Assessment of wounds in adults

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Wound assessment of acute and chronic wounds

'at a glance clinical review article for commissioned series'.

This article will:

- Provide clinical guidance on wound assessment
- Increase knowledge on the stages of wound healing
- Provide an awareness of the complications of wound healing

Wound care

Patients can require wound care at all ages from infants to the elderly and nursing practice can vary from primary or secondary care and long term care institutions. Recent studies have recommended that wound care should be viewed as a specialism which requires clinicians to have specialist training to diagnose and manage wounds appropriately (Guest et al., 2015). However, evidence suggests that this is not current practice. It has been recommended that effective treatment, diagnosis and prevention of wound complications could help reduce treatment costs and reduce the economic burden of wounds on the NHS (Guest et al., 2015). The estimated annual NHS cost for managing wounds after adjustment for comorbidities is £4.5-5.1 billion with two-thirds of this cost incurred in the community (Guest et al., 2015). The findings from this study indicated that approximately 30% of wounds lack a differential diagnosis. This could be indicative of a lack of experience by non-specialist healthcare professionals in the community. The findings of Guest et al., (2015) highlighted the need to change approaches to wound assessment and improve quality of patient care. This has been actioned by the inclusion of wound assessment as a key indicator in the commissioning for

quality and Innovation (CQUIN) framework for 2017-19 (Scott-Thomas, 2017). It is therefore essential for healthcare professional to improve their knowledge and skills in wound assessment.

The skin

Also known as the integumentary system the skin is regarded as the largest organ in the body. There are two main divisions of the skin the outer epidermis and deeper dermis. The epidermis is made up of five layers of cells. The dermis is divided into two main layers (see figure 1: layers of the skin). Editor, please include a diagram of the skin. The functions of the skin are as follows:

- Barrier and immune defence
- Touch and sense
- Excretion
- Thermoregulation
- Nutrient store
- Synthesis of vitamin
- Physical protection for organs and underlying structure
- Water-resistant barrier

(Blows, 2018)

A break in the skin caused by a wound means that these functions and barriers care temporarily lost resulting in a disruption of haemostasis.

Acute and Chronic Wounds

A wound defined by Lazarus et al., (1994) is a ‘disruption of normal anatomical structure and function which results from pathological processes beginning internally or externally to the involved organ.’ Acute wounds are classified as wounds that proceed through an orderly and reparative process to establish sustained anatomical and functional integrity (Lazarue et al., 1994). Chronic wounds are wounds which fail to proceed through an orderly, timely reparative process.

Stages of wound healing

Wound healing is usually described in 4 distinct phases, but descriptive models tend to refer to acute wounds. Chronic wounds do not follow a normal sequence of events and consequently, delays in the healing process are experienced (see figure 2: stages of wound healing).

Haemostasis

Following initial wounding, blood loss is controlled by a complex series of events. The blood and lymphatic vessels undergo vasoconstriction for a short period to create a haemostatic plug (Nguyen et al, 2009). In addition to minimising injury, this process initiates the inflammatory phase.

The inflammatory phase

Once haemostasis has been achieved the blood vessels dilate to allow essential cells into the wound bed. The release of growth factors attracts the migration of phagocytic cells neutrophils and macrophages. These cells primary function is to host immune response and autolysing any bacteria, necrotic, sloughy or dead tissue within the tissue spaces (Nguyen et al., 2009). This process is known as phagocytosis. Because of increased blood flow, there is

an increase in capillary hydrostatic pressure. The classic signs of this are redness and heat. The effectiveness of normal blood osmotic pressure increases capillary permeability which leads to protein-rich fluid leaking onto interstitial tissue spaces. As the fluid moves out of the capillaries the viscosity of the blood increases which slows down the flow. As a result, red blood cells clump together forcing white cells to move towards the endothelium of the vessels and causes swelling and pain. There is an increased demand for nutrients and oxygen in the damaged area increasing the patient metabolic rate which raises core temperature.

The proliferative phase

The proliferation stage overlaps the inflammation stage as it starts to end. The focus of this stage is to rebuild tissue through three separate processes.

Granulation: This leads to the formation of new blood vessels (angiogenesis) which deliver nutrients and oxygen to the healing tissues. Fibroblasts from the surrounding tissue are activated by growth factors released in the inflammatory phase. These replicate and produce a collagen-rich matrix which builds strength and elasticity into the wound. Granulation tissue creates the appearance of a red velvety carpet on the bed of the wound. Unhealthy granulation is characterised by a dark discolouration and bleed easily. This may be an indication of infection and poor vascular supply to the tissue (Peate & Glencross, 2015).

Contraction: The myofibroblasts create a push/pull effect to contract the wound edges.

