated. Use of correct manual handling techniques, including slide sheets or equipment to transfer patients, reduces the risk of friction and shear.
- *Monitor the patient's nutrition and hydration.* Refer to a dietitian if you are concerned about the patient's nutritional status.

Working as part of a team is important to ensure that appropriate pressure ulcer-prevention strategies are implemented. Your team includes the patient, family members, general practitioner, nurses, care staff and allied health professionals. Education of the patient, family members and other healthcare professionals is essential so that they understand the causes of skin damage.

SUPPORT SURFACES

The optimal support surface is one that relieves pressure, shear and friction and maintains a stable skin temperature (AWMA, 2012). Support surfaces should distribute bodyweight over a large surface area or totally remove pressure from the body surface, thereby reducing point pressure and tissue damage. Support surfaces alone do not eliminate the risk of pressure injury, as pressure-injury prevention requires comprehensive clinical care, regular repositioning and ongoing assessment.

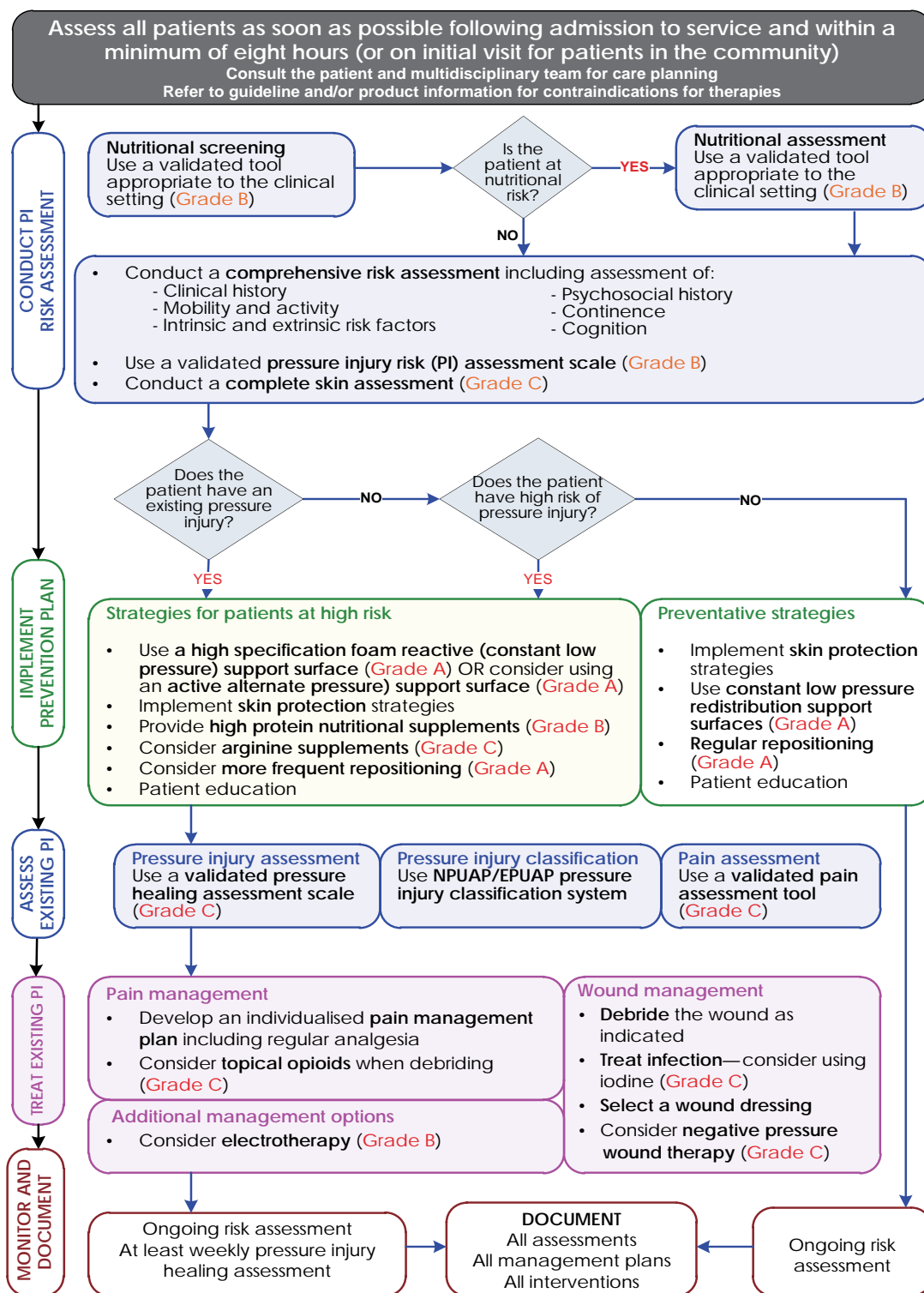


FIGURE 30-31 Flow chart for the prevention and management of pressure injury.

From Australian Wound Management Association 2012 Pan Pacific clinical practice guideline for the prevention and management of pressure injury. Osborne Park, WA, Cambridge Media, p. 12. Online. Available at www.awma.com.au/publications/2012_AWMA_Pan_Pacific_Guidelines.pdf 4 Jul 2012. Reproduced with the permission of the AWMA. All rights reserved.

There are many support surfaces available such as mattresses, overlays or chair cushions made up of a variety of different fabrics including foam, gel or air. *Comfort equipment* includes overlays, pads, cushions and sheepskins; these are mostly used for comfort and in combination with existing mattresses or chairs that a patient is using. They may provide a degree of pressure reduction and reduce shearing and friction because of their low-resistance or non-abrasive properties. Comfort devices are suitable for low-risk patients who are relatively mobile and require minimal intervention.

Constant low-pressure devices conform to body contours and aim to redistribute weight over a wider area, thereby reducing tissue interface pressure (AWMA, 2012). These devices include foam- or fibre-filled mattresses and overlays, water beds, gel pads, air overlays and mattresses with both static/constant air and low-air-loss devices (AWMA, 2012). These devices may be powered, mechanical devices or non-powered, non-mechanical devices. Constant low-pressure devices may be appropriate for medium-risk patients who are able to reposition themselves or who receive frequent repositioning.

CLINICAL EXAMPLE

Mr Bukowski re-presents 6 months after the skin tear on his left arm with a new wound located on his left lateral leg (gaiter region). The wound is failing to heal despite using the strategies that were recommended to treat his skin tears. Mr Bukowski states that the wound has been present for approximately 4 months and started as a minor skin tear. The wound has gradually been increasing in size and it has been leaking a lot. He says that sometimes he has to change the dressings every day because it leaks that much. Mr Bukowski has noticed that his skin is very dry and scaly and that his skin looks like it is going rusty. He reports that the wound is sometimes painful, particularly after he has been standing for a while, and that the pain is worse when he first gets out of bed in the morning and by late in the afternoon. He has also noticed that his ankles become quite swollen and finds that elevating his legs can help to reduce his pain and swelling. Mr Bukowski reports feeling a bit 'out of sorts'; he can't go out like he used to because he is worried that others can smell his wound, he is fearful that the leakage will ruin his

Alternating-pressure devices generate alternating high and low pressure between the body and the support surface by periodically deflating air cells under the body and redistributing the pressure on the tissue, which encourages reperfusion of previously supported areas (Queensland Health, 2009). These devices are available as overlays or single or multi-layered mattress replacements. They are suitable for high-risk patients who are immobile or obese.

