Wound Care

BELMATT
HEALTHCARE TRAINING

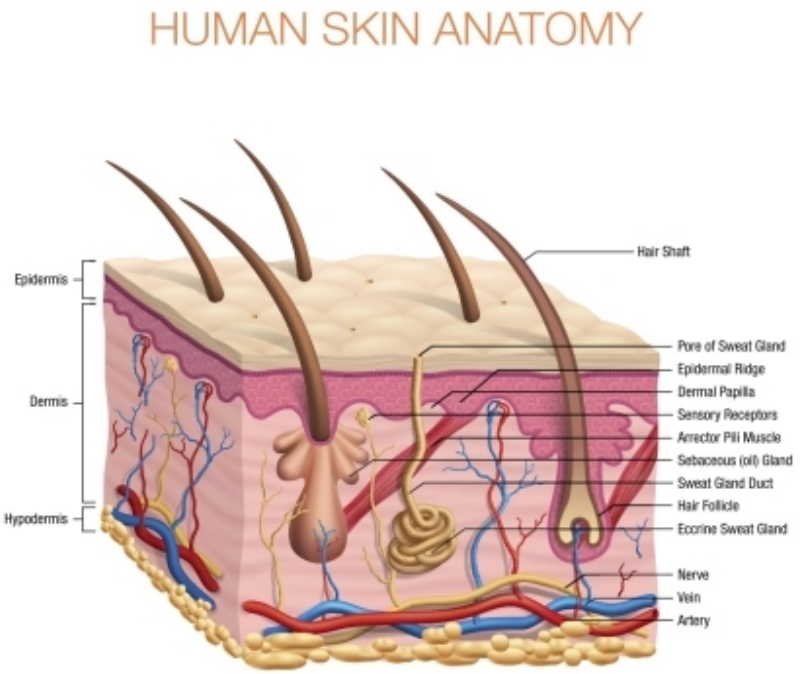
Skin: structure and function

Largest organ of the body

Primary function is protective

Composed of several layers

- Outer Epidermis and Stratum Corneum
- Dermis, containing the capillary network
- Subcutaneous layer (hypodermis, adipose layer)



Skin: structure and function

- Thickness varies from a thin membrane at internal flexures (e.g. elbows), to thicker at the soles of the feet which bear considerable pressures
- Hair follicles, sebaceous glands, and sweat glands pass through the epidermis, but arise from the dermal layer

Classifying wounds

A wound can be defined as:
“A cut or break in the continuity of any tissue, caused by injury or operation”

Wounds can be classified according to their nature:

- Abrasion
- Contusion
- Incision
- Laceration
- Open
- Penetrating
- Puncture
- Septic etc……

Classifying wounds

Wounds may be classified according to the

number of skin layers involved:

Superficial

- Involves only the epidermis

Partial Thickness

- Involves the epidermis and the dermis

Full Thickness

- Involves the epidermis, dermis, fat, fascia and exposes bone

Classification of Healing

- Three basic classifications exist:

Healing by primary intention

- Two opposed surfaces of a clean, incised wound
- (no significant degree of tissue loss) are held together.
- Healing takes place from the internal layers outwards

Healing by secondary Intention

If there is significant tissue loss in the formation of the wound, healing will begin by the production of granulation tissue wound base and walls.