Epithelisation: The wound is resurfaced by epithelial cells

The maturation phase

The maturation phase involves remodelling of tissue to form scar tissue. This phase can take up to 2 years. Cellular activity reduces and the number of blood vessels in the wound decreases.

Editor, please include drawings on the stages of wound healing

Assessment

A holistic wound assessment is essential to identify causative and contributory factors, support diagnosis and highlight factors which may contribute to delayed wound healing. Wound assessment is about assessing the wound bed, planning appropriate interventions, evaluating treatment and interventions and continual reassessment (Ousey & Cook, 2012). Accurate and timely wound assessment is the underpinning of effective clinical decision making, agreeing on appropriate patient-centred goals and reduced morbidity and costs associated with wound care (Posnett et al., 2009). Conditions such as obesity, cardiovascular disease, anaemia, respiratory disease, diabetes, renal failure, immune disorders and concurrent lifestyle factors such as smoking, mobility, nutrition and stress are important to determine how well the wound will heal (Bendow, 2016).

Assess the patient

Assessment involves gathering and interpreting information about the patient. Confirm the patient's specific requirements and reason for the assessment. A holistic assessment should include specific questions relating to the patients' health and wellbeing. This will provide clinicians with a strong foundation to manage the patients' skin and wound identifying intrinsic and extrinsic factors that may delay wound healing.

- Age
- History and duration of the wound. This should include how the wound was caused, type of wound and if it is affecting aspects of their life (Wilson, 2012). Pressure ulcers should be categorised according to the EPUAP-NPUAP (2009) grading consensus document.

- Past medical history including any previous wounds – this is particularly relevant for leg ulcers. Twelve-month recurrent rates for leg ulcers range between 26% and 69% (NICE, 2020)
- Medical and family background. Include questions about allergies, previous investigations, surgical procedures. Pay attention to family history, cause of death of deceased members and chronic diseases that occur in the family. This will indicate of the presence of inherited or congenital conditions or diseases (Hess, 2019)
- Ask the patient if they have any chronic medical conditions
- Obtain a list of medications, any previous dressings used and how effective these were
- Nutritional status and any supportive therapies or dietary supplements. The Malnutrition Universal Screening Tool (MUST) (BAPEN, 2018) is useful for nutritional screening
- Lifestyle choices, current activities, use of drugs, alcohol, smoking
- Psychological status, stress, anxiety
- Socioeconomic circumstances, employment, occupation
- Consideration of all factors that influence wound healing (see table 1 factors that influence wound healing)

Table 1: Table factors that affect wound healing

Intrinsic	Extrinsic
Oxygenation – Oxygen is essential for cell metabolism and energy production. Hypoxic wounds are at increased risk of infection,	Age – skin loses its elasticity with ageing. Collagen is reduced and blood flow can be restricted due to other chronic conditions.

reduced angiogenesis (the development of new blood vessels), reduced epithelialization, fibroblast (connective tissue cell) proliferation, collagen synthesis and wound contraction (Guo & DiPietro, 2010)	Other factors that delay wound healing in older people are altered inflammatory response, delayed T-cell infiltration and alterations in chemokine production, reduced macrophage phagocytic capacity.
Infection – Once the skin is injured, micro-organisms that are normally on the skin surface access underlying tissue. Infected wounds become 'stuck' in the inflammatory phase. The pathogenic microbes compete with the fibroblasts for nutrients and other resources (Guo & DiPietro, 2010)	Gender – Oestrogen helps to regulate a variety of genes associated with regeneration. Older males and post-menopausal women are at a higher risk of chronic wounds (Oh & Phillips, 2006)
Venous insufficiency - Increased venous pressure; over time leads to a chronic inflammatory response, which can cause the breakdown of tissue resulting in venous leg ulceration (Wounds UK, 2016).	Comorbidities - Conditions such as diabetes, chronic venous insufficiency, peripheral arterial disease and immune deficiency disorders are known to delay the wound healing process. Additional screening for these comorbidities in patients with wounds is recommended. In Diabetes narrowed blood vessels lead to decreased blood flow and oxygen to a wound. Elevated blood sugars decrease red blood cells which carry nutrients to the tissue and lowers the