Specialty beds combine a bed and sleeping surface and are designed for patients at very high risk for pressure injury.

Pressure injury prevention and management requires a collaborative approach. The patient's risk status and risk factors provide the basis for the formation of an individualised prevention and management plan. The management plan should provide specific details of what care is required, who is responsible for that care, frequency of turning, equipment required, referrals and expected outcomes (AWMA, 2012). Clinical interventions must be regularly monitored and documented and communicated to staff, patients, families and carers.

good clothes and his wound might get worse. He hasn't told his daughter about his wound because he doesn't want to worry her.



FIGURE 30-32 Mr Bukowski's leg ulcer.

From Wound Healing Community Outreach Service, Queensland University of Technology.

• CRITICAL THINKING

Based on the clinical scenario above, consider the following questions:

- What factors are likely to have led to the development of this leg ulcer?
- Based on the history and clinical examination data, what type of leg ulcer might this be?
- Is this wound healing by primary or secondary intention?
- What characteristics would indicate if this wound was infected?
- What is the predominant tissue type in the wound bed?
- How would you describe the wound edges?

Ulcers

LEG ULCERS

A leg ulcer is a wound that occurs between the knee and ankle that takes more than 4 weeks to heal. There are two common types of leg ulcers: *venous* and *arterial* leg ulcers. Assessment is the key to effective management of leg ulcers, yet many people with leg ulcers have never had a specialist assessment to identify the type of leg ulcer they are suffering from. Hence, leg ulcers may last for many years and, even if they heal, may soon break out again if the correct treatment and prevention strategies have not been provided.

Every leg ulcer has key features or characteristics that help determine the type of leg ulcer the person is suffering from. The key characteristics for the most common types of leg ulcers are outlined in Table 30-18, later in the chapter.

VENOUS LEG ULCERS are the most common type of leg ulcer. They occur because of high blood pressure in the veins in the lower limb (known as *venous hypertension*). Veins carry blood from the legs back to the heart. Veins in the lower leg have one-way valves to prevent blood running backwards, and when the calf muscles contract, blood is moved along the veins back towards the heart.

However, sometimes the valves in the veins or the calf muscles fail to work properly, for a number of different reasons (e.g. damage from a past clot in the vein), leading to chronic venous insufficiency or venous disease. The constant high pressure in the veins eventually causes fluid to leak out of the veins and into the surrounding tissues and skin. Although the reason for ulcer formation is not fully understood, the combination of high pressure in the veins and particles in the fluid forced into the tissues causes inflammation. This results in the skin easily breaking down and forming an ulcer. Table 30-15 highlights some of the risk factors for venous leg ulcers.

Once you have identified the signs and symptoms of a venous leg ulcer, you then need to determine the appropriate treatment. Key evidence-based management strategies for venous leg ulcers are summarised here.

- **Dressings** used to treat venous leg ulcers vary depending on the condition of the ulcer and the goals of treatment. Dressings should maintain a moist wound-healing environment, manage wound leakage (exudate), protect the skin around the ulcer, be non-adherent to reduce trauma on removal, and be cost-effective, acceptable to the patient and able to be changed less often where possible.

- **Apply graduated compression bandaging.** The key to healing a venous leg ulcer is to treat the underlying cause (i.e. reduce the high blood pressure in the veins). Graduated compression bandaging works by improving venous return, reducing swelling in the lower limb and improving foot- and calf-muscle pump action. Bandages are applied from the base of the toes to just below the knee. The bandage is said to be *graduated* because the ankle is smaller than the calf. Therefore, the pressure exerted by the bandage at the ankle is higher than that applied at the calf. You need special training in how to apply graduated compression bandages correctly, because if they are applied incorrectly they can cause significant damage to the patient's circulation and may even make the ulceration worse.

- **Apply compression stockings.** Graduated compression stockings for life after wound healing help to prevent venous leg ulcers from recurring, because they continue to provide compression to treat the underlying cause of the leg ulcers (i.e. poor circulation). A venous leg ulcer is really a symptom of an underlying disease process. Compression stockings can also be used to prevent venous leg ulcers. Failure to reach an accurate diagnosis and/or to recognise the signs and symptoms of venous disease may result in the unsafe application of the graduated compression bandaging.

ARTERIAL LEG ULCERS are less common than venous leg ulcers and are the result of peripheral arterial disease. Arteries supply blood and oxygen to the lower limbs; arterial leg ulcers result from inadequate blood supply and oxygen in the arteries. If blood supply to the lower legs is poor, the leg is starved of oxygen and nutrients; the skin fails to function normally and an ulcer may develop. A patient with arterial disease may have very cool or cold feet, the skin may be pale, blue (cyanosed) or dusky red in colour and they may complain of pain in the foot or calf

TABLE 30-15 **RISK FACTORS FOR VENOUS LEG ULCERS**

RISK FACTOR	EXPLANATION
Age	Blood flow decreases as a person ages, and decreased mobility leads to the calf muscles becoming less effective and not being used as much as they need to
Obesity	Excess weight, particularly around the waist and thighs, puts extra pressure on the veins and they have to work harder to move blood flow back towards the heart. Note that multiple pregnancies may also be a cause of excess weight
Varicose veins	The one-way valves that stop blood from travelling backwards in the veins stop working and this leads to pooling of blood in the lower legs
Past deep-vein thrombosis or trauma to lower limbs	A history of deep-vein thrombosis (i.e. blood clot) or trauma may result in permanent damage to the veins
Jobs that involve sitting or standing for long periods of time	Occupations that involve sitting or standing for long periods of time may result in less-effective blood flow through the veins and pooling of blood in the lower legs
Family history or congenital valvular incompetence	There is a strong link between family history and leg ulcers. In addition, in rare cases some people are born with problems that affect their veins, placing them at higher risk of venous disease
Health conditions	Disorders such as congestive cardiac failure lead to swelling of the lower limbs because the heart is not able to process blood flow effectively

muscle. Pain is often worse at night when the lower leg is elevated in bed and pain is only relieved when the legs are lowered. During exercise, the muscles in the lower leg need more oxygen; when a person has arterial disease, the blood supply is decreased and pain occurs in the foot or calf muscle on exercising. This pain is known as *intermittent claudication*. Table 30-16 outlines the patient risk factors for developing arterial leg ulcers.

Patients with arterial leg ulcers may benefit from a review by a specialist. This is because restoring blood flow by revascularisation is the intervention most likely to heal arterial leg ulcers.

Improving oxygenation of the wound environment promotes healing. Steps to improve oxygen supply to the tissues include avoidance of dehydration, cold, stress and pain. Dressings used to treat arterial leg ulcers vary depending on the condition of the ulcer and goals of the treatment. Topical antimicrobial dressings may be helpful to prevent infection.