Delayed primary healing

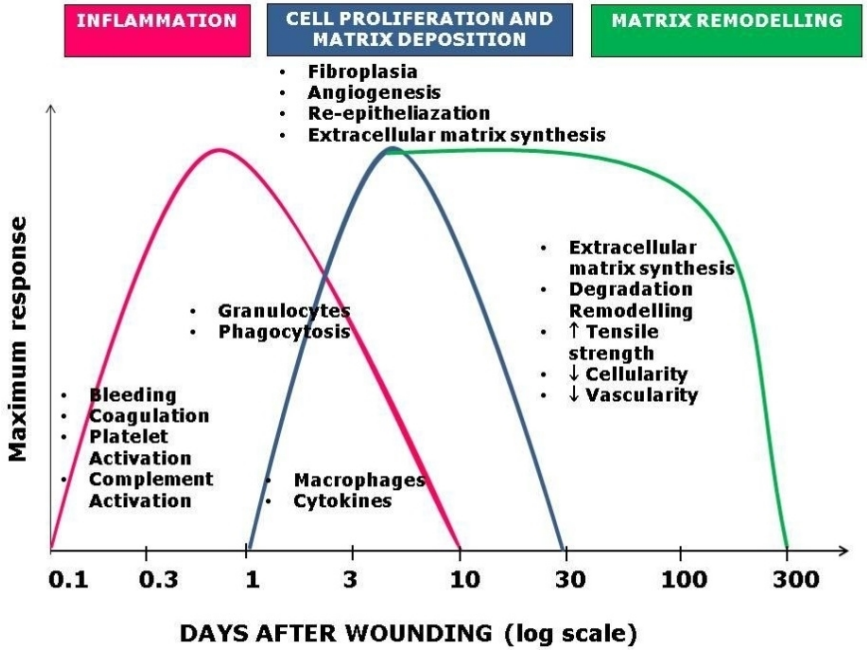
If there is high infection risk – patient is given antibiotics and closure is delayed for a few days e.g. bites

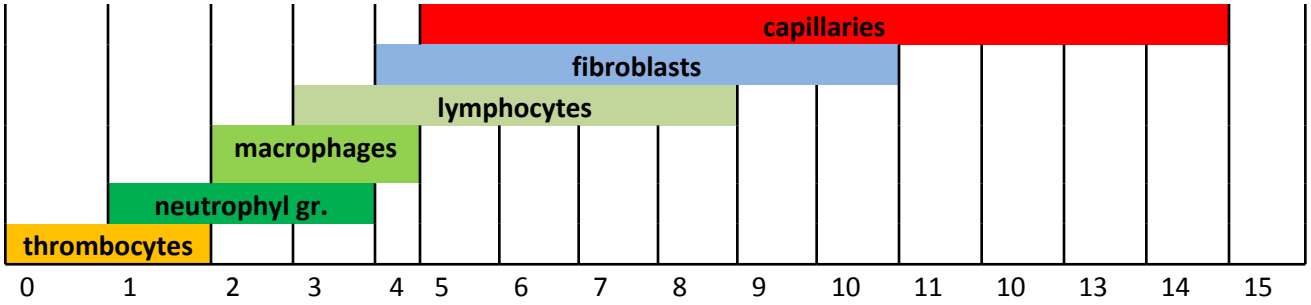
Wound healing

- All wounds heal following a a specific sequence of phases which may overlap
- The process of wound healing depends on the type of tissue which has been damaged and the nature of tissue disruption
- The phases are:
  - Inflammatory phase
  - Proliferative phase
  - Remodelling or maturation phase

The wound healing

- Haemostasis-inflammation
- Granulation-proliferation
- Remodelling





http://www.worldwidewounds.com/2004/august/Enoch/images/enochfig1.jpg

The main steps of the wound healing

1. Hemostasis-inflammation

vasoconstriction
fibrin clot formation

proinflammatory citokines and growth factors releasing

vasodilatation
infiltration PMNs, macrophages

cytokines releasing
→ angiogensis
→ fibroblast activation
→ B- and T-cells activation
→ keratinocytes activation
→ wound contraction

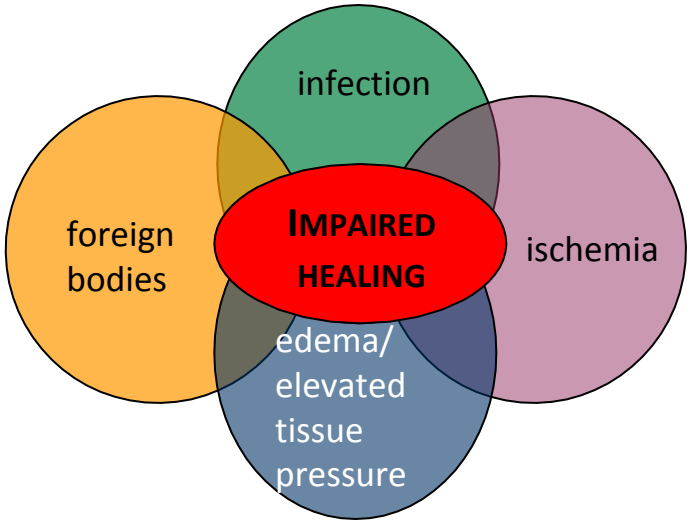
2. Granulation-proliferation

fibroblast migration
collagen deposition
angiogensis
granulation tissue formation
epithelisation
contraction