	efficacy of white blood cells (neutrophils and monocytes to fight infection
Diabetes – prolonged wound hypoxia, dysfunction in fibroblasts and epidermal cells, impaired angiogenesis and neovascularization (natural formation of new blood vessels), decrease host immune resistance and neuropathy (Guo & DiPietro, 2010).	Obesity – reduces the availability of oxygen to the wound. Skin folds can harbour bacteria and damage can be caused by skin to skin friction and increase the risk of pressure ulcer development (Mitchell, 2019). Obesity can also be connected to stress, anxiety and depression.
Peripheral arterial disease – decreased blood flow to the lower extremities and wound. Reducing the amount of oxygen and nutrients to the wound bed.	Medications: steroids, non-steroidal anti-inflammatory drugs, chemotherapy – many medicines interfere with clot formation or platelet function, inflammatory responses and cell proliferation
Temperature – the cooler the wound the longer it will take to heal. Higher temperatures promote vascular and arterial dilation.	Nutrition - ~Nutrition is required to provide adequate support for the increased energy demands during the healing process. Inadequate protein leads to skin fragility, decreased immune function and poor wound healing. The body requires 30-35 Kcal to heal a wound daily and 40 Kcal if the patient is underweight.

Necrotic tissue or foreign bodies – both prolong the inflammatory response and increase the risk of infection	Lifestyle factors: Alcoholism and smoking – Smoking causes vasoconstriction which leads to hypoxia. Neutrophil and monocyte (cells which help prevent infection) activity are reduced and fibroblast proliferation and migration is reduced. Collagen is reduced in smokers which means less tensile wound strength Alcoholism – diminishes host resistance making the body more at risk of infection. Decreases phagocytic function (phagocytosis is a three-stage process in which neutrophils, monocytes and macrophages engulf and destroy microorganisms, other foreign antigens and cell debris). Cytokine (small secreted proteins released by cells that have a specific effect on the interactions and communications between cells) release is suppressed and angiogenesis is reduced.
Oedema – affects the permeability of vascular membranes, inflammation or tissue trauma. Also, fluid can leak into the surrounding tissue.	Immunocompromised conditions: cancer, radiotherapy, AIDS. Chemotherapy and radiation – can slow wound healing. Processes such as cellular

	replication, inflammatory reactions and tissue repair are compromised. Radiation therapy can cause permanent tissue damage.
Dehydration – fluids are required for oxygen profusion, hydration of the wound bed, transportation of nutrients, as a solvent for vitamins, minerals, glucose, amino acids and to transport waste away from cells.	Stress and anxiety – stress delays wound healing but altering the multiple physiological pathways required in the repair processes (Gouin & Kiecolt-Glaser, 2012). Stressors can lead to negative emotional states for example anxiety and depression which have an impact on physiologic processes and behavioural patterns that influence health outcomes (Guo & DiPietro, 2010)
	Pain – Ineffective wound pain management can delay wound healing and contribute to lack of compliance (Frescos, 2011)

Assess the wound

- Confirm the patients identify, explain and discuss the full procedure and obtain consent
- Wash hands and put on aprons and gloves
- Wound site – document the location of the wound on a body map and the care plan

- Is the wound open or closed?
- Wound size – wound size should be measured and documented in the patients' notes on each dressing change. Use visual documentation of tracing and photographs to support this. If, photographing the wound adhere to local guidelines and seek permission from the patient (Ousey & Cook, 2012)
- Wound depth – if necessary take a measurement of the wound depth using a sterile swab. This procedure should only be carried out by qualified practitioners who are familiar with the anatomy and structures in close proximity of the wound.
- The extent of tissue involvement – does the wound involve the epidermis, dermis, fat, fascia, muscle and/or bone?
- Colour and type of wound bed tissue – document the colour of the wound bed and percentage of types of tissue. Colour of tissue is used to distinguish between viable and non-viable tissue. Consider if the presences of devitalized or non-viable tissue is a contributing factor to delayed wound healing (Atkin et al., 2019) (see table 2, wound bed colour and tissue type)

  Table 2: Wound bed colour and tissue type

Type	Colour of tissue
Necrotic	**Black**
Sloughy	**Yellow**
Granulating	**Red**
Epithelialising	**Pink**
Infected	**Green**

- Document the exudate. This should be described by colour, consistency, odour and quantity at on each dressing change. Avoid using subjective measures such as +++

or light, moderate and heavy. A better gauge is to assess the dressing type and wear time (Nichols, 2016). Large amounts of exudate could be an indication of infection and a barrier to wound healing. Consider using the wound exudate continuum framework which allows exudate to be scored a high, medium or low against its viscosity (Gray et al., 2005) (see table 3 Descriptions of exudate and its significance).