Controlling risk factors known to affect the arteries is essential. For example, the healthcare professional should try to ensure that blood glucose levels are kept within normal ranges, blood pressure is controlled, cholesterol levels are reduced, medications are reviewed and the patient has a healthy and balanced diet, stops smoking and is encouraged to maintain a healthy weight relative to their height.

DIABETIC FOOT ULCERS

A **diabetic foot ulcer** is an ulcer located on the foot, and is associated with a loss of protective sensation (neuropathy) and/or the presence of ischaemia in a patient with diabetes. Diabetic foot ulcers are more likely to occur if the patient has uncontrolled or prolonged high blood-sugar levels (hyperglycaemia).

Once you have identified the signs and symptoms of a diabetic foot ulcer, you then need to determine the correct treatment. Key evidence-based management strategies for diabetic foot ulcers may include the following:

- *Recommend a medical review:* patients with diabetic foot ulcers may benefit from review by a specialist.
- *Use a team approach to care:* care of diabetic foot ulcers should be undertaken by a multidisciplinary team including podiatrists, orthotists, wound-care specialists, the patient's doctor, an endocrinologist, a dietitian and a diabetic educator.
- *Ensure adequate oxygenation:* improving oxygenation of the wound environment promotes healing. Steps to improve oxygen supply to the tissues include avoidance of dehydration, cold, stress and pain.
- *Ensure off-loading of pressure points:* it is essential to review the patient's footwear and ensure that pressure is relieved. Otherwise, the wound will fail to heal. Areas of abnormal pressure distribution on the diabetic foot are usually located on the plantar aspect of the foot under the hallux, first and fifth metatarsal heads and under the heel (Grey and others, 2006).
- *Apply suitable dressings:* dressings used to treat diabetic foot ulcers vary depending on the condition of the ulcer and goals of treatment. Topical antimicrobial dressings may be helpful at preventing infection.
- *Control risk factors:* controlling risk factors known to affect the arteries is essential. For example, try to ensure that blood glucose levels are kept within normal ranges, the blood pressure is controlled, cholesterol is reduced, medications are reviewed, and the patient has a healthy and balanced diet, stops smoking and is encouraged to maintain a healthy weight relative to their height.

ASSESSMENT AND MANAGEMENT

Being able to recognise the key signs and symptoms of the different types of ulcers is very important to help obtain an accurate diagnosis. The following steps may assist in clinical examination to determine the aetiology of ulceration. Table 30-17 compares the key characteristics of venous arterial and diabetic ulcers. Assessing these characteristics can assist you to determine the aetiology of ulceration.

TABLE 30-16 RISK FACTORS FOR ARTERIAL LEG ULCERS

RISK FACTOR	EXPLANATION
Atherosclerosis	Hardening, narrowing or blockage of the arteries because of fatty deposits (plaques) or cholesterol reduces blood supply to the lower leg
Smoking	Cigarette smoking is a well-known risk factor for atherosclerosis and heart disease
Hypertension	High blood pressure leads to hardening of the arteries
Diabetes	Poorly controlled diabetes leads to high cholesterol levels in the blood and increased risk of hardening of the arteries. There is also an increased risk of strokes, heart disease and ulceration of the lower limbs
High cholesterol	High cholesterol is a major risk factor for hardening of the arteries
Stress	There is a link between high levels of stress and arterial disease
A history of heart disease, heart attack or stroke	These conditions increase the risk of further problems with the peripheral arteries
Obesity	Excess weight, particularly around the waist and thighs, puts extra pressure on the arteries and the heart has to work harder to move blood flow around the body

PREVENTION STRATEGIES

Once you have learned how to assess and manage venous, arterial and diabetic foot ulcers, there are some important evidence-based strategies that you can put in place to reduce the risk of the ulcer recurring. Box 30-3 highlights some of the key prevention strategies.

• CRITICAL THINKING

Think about how you would decide on the management of Mr Bukowski's leg ulcer:

- How would you cleanse this wound?
- What type of management strategies would you employ for this type of leg ulcer? What dressing regimen would you choose at this point, and why? How would you manage the skin around the wound?
- What self-help advice would you give to Mr Bukowski? What strategies would you recommend to prevent leg ulcer recurrence in the future?
- Are there any other healthcare professionals that you would liaise with in this case?

Malignant/fungating wounds










Malignant fungating or cancerous wounds are those that affect people with cancer. Fortunately they occur infrequently, but are typically described as a devastating, overwhelming and distressing experience (Alexander, 2010). They are caused by the infiltration of the skin by a local tumour such as a squamous-cell carcinoma or melanoma; haematological malignancy such as cutaneous T-cell lymphoma; or metastatic spread from a primary tumour, for example breast cancer where metastasis occurs along tissue planes, capillaries or lymph vessels (Adderley and Smith, 2007; Naylor, 2002). Lesions are characterised by a process of both *ulcerative* (crater-like) and *proliferative* (nodular or cauliflower-shaped) growth that can cause extensive damage to the skin and surrounding structures (Lewellyn and others, 2002).

Although rare, malignant changes may develop in chronic wounds (Marjolin's ulcer) and are most commonly associated with burn-scar ulcers, pressure or venous ulcers (Naylor, 2002). This type of malignancy is usually aggressive and has a high rate of metastatic spread and local recurrence

BOX 30-3 LEG ULCER PREVENTION STRATEGIES


- Follow up and check the skin regularly.
- Apply a pH-neutral moisturiser to the skin at least twice daily.
- Ensure shoes are well-fitting, soft and comfortable.
- Be extremely careful when cutting toenails. Preferably, a podiatrist should do this.
- Avoid soaking the feet in hot water, using heating pads and applying harsh topical skin cleansers.
- Protect the toes and heels of patients with decreased mobility by using effective pressure-relief devices such as foam or gel pads.
- Use leg-protection devices to avoid injury (e.g. limb protectors or long trousers).
- Keep the lower legs warm. Passive warming of the lower legs and feet, such as covering the legs with a blanket, improves blood supply (perfusion). However, do not use hot water bottles, electric blankets or foot spas, or position the feet close to heating devices. This is because the person may not be able to feel if damage is occurring, which risks burning of their skin.
- Encourage lower-limb exercises, at least every hour. Simple exercises may include drawing figures with the toes, pushing the toes towards the floor and then pointing them up towards the nose, standing on the balls of the feet, tiptoeing up and down, walking or swimming. Any movement of the calf muscle helps to move blood back to the heart. Also discourage crossing of the legs, which reduces arterial blood flow.
- Elevate the affected limb at least 3–4 times every day for at least 15 minutes each time, to help reduce high blood pressure in the lower legs and reduce swelling. Elevation means placing the patient's legs on pillows, a chair or another object so that the feet are above the level of the knees, and the knees are above the level of the hips. Try to discourage patients from sitting with their legs down and stationary for more than an hour at a time. Patients should put their feet up while performing sit-down tasks. Elevating the legs to the level of the hips doesn't reduce swelling, but it keeps the swelling from getting worse. Elevating the legs above the level of the heart is needed to reduce swelling.
- Smoking cessation interventions are an important part of the treatment plan.
- Ensure the patient maintains a healthy weight relative to their height. A well-balanced diet and healthy weight reduces the risk of arterial disease.
- Manage any underlying diseases; ensuring that underlying diseases such as diabetes, heart disease or hypertension are well controlled helps to prevent complications such as arterial leg ulcers.
- Education of patients, family members and other staff helps to ensure that problems are identified early and strategies are implemented to reduce risk. It is especially important that the patient does not walk barefoot if they have diabetes or arterial disease, as they might tread on something and damage their skin and not be aware they have done so.
- For patients with venous leg ulcers, use of graduated compression stockings for life reduces ulcer recurrence rates. Compression stockings should be measured and fitted by a trained practitioner to ensure that they are the correct size for the person. Compression hosiery should be replaced at least every 6 months. Compression stockings must be worn every day except while in bed, bathing or swimming. Stockings should be applied as early in the day as possible to prevent the legs from swelling. Remove hosiery as close to bed-time as possible.