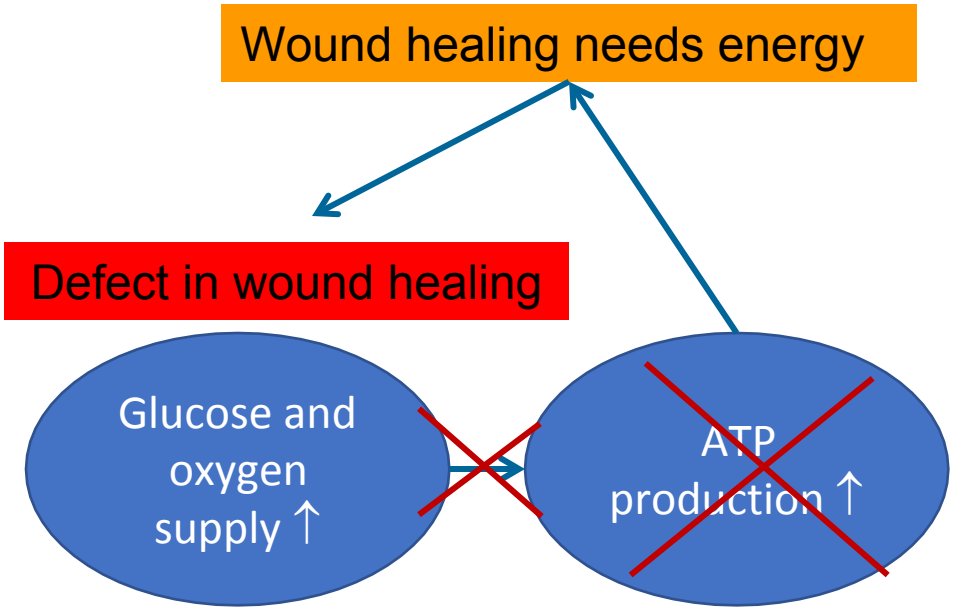
3. Remodelling

regression of many capillaries
physical contraction – myofibroblasts
collagen degeneration and synthetisation
new epithelium
tensile strength – max. 80%

Factors effecting on wound healing LOCAL



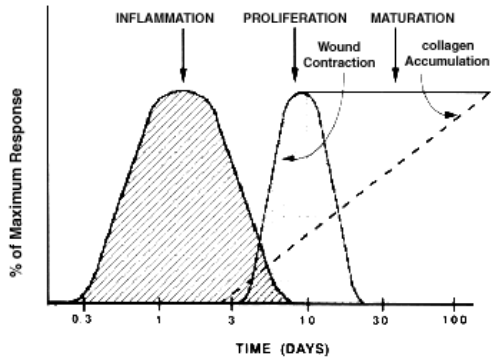
Chronic inflammation
Inflammatory cells ↑
Inflammatory cytokines and IL ↑



Elongation of inflammatory phase

Endotoxin → collagenase stimulation
↓
Collagen degration

Schematic Diagram of the Phases of Wound Healing



The healing process

Day 0 – 5

- The healing response starts at the moment of injury – the clotting cascade is initiated
- This is a protective tissue response to stem blood loss
- The inflammatory phase is characterised by heat, swelling, redness, pain and loss of function at the wound site
- Early (haemostasis)
- Late (phagocytosis)
- This phase is short lived in the absence of infection or contamination

Stages of Wound Healing

Day 3 – 14

Characterised by the formation of granulation tissue in the wound

Granulation tissue consists of a combination of cellular elements including:

Fibroblasts, inflammatory cells, new capillaries embedded in a loose extra-cellular collagen matrix, fibronectin and hyularonic acid

- Collagen first detected at day 3 and rapidly increases for approx. 3 weeks, then more gradually for the next 3 months
- Fibroplasia (fibroblast proliferation and synthetic activity) continues in parallel with re-vascularisation
- Endothelial cells from the side of venules closest to the wound begin to migrate in response to angiogenic stimuli (angiogenesis) forming capillary buds, then loops

Wound Healing

Epithelialisation

The epidermis immediately adjacent to the wound edge begins to thicken within 24hrs after injury

In approximated incised wounds re-epithelialisation is usually complete within 48hrs.

- Can last up to 2 years
- New collagen forms, changing the shape of the wound and increasing the tensile strength
- Scar tissue, however is only ever approx. 50-80% as strong as the original tissue
- During the remodelling process there is a gradual reduction in cellularity and vascularity of the reparative tissue

Wound Healing

Contraction

Only undesirable where it leads to unacceptable tissue distortion and an unsatisfactory cosmetic result

Wound contraction usually begins from day 5 and is complete at approx. day 12 - 15

- Basic concept is that the presence of exudate will provide an environment that stimulates healing
- Exudate contains:
  - Lysosomal enzymes, WBC's, Lymphokines, growth factors……..
- There are clinical studies which have shown that wounds maintained in a moist environment have lower infection rates and heal more quickly

Factors affecting healing

- Immune status
- Blood glucose levels (impaired white cell function)
- Hydration (slows metabolism)
- Nutrition
- Blood albumin levels (‘building blocks’ for repair, colloid osmotic pressure - oedema)
- Oxygen and vascular supply
- Pain (causes vasoconstriction)
- Corticosteroids (depress immune function)

Complications of wound healing
Early complications

Mixed wound infection

- e.g. gangrene
- necrotic tissues
- putrid and anaerobic infection
- a severe clinical picture
- TREATMENT
- aggresive surgical debridement
- effective and specified (antibiotic) therapy

Late complications

Hypertrophic scar
Keloid

- Develop in areas of thick chorium
- Non-hyalinic collagen fibres and fibroblasts
- Confine to the incision line

TREATMENT

- Regress spontaneously

(1-2 yrs)

- Mostly African and Asian population
- Well-defined edge
- Emerging, tough structure
- Overproliferation of collagen fibers in the subcutaneous tissue
- Subjective complains