Table 3: Descriptions of exudate and its significance (WUWHS, 2007; Wounds UK, 2013; Nichols, 2016)

Type	Consistency	Colour	Significance
Serous	Thin, watery	Clear, straw-coloured	Often considered normal but increased volume may indicate infection (e.g. Staphylococcus aureus). May also be due to fluid from urinary or lymphatic fistula
Fibrinous	Thin, watery	Cloudy	May indicate the presence of fibrin strands which would indicate a response to inflammation
Serosanguineous	Thin, slightly thicker than water	Clear, pink	Presence of red blood cells indicates capillary damage (e.g, after surgery or a traumatic dressing removal)

Sanguineous	Thin, watery	Reddish	Low protein content due to venous or congestive cardiac disease, malnutrition – or enteric or urinary fistula
Purulent	Viscous, sticky	Opaque, milky, yellow or brown, sometimes green	White blood cells, bacteria, slough or from enteric or urinary fistula. Bacterial infection (e.g. Pseudomonas aeruginosa)
Haemopurulent	Viscous	Reddish, milky	Established infection. May contain neutrophils, dying bacteria, inflammatory cells, blood leakage due to dermal capillaries, some bacteria
Haemorrhagic	Viscous	Dark red	Capillaries break down easily and bleed due to infection or trauma

- Assess the odour. A slight odour can be due to wound occlusion and associated with some dressing types. Necrotic and fungating wounds can often be malodorous. Often heavily colonised chronic wounds have malodour problems (Edward-Jones, 2018). The odour of a wound helps to define the presence and type of bacteria and will assist with dressing selection. This should be assessed once the wound has been cleaned (Thomas, 2019). Consider using an odour assessment tool to record at each visit (see table 4).

Table 4: Odour assessment tool (Haughton & Young, 1995)

Strong Odour	Evident on entering the room with dressing intact
Moderate odour	Evident on entering the room with the dressing removed
Slight odour	Evident close to the patient with the dressing removed
No odour	No odour evident with dressing removed

- Assess for infection. In an acute wound infection may be indicated by the presence of swelling, localized heat or pain, erythema (redness), purulent discharge, increased exudate, malodour and pyrexia (Wilson, 2012). Check if any previous swabs have been taken and the results of these. The diagnosis of wound infection should be the combination of clinical judgement and clinical presentation that leads to the wound being swabbed. Use Levine's technique to collect swab cultures from infected wounds (this technique consists of rotating a swab over a 1cm squared area with sufficient pressure to express fluid from within the wound tissue (Cooper, 2010). The swab should be moved across the surface of the wound in a zig-zag motion at the same time as being rotated (Levine et al., 1976) If the wound is dry moisten the tip of the swab with sterile saline (Cooper, 2010). A representative area of the wound should be swabbed if the wound is large then at least 1cm squared should be sampled from the wound bed and wound margin.

- Assess for any foreign bodies present such as dirt or grit these can increase the risk of infection.

- Is there a fistula or sinus present? A fistula is an abnormal connection between two spaces, for example, the skin surface and bowel. A sinus is a tract that ends in a blind cavity. This will influence treatment and management decisions.

- Assess the peri-wound and surrounding skin. The peri-wound should be assessed for colour and temperature. Inflammation and erythema indicate wound infection. Excessive amount of exudate can cause the peri-wound to become macerated and break down (Mitchell & Hill, 2020). Peri-wound moisture associated dermatitis may be an indication that a more absorbent wound dressing or more frequent dressing changes are required. Assess for any localized maceration due to aggressive removal of dressings and dressing adherence this affects the skin barrier by stripping away parts of the epidermis (Mitchell & Hill, 2020).

- Assess the presence or absence of pain. Any type of wound pain may indicate infection, underlying tissue destruction, neuropathy or vascular insufficiency (Hess, 2019) Ask the patient if they are experiencing any pain and does the pain affect quality of life? (NICE, 2020) recommend the use of a valid pain tool for assessment.

- Assess the lower limb for any signs of arterial disease or chronic venous insufficiency (see table 5). This will influence treatment choice referral for further investigations and long-term management (Mitchell & Elbourne, 2019).

Table 5: Signs of venous and arterial disease

Signs of venous disease	Signs of arterial disease
Spider veins	Shiny, hairless skin
Varicose veins	Cold foot or lower limb

Oedema	Intermittent claudication (Pain in the thigh or calf muscles when walking or climbing stairs)
Pigmentation or eczema	Brittle or slow-growing toenails
Lipodermatosclerosis (changes in the skin including harness, change in skin colour swelling) or atrophie blanche (ivory-coloured scars on the legs)	Numbness in legs
Active or healed venous leg ulcer	Arterial leg ulcer

- Assess the patients' knowledge of health and level of health literacy. The educational needs of the patient must be evaluated on an individual basis.
- Ask the patients bathing routines different soaps used and if any products lead to skin irritation. Ask the patient if his/her skin changes with the seasons.

Conclusion

Holistic wound assessment which focuses on patients physical and mental wellbeing is essential to precede effective wound treatment and management and ensuring quality patient care. Thorough, accurate and regular assessment can optimise wound healing and progression in enhance patients quality of life.

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