TABLE 30-17 CHARACTERISTICS OF LEG ULCERS

CHARACTERISTIC	VENOUS	ARTERIAL	DIABETIC
Location	Above the ankle bones, on the lower third of the leg in the calf muscle region 	Toes, shin or over pressure points (i.e. sites subjected to trauma, the rubbing of footwear and ankle bones) 	Sole of the foot, the toes or over pressure points such as the ball of the foot 
Depth	Shallow, affecting the epidermis and dermis	Usually shallow but may be deep	Usually shallow but may be deep and may have tracking or undermining (i.e. probes to tendon or bone)
Appearance	Ruddy or beefy red, granular appearance	Pale grey or yellow in colour with no evidence of new tissue growth. May also be black (necrotic) and tendons may be exposed	Red granular, pale grey or yellow in colour. May also be black (necrotic) and tendons may be exposed
Wound shape and margins	Flat and irregular, often resembling the shape of a cartoon figure or country 	Smooth, even or punched-out appearance. The shape of the wound may conform to injury if caused by trauma 	Calloused wound margins
Exudate	Moderate to heavy	Low to moderate	Low to heavy. An infected ulcer may have purulent, foul-smelling leakage
Surrounding skin	Ankle flare or small veins concentrated around the ankles  Varicose veins 	Pale, shiny, taut skin Cold legs and feet even in a warm environment Absence of hair on the legs or toes Legs dusky red or blue (cyanosed) Blackened toe nails Tendon exposed in wound bed 	Dry, calloused skin around wound margins Cold legs and feet, even in a warm environment Absence of hair on the legs or toes Evidence of previous foot ulcers or amputation 

	<p>Oedema or swelling around the ankle or calf muscle region</p>  <p>Atrophie blanche or absence of pigmentation in the tissue (sometimes indicating a history of previous ulcers)</p>  <p>Hyperpigmentation or discolouration of lower limb</p>  <p>Hyperkeratosis (dry, flaky skin)</p>  <p>Venous stasis eczema</p> 	<p>Foot deformities such as Charcot's foot, hammer toes or clawed toes</p> <p>Thickened toenails</p> <p>Redness of the affected area when the legs are dependent or 'dangled' and pallor when the foot is elevated</p>
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continued

CHARACTERISTIC	VENOUS	ARTERIAL	DIABETIC
	<p>Haemosiderin staining, or red blood cells which have died and then build up under the skin, staining the skin a brown colour</p> 		
Pain	<p>Ranges from no pain to severe, constant pain Pain is often worse after standing for long periods May be described as an achy, dull pain or a feeling of pressure Pain is usually relieved by elevating the limb above heart level, because this relieves the pressure on the veins and reduces swelling</p>	<p>Often accompanied by severe cramping pain in the foot or calf muscle at rest when the legs are elevated Pain may also increase when walking short distances (known as intermittent claudication)</p>	Often painless
Referral criteria	<p>Uncertainty in the diagnosis Low or high ankle-brachial pressure Index (ABPI) (i.e. less than 0.9 or greater than 1.2) The ulcer is complicated (e.g. multiple aetiology such as arterial or rheumatoid disease) There are signs of infection, the ulcer or lower limb appears ischaemic and/or the wound can be probed to bone The ulcer deteriorates or fails to improve after 3 months The patient has symptoms which limit their lifestyle and quality of life (e.g. rest pain) and would benefit from surgical revascularisation</p>		

(Naylor, 2002). Diagnosis can only be confirmed following biopsy of the wound, although signs of malignant change in a chronic wound are typically characterised by onset of pain or a change in the type or intensity of pain, malodour and change in character, volume or appearance of exudate.

Malignant wounds can have a significant impact on the patient and their family and greatly affect quality of life. Wound-management priorities vary considerably for each patient and strategies should be targeted according to the patient's preferences. Most patients with a malignant wound will be in the terminal stages of their illness and wound healing is unlikely to occur. The main aim of wound management is aimed at controlling or eliminating the distressing symptoms associated with these wounds.

Malignant wounds often produce copious amounts of exudate which can be difficult to manage (Naylor, 2002). Exudate production is secondary to increased permeability

of blood vessels in the tumour and secretion of vascular permeability factor by tumour cells, or increased exudate due to the presence of infection (Naylor, 2002). High volumes of exudate may result in maceration and irritation of the skin. There are many dressings available for the management of exudate (e.g. foams and alginates), and selecting a dressing that will absorb exudate but still maintain a moist environment is essential (Adderley and Smith, 2007).

An offensive malodour caused by bacterial infection and/or the presence of devitalised tissue within the wound bed is frequently the most distressing aspect of a malignant wound; it can be socially isolating and cause loss of appetite and nausea (Alexander, 2010). Debridement of necrotic or devitalised tissue is the main method of treatment for malodorous fungating wounds (Naylor, 2002). However, surgical sharp debridement is not recommended due to the high risk of bleeding; autolytic debridement is the

preferred method of debridement (Naylor, 2002). The use of antimicrobials (e.g. metronidazole gel) can help to reduce the amount of bacteria present in the wound, thereby reducing malodour. The use of topical activated-charcoal dressings and occlusive dressings may help to control odour, and environmental agents such as room deodorants and fragrances for control of odour may also assist (Carville, 2007).

Bleeding can occur secondary to erosion of blood vessels by malignant cells and may be exacerbated by decreased platelet function within the tumour (Naylor, 2002). Profuse, spontaneous bleeding can be very distressing and careful management of the wound at dressing changes is essential to minimise the risk of bleeding. Preventative measures to reduce the risk of bleeding, such as the use of non-adherent dressings, maintaining a moist environment, haemostatic dressings (e.g. alginates or haemostatic sponges) and wound cleansing by irrigation, will help to reduce the risk of trauma and bleeding (Naylor, 2002).

Pain is caused by a number of mechanisms, including pressure on nerves and blood vessels and exposure of the dermis (Naylor, 2002). Pain frequently results in loss of sleep, distress and anxiety and may be exacerbated by wound-dressing changes. Pain should be assessed before, during and after wound-dressing changes and analgesia should be prescribed using the World Health Organization (WHO) guidelines (see Chapter 41) for the control of cancer pain and in accordance with local prescribing guidelines (Naylor, 2002). The use of non-adherent and dressings which maintain a moist environment may help to reduce pain associated with wound-dressing changes.