TREATMENT

- Postoperative radiation
- Corticosteroid + local anaesthetic injection

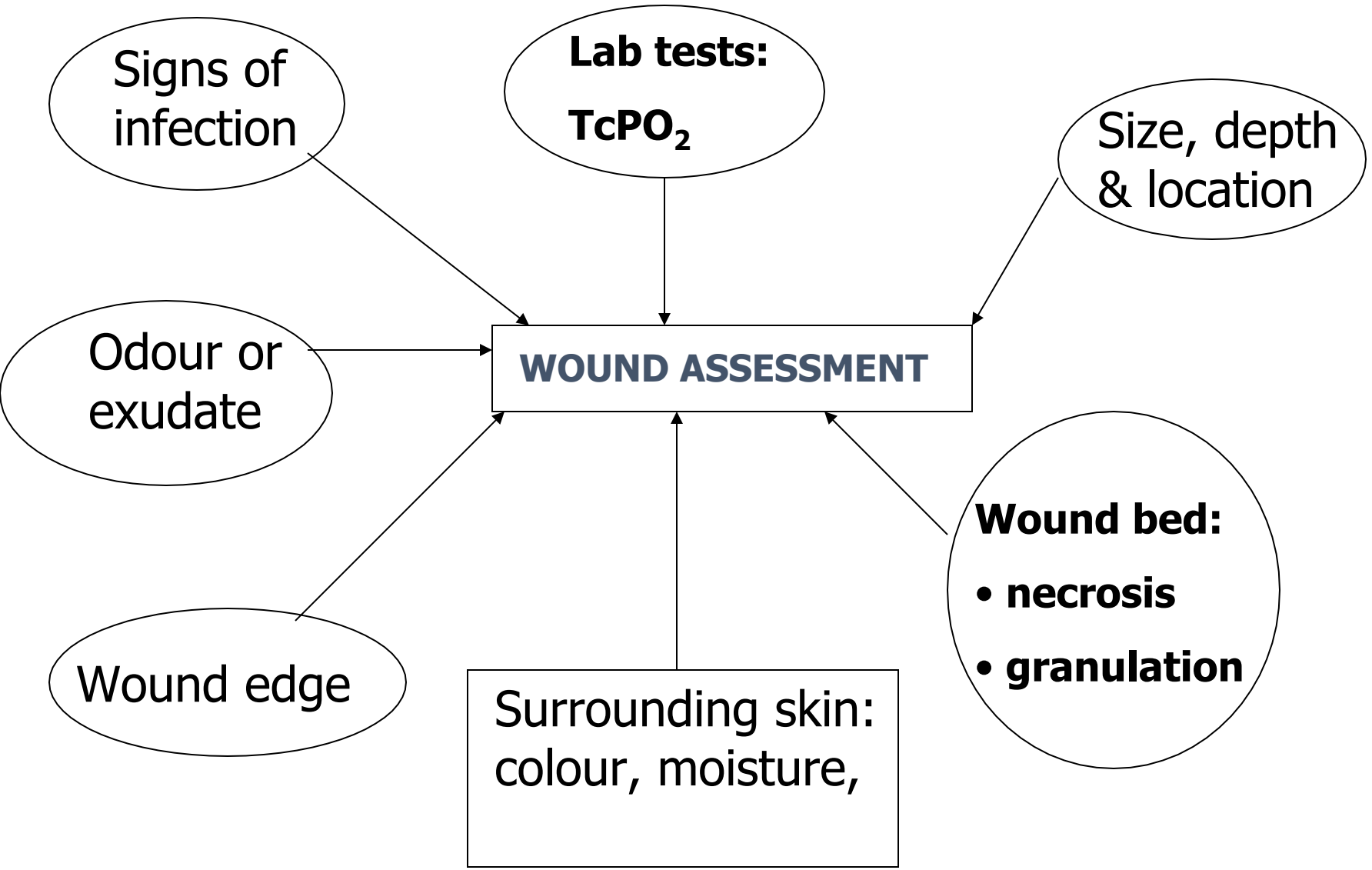
Practical considerations

- The cause of the wound
- Underlying disease processes
  - Current health status
- Medication
- Acute or chronic?
- Attitude to the wound
- Availability of care

Healing requirements

- Identification of the hindrance to healing
- Adequate nutritional status
- Adequate perfusion and oxygenation
- High quality, research-based patient and wound management
- Correction of the underlying cause of the problem
- Disease management

Wound assessment



Grading by tissue Involvement

- Grade I – non-blanchable erythema
- of intact skin. Discoloration of the
- skin, warmth, oedema, induration
- or hardness may also be used as
- indicators in people with dark skin.

- Grade II – partial-thickness skin loss
- involving epidermis, dermis or both.
- The ulcer is superficial and presents
- clinically as an abrasion or blister.

Grade III – full thickness skin loss involving damage or necrosis of subcutaneous tissue that may extend down to but not through underlying fascia

Grade IV – extensive destruction, tissue necrosis or damage to muscle, bone or supporting structures with or without full thickness skin loss.