The position of the wound may be a significant source of distress for the patient, particularly if in a highly visible area such as the breast or face. Wound management strategies aimed at devising a cosmetically acceptable dressing may help to promote self-esteem and minimise distress.

The skin around the fungating wound is susceptible to breakdown and must be assessed for signs of bacterial infection, fungal infection, maceration and excoriation. The use of non-traumatic adhesives, skin sealants and creams or ointment barriers can help to provide protection to the periwound skin.

Palliative treatment may include radiotherapy and systemic or topical chemotherapy to reduce tumour size, exudate and malodour (Adderley and Smith, 2007). *Radiotherapy* in the form of X-rays or radioactive substances is used as a localised cancer treatment or in combination with other treatments such as surgery or chemotherapy, and is used to reduce the size of a tumour, to control the spread of disease or to relieve symptoms of advanced disease (Regan, 2007). Radiotherapy is unable to differentiate between normal and abnormal cancer cells, and the radiation can damage healthy tissue and may result in skin atrophy, soft-tissue fibrosis and microvascular damage or burn injury (Regan, 2007). Skin reactions to radiotherapy typically occur 2 weeks into treatment; the

likelihood of developing a reaction depends on a number of factors including the patient's age, skin integrity, type of radiation and amount of energy used, chemical and skin irritants used by the patient, nutritional status, presence of skin folds and concurrent chemotherapy (Regan, 2007). Skin reactions may be mild such as dry skin or may lead to moist desquamation.

Strategies that can be taken to minimise the effects of radiation include preventing mechanical trauma caused by shaving, friction, pressure, adhesive tapes or constrictive clothing; avoiding the use of chemical trauma from soaps, deodorants, shaving creams, astringents or make-up; avoiding extremes of heat and cold to prevent thermal trauma; avoiding skin products containing metallic substances, including zinc cream and talcum powder; avoiding exposure to the sun; moisturising the skin frequently with a pH-neutral emollient; and ensuring adequate nutrition and hydration (Carville, 2007).

Chemotherapy may be used to reduce the size of a malignant wound; it involves the use of systemic or localised cytotoxic drugs (Regan, 2007). Chemotherapy can cause skin reactions including transient erythema, hyperpigmentation, photosensitivity, nail changes, palmar/plantar syndrome and inflammatory reactions in tissue that has been previously irradiated resulting in blisters, vesicle formation, exfoliation and ulceration (Regan, 2007). Chemotherapy can decrease the size of a malignant wound by destroying malignant cells, and reduce pressure on nerves and blood or lymph vessels thereby reducing exudate production and potential to bleed (Regan, 2007).

Extravasation of the skin can occur secondary to the use of chemotherapy drugs, resulting in ulceration of the skin, nerve damage, significant pain, disfigurement and potential limb loss (Regan, 2007). Extravasation occurs over a few days with maximum severity over 2–3 weeks. The degree of tissue damage is secondary to the amount of drug extravasated, drug concentration, site, needle insertion device and technique (Regan, 2007). The affected tissue may appear swollen, tender and red and progressively worsen into ulceration, and may involve tendon and nerves. Severe tissue damage may require surgical intervention (Regan, 2007). Prevention of extravasation injuries includes a thorough assessment of the patient, venous access, related risk factors, knowledge of the drug and early recognition of the signs of extravasation injury including burning pain, erythema and oedema at injection site.

Malignant fungating wounds are a significant problem and challenging for both patients and healthcare professionals. The key to effective management is accurate assessment to improve quality of life through symptom control; however, there is insufficient evidence to provide clear direction for practice with regard to improving quality of life or managing wound symptoms associated with fungating wounds (Adderley and Smith, 2007; Lo and others, 2008, 2012).

Adjunct wound therapies

Hyperbaric oxygen therapy (HBOT) is a treatment designed to increase the supply of oxygen to wounds that are not responding to other measures to treat them. HBOT involves people breathing pure oxygen in a specially designed chamber (such as that used for deep-sea divers suffering pressure problems after resurfacing). Evidence suggests that HBOT seems to reduce the number of major amputations in people with diabetes who have chronic foot ulcers, and may reduce the size of wounds caused by venous disease, but at this stage there is no evidence to confirm or refute any effect on other wounds caused by lack of blood supply due to arterial disease or pressure injury (Goldman, 2009; Kaur and others, 2012; Kranke and others, 2004).

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KEY CONCEPTS

- Having a good understanding of the anatomy and physiology of the skin is essential in order to determine whether a patient is at risk of compromised skin integrity.
- Wound healing is achieved through the process of vasodilation, inflammation, proliferation and maturation.
- There are various modes of wound healing, including primary intention or secondary intention.
- Wounds are classified as either acute or chronic depending on the duration of injury.
- There are many factors that affect the wound-healing process.
- Assessment is essential in order to recognise those at risk of skin breakdown and to aid in implementing appropriate wound management and prevention strategies.
- Regular evaluation of the effectiveness of the wound management plan is essential.

ONLINE RESOURCES

Australian Wound Management Association; provides a number of important clinical guidelines such as the *Australian and New Zealand clinical practice guideline for prevention and management of venous leg ulcers* and *The Pan Pacific clinical practice guideline for the prevention and management of pressure injury*, www.awma.com.au/publications/publications.php

STAR Skin Tear Classification System, www.silverchain.org.au/assets/files/STAR-Skin-Tear-tool-04022010.pdf

World Union of Wound Healing Societies; consensus documents related to wound care, www.wuwhs.org/general_publications.php

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Preface

To the student

Welcome to the fourth edition of the most successful fundamental text ever to be published for nursing students across Australia and New Zealand. Within this new edition we have maintained the core function of a fundamentals book: that of providing the next generation of nurses with crucial knowledge and skills related to your chosen profession and your practice. However, we have added a goal of supporting your development of a range of critical skills and understandings that will prepare you for the ever-changing and complex world of healthcare.

As editors, we began work on this new edition with the aim of emphasising the importance and complexity of *fundamental* nursing care. In our experience, many people confuse these complex nursing activities with kindness or niceness. Indeed, to the general public and those new to the profession, many of the topics covered in a textbook like

this may seem simple or trivial. They may even wonder why it takes an educated person to do them. We hope that as you work through these chapters, you come to realise why activities such as feeding, bathing, toileting, walking or turning patients are critically important aspects of care, recovery and rehabilitation. The clinical examples and critical thinking questions throughout this text underscore how putting this nursing knowledge and skill into practice can mean the difference between, on the one hand, patient recovery and independence—and, on the other, costly and life-threatening complications, functional decline and disability.

The profound impact of nurse staffing levels, education, workload, skill mix and the nursing work environment on patient outcomes has been well documented in a large and growing body of international research evidence over the past decade (see the box below). These results overwhelmingly support the position that the quality of

Nurse staffing	Nurse staffing levels of health care settings have a significant effect on morbidity and mortality and the occurrence of adverse events, with higher staffing levels associated with lower mortality, lower incidence of infections, decubitus ulcers, ⁶ postoperative pulmonary complications, pneumonia, and septicemia. ⁴
Nursing workload	Each additional patient allocated to nursing workload increases the likelihood of patient death; ⁷ increased overtime is associated with urinary tract infections, decubitus ulcers, ⁸ and increased workload with patient falls, respiratory infections, and patient complaints. ⁹ Nurses working shifts of 12.5 hours or more are three times more likely to make an error; and working more than 40 hours a week increases the risk of error. ¹⁰
Nursing skill-mix	An increase in registered nurse staffing is associated with decrease in pneumonia, ^{11,12} lower rates of "failure to rescue", and reduced incidence of death from shock or cardiac arrest, gastrointestinal bleeding, sepsis, deep vein thrombosis, or pneumonia. ¹³
Work environment	Each additional patient allocated to nursing workload is associated with a 23% increase in nurse burnout and a 15% increase in nurses' job dissatisfaction. ¹⁴ Insufficient resources, inadequate support and inadequate equipment are all associated with an increase in injuries to nurses, ¹⁵ higher nurse turnover, ¹⁶ and an increase in errors. ¹⁷

BOX 1 Effect of nursing interventions on quality and safety of health care.

From Australian Nursing Federation (ANF) 2009 Ensuring quality, safety and positive patient outcomes: why investing in nursing makes sense. ANF, Melbourne. Online. Available at http://anf.org.au/documents/reports/Issues_Ensuring_quality.pdf 27 Aug 2012.

nursing care matters—not because nurses are kind, sweet and selfless, but because appropriate nursing care saves lives and improves patient outcomes, as well as patients' experiences of their care.

As Aranda (2007) argues:

Herein lies the central point of our [nursing's] image and identity problem—basic nursing care is not understood as skilled practice by nurses themselves or by the public ... I point out that while yes we do bath and shower people and engage in work that is sometimes difficult and unpleasant, this work is a door to understanding human experiences of illness. It is through this door that opportunities to make a real difference in the quality of that experience occur.

Nurses themselves contribute to the invisibility and devaluing of nursing work when they sentimentalise and downplay their contribution to patient care. Consider the American journalist and author Suzanne Gordon's observation that nurses often refer to themselves and each other as 'just a nurse'. As part of a nurse-recruitment campaign, Gordon developed the idea of creating a poster that juxtaposed this phrase so that it illuminated the richness and importance of nursing (see the figure below).



FIGURE 1 Poster created by Suzanne Gordon for a nurse-recruitment campaign

Source: <http://suzannegordon.com/just-a-nurse-poster-bookmark>

We encourage you to embrace this concept of nursing as *knowledge work* and engage with the features of this text that aim to cultivate this approach to nursing practice.

The first part of this is to form a *critically reflective approach to self-care and development* throughout your nursing career, through supporting your insight into how your own thinking around the information discussed within each chapter is evolving. We are, therefore, seeking to engage your reflective processes to achieve deep understanding of 'so what do I think about this now?', and of the broader ideas around caring for self and others we work with in order to maximise the likelihood of effective workplace cultures and the best outcomes for patients/clients.

The second part is an extension of the above, and seeks to actively engage you in *thinking about the content* you encounter throughout the book, to facilitate deeper learning and memory and to resist the idea of rote learning. We know that one of the most effective ways of achieving this is to provide examples and stories that are meaningful, and we have taken this approach throughout the book by integrating clinical scenarios or practice examples and critical thinking questions throughout each chapter.

The third part of the approach focuses on ensuring that you are exposed to, and hopefully come to understand, the *similarities and differences in patient/client/family experiences and needs*, and how these vary across individuals, groups and in relation to environmental and other contextual factors. We have, therefore, moved away from a reliance on highlighting specific cultural issues or age/development stages to a more integrated approach to discussing and dealing with diversity in relation to the content of the specific chapter.

Last, we believe it is crucial that you see the *dynamic and evolving nature of evidence for nursing practice*—how thinking and knowledge evolve—and understand the need to see ongoing changes in practice as the norm. We also want you to see the need for all clinicians to actively engage in processes associated with their own learning, the learning of others, and the development of practice. We have continued to focus on evidence through the use of research highlights, but once again we have taken a more integrated approach to capture the most up-to-date knowledge/evidence and practices that we can.

Overall, we would like to dedicate this edition to all those students studying to become the best nurses they can be—we wish you well in your endeavours and hope this book provides a solid foundation on which to build the knowledge and expertise required to join one of the most highly regarded, and crucial, professions in the world.

REFERENCE

Aranda S 2007 Image, identity and voice—nursing in the public eye. 6th Vivian Bullwinkel Oration. Royal College of Nursing, Australia.

Text Features

Nursing today
Chapter 1

Jill White

KEY TERMS

Caregiver, p. 11	Health reforms, p. 8
Clinical decision maker, p. 11	International Council of Nurses (ICN), p. 3
Clinical nurse specialist, p. 12	Nurse educator/academic, p. 13
Code of conduct, p. 12	Nurse manager, p. 13
Code of ethics, p. 12	Nurse practitioner, p. 13
Continuing education, pp. 14–15	Nurse researcher, p. 13
Enrolled nurse, p. 14	Registered nurse, p. 14
Evidence-based practice, p. 10	

LEARNING OUTCOMES

Mastery of content will enable you to:

- Define the key terms listed.
- Discuss the rich history of nursing in Australia and New Zealand.
- Describe nursing practice and the role of the nurse.
- Discuss educational and career options available to registered nurses.

Key terms are listed (with page numbers) at the beginning of each chapter and defined within the text.

Learning outcomes highlight the key content and what the student will attain from each chapter.

Research highlights provide examples of the most up-to-date knowledge, evidence and practice.

RESEARCH HIGHLIGHT

Research focus

This important research project explored variability in the working environment across nursing units (or wards) in New South Wales.

Research abstract

The key finding in this research was that there was no such thing as a 'typical' unit or ward. It was found that patient acuity had risen and the diversity of patient conditions on any ward had increased substantially within medical–surgical units over the five years to 2005. The fast turnover of patients and the movement of patients from ward to ward as beds became available increased the nursing workload; this was called 'churn'. The skill-mix, i.e. the proportion of registered nurses (RNs) to enrolled nurses or assistants in nursing (AINs), was very important to the quality of patient care. The research confirmed the work from Magnet hospitals that within this research work environment, elements such as nurses' autonomy, control over their practice and good leadership were important for both the nurses' satisfaction

Evidence-based practice

- Patient movements between wards of stay produces extra workload
- Patients in principal referral hospital previously—higher acuity—than workload.
- There is a greater number of nurses which has changed the skill-mix; the number of RNs has a deleterious outcome.
- The higher the proportion of RNs, the higher the proportion of R decubitus ulcers, pneumonia and less likely to fall with increased acuity.
- Adequate staffing, control over practice, good leadership increases job satisfaction.
- Adequate RN staffing improves patient outcomes.

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Duffield C, Roche M, O'Brien-Palmer K. Gluing it together: nurses

WORKING WITH DIVERSITY CULTURAL ASPECTS OF CARE

Although the biophysical aspects of sleep architecture and function are universal, sleep patterns, culturally constructed. For example, the tendency to encourage infants and young children to sleep in family members, is a relatively new Western social practice, bringing with it its own problems and childhood development, secure attachment and wellbeing. In contrast, in some Asian groups, co-sleeping is believed to be essential as a protective mechanism from a range of physical and spiritual harms. In family homes and smaller houses are the norm, closer sleeping arrangements for infants and children means that what is considered normal or problematic sleep habits in infants and young children in a family.