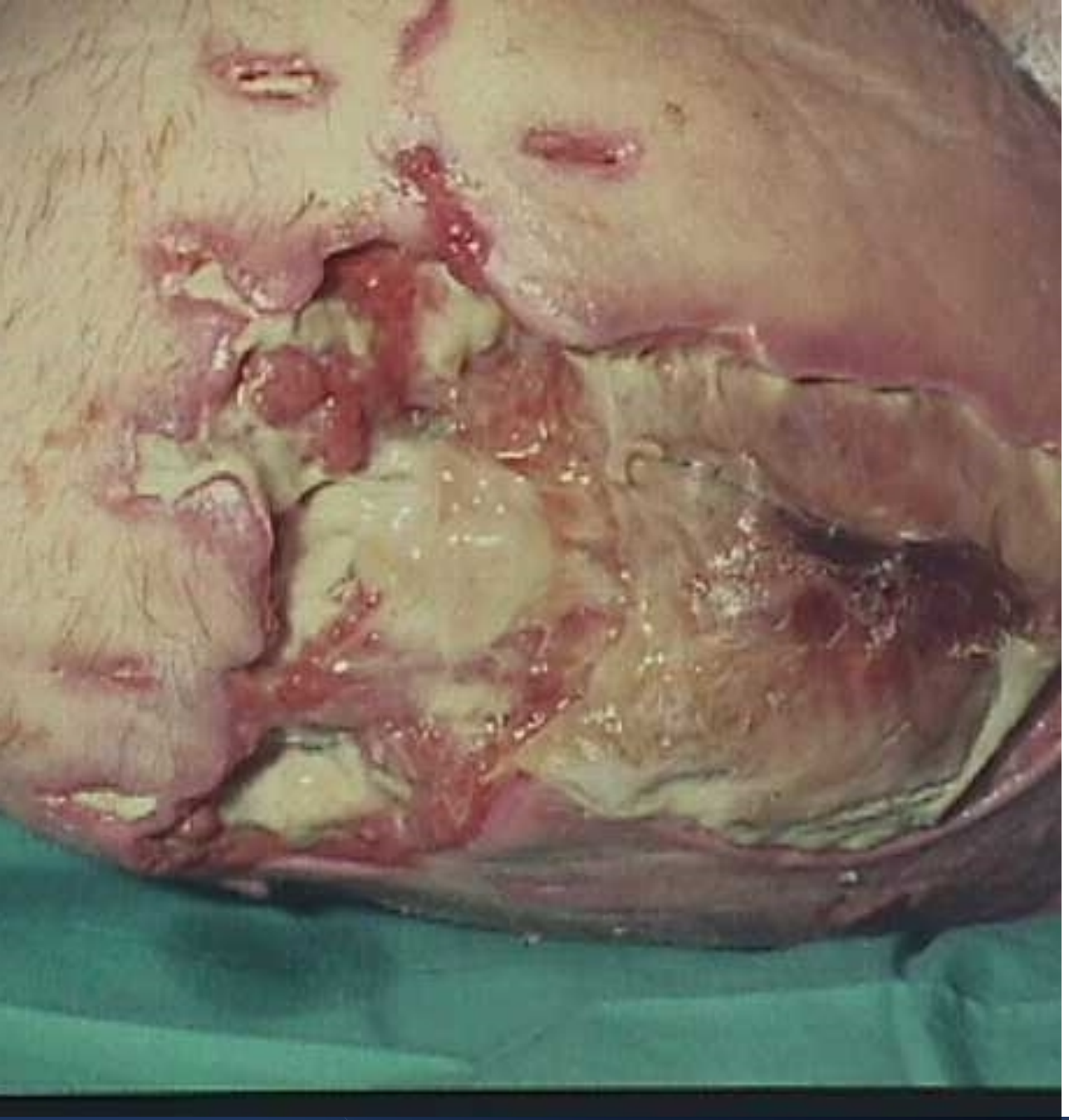
EPUAP 1999

Clinical appearance

Describes the type of material present

In the base of the wound:

- Slough (yellow)
- Necrotic tissue (black)
- Infected tissue (green)
- Granulating tissue (red)
- Epithelialising (pink)



Sloughy wound

- **Aim**: to liquefy slough and aid its removal
- Dead cells accumulated in exudate
- Prepare wound bed for granulation
- Assess wound depth and exudate levels
- Hydrogels, hydrocolloids, alginates and hydrofibre dressings

Sloughy, Yellow Wounds

- The wound is covered or partially covered in soft, moist, dead tissue, mainly yellow in colour but possibly ranging from white through to dark grey or brown. This tissue is composed of dead cells accumulated in exudate and should be removed to reduce the risk of infection.
- The exudate levels must be accurately assessed before choosing the most suitable product.