IMPLICATIONS FOR PRACTICE

- Assess expectations, beliefs and values, and sleep routines with families.
- Assess child's sleep patterns including total hours of nocturnal sleep, patterns of wakefulness, and numbers of naps taken
- Assess bedtime rituals and habits
- Assess sleep issues and plan interventions from the perspective of what is normal for the specific child and family.

Working with diversity encourages students to see cultural, gender and age related issues in the broadest possible way.

Critical thinking questions provide a focus on the critical thinking and reflection processes to achieve deeper understanding and meaningful learning.

● **CRITICAL THINKING**

Florence Nightingale was a most extraordinary nurse, focused on public health as much as personal healthcare. Discuss in a small group the similarities and differences between Nightingale thinking and the return to a primary healthcare agenda of the current Western healthcare systems.

Social, economic and political influences on nursing

There are many external forces that affect nursing. These include demographic changes such as the ageing of the population, consumer expectations, which have been

ill, an increase in what is a marked increase in day surgery on the day of surgery as opposed to patients in for tests and prep around more quickly, and are of recuperation. There is, the get to know their patients and their recovery—sources of job. The reorganisation of increased numbers of man healthcare professional but little understanding at senior and its value to the 'business nurses were let go in favour and many directors of nursing a job. In relation to caregiver of the importance of the ne

CLINICAL EXAMPLE

THE OVERLOOKED SYMPTOM

I came to work that morning and had two patients in our transplant intensive care unit. One was a 22-year-old man who had received a liver transplant about 48 hours earlier. When I was doing my morning head-to-toe check, I found that he was very sleepy, his eyes were closed, he was jaundiced, and he wouldn't respond when I talked to him. When he did try to talk to me, he mumbled incomprehensibly.

I knew these symptoms were a problem. As an experienced transplant nurse, I knew that when you give somebody a liver and it works, they're not jaundiced and they're alert. They're perky, eating, talking, and even walking the halls.

This young man was doing none of that. So I checked all his vital signs, his blood pressure, pulse, temperature. Everything was where it should have been at that point in time, two days post transplant. Although his urine output was okay, the urine was a dark amber colour—which was a concern. I did his morning lab work, and everything was fine. But I was still worried. As the shift progressed, he became more lethargic and sleepy. I did another set of blood work on him, and it started to document that life in his liver was deteriorating.

'Look,' I told him, 'I'm sorry, I'm the surgeon because this is not good and I hung up.'

Just as I got off the phone with walked in. 'Lou,' I said, 'look, this His liver has failed.'

I presented all the data support explained that he was going into encephalopathic. He was filling up transplanted liver was not able to been a transplant nurse for over 10 years this even without doing any nurse.

I was right. Indeed, his new blood liver. The other critical liver lab value fact. So did his urine. The brown colour was bile that the liver was not able to excrete your bile in your stool, white brown). The fact that his labs were was meaningless because they had the course of the shift.

'We have to put him back on the

Clinical examples assist students apply theory to practice by highlighting clinical scenarios they are likely to encounter.

SAMPLE NURSING CARE PLAN

SPIRITUAL WELLBEING

ASSESSMENT*

during his last three visits. During that time James expresses a fear of dying and a loss of faith with God: 'to me? This just can't be happening!' The RN attempts to learn more about James's faith and soul. James begins to cry and admits that he feels very alone. 'I just don't know what to believe in any so suddenly. It is as though God and everyone else has abandoned me. I am so afraid. Life isn't a discussion, James says has been unable to sleep, has little desire for food, and is having difficulty friends.

Nursing diagnosis: Spiritual distress related to fear and uncertainty of advanced illness.

PLANNING

GOALS	EXPECTED OUTCOMES
Client will express a sense of purpose.	Client will discuss how the experience has had a positive influence in life.
Client gains a sense of hope.	Client expresses a sense of confidence available for AIDS. Client begins to talk of the future.
INTERVENTIONS	RATIONALE
Instilling hope	
<ul style="list-style-type: none"> • Education to discuss typical course of HIV, emphasising the typical pattern of remissions with drug therapy. Review therapies available for treatment. 	Knowledge about disease will help living with HIV rather than dying. Reality of disease course will help.
Spiritual support	
<ul style="list-style-type: none"> • Encouragement expression of loneliness through establishing a caring presence. 	Presence reflects being in tune with caring. It is an effective technique discussion more approachable.

Sample nursing care plans assist students understand the process of assessment, nursing diagnosis, planning goals, outcomes, identifying interventions and the process for evaluating care.

SKILL 28-2

Assessing the radial and apical pulses

DELEGATION CONSIDERATIONS

Pulse measurement can be delegated to enrolled nurses who are informed of:

- appropriate patient position when obtaining apical pulse measurement
- appropriate duration of radial and apical pulse count.
- patient history or risk of irregular pulse
- frequency of pulse measurement
- the usual reportable levels for the patient
- the need to report any abnormalities.

EQUIPMENT

- Stethoscope (apical pulse only)
- Wristwatch with second-hand or a digital display
- Pen, observation chart
- Alcohol swab

STEPS

1. Determine need to assess radial or apical pulse:
 - a. Note risk factors for alterations in apical pulse.

RATIONALE

Certain conditions place patients at risk of pulse alteration. Heart rhythm can be affected by heart disease, cardiac arrhythmias, onset of sudden chest pain or acute pain from any site, invasive cardiovascular diagnostic tests, surgery, sudden infusion of large volume of intravenous fluid, internal or external haemorrhage, and administration of medications that alter heart function.

- (3) Place tips of first two fingers of hand over groove along radial or thumb side of patient's inner wrist (see illustration).



Fingertips are the most sensitive parts of hand to palpate arterial pulsation.



Step 7A(2) Measuring radial pulse in supine patient.

- (4) Lightly compress against radius, obliterate pulse initially, and then relax pressure so pulse becomes easily palpable.
- (5) Determine strength of pulse. Note whether thrust of vessel against fingertips is bounding, strong, weak or thready.
- (6) After pulse can be felt, look at watch's second-hand and begin to count rate; when second-hand hits number on dial, start counting with 0, then 1, 2 and so on.
- (7) If pulse is regular, count rate for 30 s and multiply total by 2.
- (8) If pulse is irregular, count rate for 60 s. Assess frequency and pattern of irregularity.

Step 7A(3) Position of fingertips for obtaining radial pulse.

- Pulse is more accurately assessed with moderate pressure. Too much pressure occludes pulse and impairs blood flow.
- Strength reflects volume of blood ejected against arterial wall with each heart contraction.
- Rate is determined accurately only after nurse is assured pulse can be palpated. Timing begins with 0. Count of 1 is first beat palpated after timing begins.
- A 30 s count is accurate for rapid, slow or regular pulse rates.
- Inefficient contraction of heart fails to transmit pulse wave, interfering with cardiac output, resulting in irregular pulse. Longer time ensures accurate count.

Critical decision point: If pulse is irregular or rapid, assess for pulse deficit that may indicate alteration in cardiac output. Count apical pulse while colleague counts radial pulse. Begin apical pulse count out loud to simultaneously assess pulses. If pulse count differs by more than 2, a pulse deficit exists.

10. Perform hand hygiene.
11. Compare readings with previous baseline and/or acceptable range of heart rate for patient's age (see Table 28-2).
12. Compare peripheral pulse rate with apical rate and note discrepancy.
13. Correlate pulse rate with data obtained from blood pressure and related signs and symptoms (palpitations, dizziness).

- Reduces transmission of microorganisms.
- Checks for change in condition and alterations.
- Differences between measurements indicate pulse deficit and may warn of cardiovascular compromise. Abnormalities may require therapy.
- Differences between radial arteries indicate compromised peripheral vascular system.
- Pulse rate and blood pressure are interrelated.

RECORDING AND REPORTING

- Record pulse, noting the site used, in observation chart. Measurement of pulse rate after administration of specific therapies should be documented in narrative form in progress notes.
- Report abnormal findings to nurse in charge or medical practitioner.

HOME CARE CONSIDERATIONS

- Assess home environment to determine room that will afford quiet environment for auscultating apical rate.

Skills

Steps and rationale

Each skill features the trusted step-by-step approach and rationales to help students understand how and why a skill is performed.

Images

Support learning and demonstrate how to perform techniques

Critical decision points

alert you to critical steps within a skill to ensure quality and safety in client care.

Recording and reporting

provides guidelines for documentation and reporting

Home care considerations

highlight on-going care requirements and patient education for the home setting

...it is common to bathe or shower daily, other cultural groups it is customary to bathe once a week (see Working with diversity).

Condition

...ertain types of physical limitations lack the physical energy and dexterity to care. A patient in traction or a cast or who is line or other device connected to the assistance with hygiene. Illnesses that cause se dexterity...

...uses them when making clinical judgment patient's overall nursing care.

NURSING PROCESS

●●● ASSESSMENT

Nursing assessment is an ongoing process not have assessed all body regions before hygiene; however, the nurse routinely assesses...

Truly individualising hygiene care shows the nurse's respect for the patient's needs. As the nurse learns what the patient expects, this information can be incorporated into goal development (see Planning, below).

●●● NURSING DIAGNOSIS

The nurse's assessment will reveal condition of the skin, oral cavity and sense organs as well as the patient's need for and ability to meet personal hygiene needs. The nurse reviews all data gathered, considers previous patients for cleaning and hydrating inflamed tissues and eliminating sources of irritation will be the focus of nursing Box 34.4... possible nursing diagnoses that patients in need of hygiene care.

●●● PLANNING

During planning, the nurse synthesises information multiple... Critical thinking... that the patient's plan of care integrates all that the nurse knows about the individual patient and key critical thinking elements...

Nursing process provides a consistent framework and critical thinking model for nursing practice within the clinical skills chapters. These sections are clearly identified within the text with using green headings.

●●● EVALUATION

Patient care

Evaluation of hygiene measures occurs both during and after performance of each particular skill. For example, as the nurse bathes a patient, close inspection of the skin reveals whether drainage or other soiling is effectively removed from the skin's surface. Once the bath is complete, the nurse asks the location of clothing distribution centres for basic hygiene supplies or a shelter where bathing facilities are available. Frequently the nurse will consult with social workers or staff in local... to be sure patients have the resources they need to maintain...

interventions. The nurse evaluates the patient's condition against existing therapies and... Throughout evaluation, the nurse cares and gauges whether critical-thinking approaches... all factors when evaluating...

●●● IMPLEMENTATION

Providing hygiene is a very basic but important part of a patient's care. The nurse uses caring practices that help to alleviate the patient's anxiety and promote comfort...

...mellitus, explain how impaired and when poses a risk for poor... Adapt instruction of bathing facilities. Not situation that exists accessible shower or Use what facilities that personal care it safety is ensured, an

<p>KNOWLEDGE</p> <ul style="list-style-type: none"> Anatomy and physiology of integument, oral cavity and sense organs Principles of comfort and safety Communication principles that convey caring Risk factors posing hygiene problems 	<p>ASSESSMENT</p> <ul style="list-style-type: none"> Observe the patient's physical condition and integrity of integument, oral cavity and sense organs Explore any developmental factors influencing the patient's hygiene needs Note the patient's self-care ability and hygiene practices Determine the patient's cultural preferences 	<p>ATTITUDES</p> <ul style="list-style-type: none"> Display curiosity; be thorough in assessing the condition of the patient's tissues; changes may indicate signs of disease Display humility; hygiene care is not the same for all patients; know when to learn more about the patient's preferences
<p>EXPERIENCE</p> <ul style="list-style-type: none"> Previous client responses to planned nursing interventions to promote sensory function 	<p>STANDARDS</p> <ul style="list-style-type: none"> Apply Diabetes Australia's practice standards for foot care Apply guidelines on prevention and management of pressure ulcers 	

stress management are important strategies in promoting your own health and being an effective role model to other staff members and clients.

Also take the time in your early career to critically evaluate the management and clinical styles of your peers. It is often through this reflective process that we develop and cultivate our own working style. Look for favourable role models and adopt their practices. If possible, it is also optimal to identify a mentor, an individual who can assist and support you in your career development.

KEY CONCEPTS

- A positive practice environment is required to develop and sustain an effective and efficient nursing workforce.
- Evidence-based practice should be the platform for effective nursing care.
- Nurses work in a range of settings in independent, dependent and collaborative nursing roles.
- Acknowledging key competencies is an important step in becoming a registered nurse.
- The nursing unit manager plays an important role in establishing a philosophy of nursing practice and monitoring nursing standards.
- Key competencies for the registered nurse relate to professional practice, recognising the professional,

ONLINE RESOURCES

- Australian Nursing and Midwifery Accreditation Council (ANMAC), www.anmac.org.au
- Australian Resource Centre for Healthcare Innovation, www.archi.net.au
- Cancer Australia, canceraustralia.gov.au
- Cancer Society of New Zealand, www.cancernz.org
- Cochrane Collaboration, www.cochrane.org
- Health Research Council of New Zealand, www.hrc.org.nz
- International Council of Nurses, www.icn.ch
- Joanna Briggs Institute, www.joannabriggs.edu.au
- National Health and Medical Research Council, www.nhmrc.gov.au
- National Heart Foundation, www.heartfoundation.org.au
- National Institute for Clinical Studies, www.nhmrc.org.au
- Nursing and Midwifery Board of Australia, www.nursingmidwiferyboard.gov.au
- Nursing Council of New Zealand, www.nursingcouncilnz.org.nz
- Royal College of Nurses Australia, www.rcna.org.au
- Sigma Theta Tau International, www.sigtatau.org

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- Nursing and Midwifery Board of Australia. Online Available at www.nursingmidwiferyboard.gov.au 26 Mar 2012.
- Banner D, MacLeod MLP and others 2010 Role of the nurse in rural and remote primary health care nursing. *International Journal of Nursing Practice* 26(1):40-57

Key concepts provide a summary of each chapters key points to reinforce learning.

References provide an up-to-date list of evidence-based sources and journal articles.



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