Aim of management:

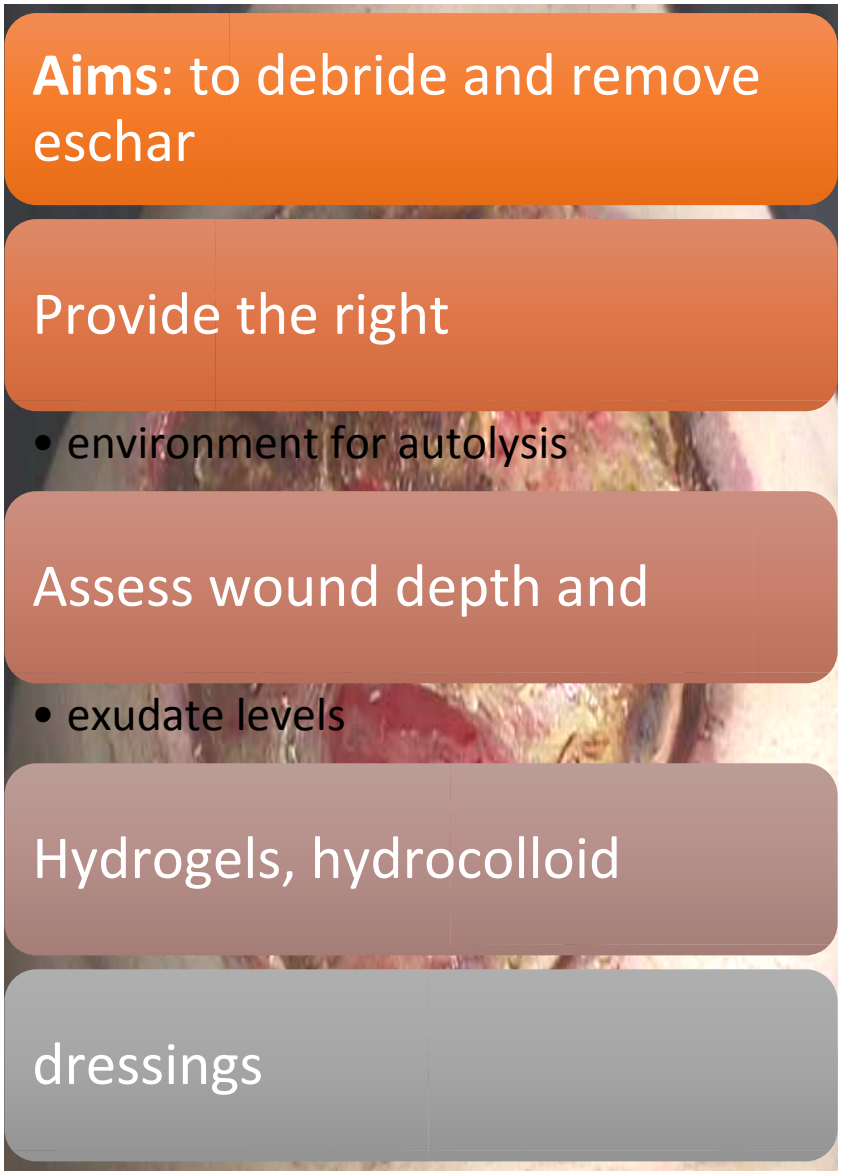
to de-slough, prevent infection.

- Dressings: after determining the exudate levels, hydrogel or hydrocolloid dressings to encourage autolysis should be used.

Dressings for Sloughy wounds

- The wound must be monitored for signs of infection and managed with dressings containing honey (eg Activon) or silver (eg Aquacel AG, Acticoat), and a decision made as to whether systemic antibiotics are required if there is a host response to the wound infection.
- Alternative methods may include larval therapy (biological debridement), in which sterilised maggots (available on prescription) work quickly and selectively to digest necrotic material by secreting bactericidal enzymes. Larval therapy has been demonstrated to be effective against methicillin-resistant *Staphylococcus aureus* and beta-haemolytic streptococcus. Although larval therapy has been widely practised throughout the UK for almost 20 years, it does make many feel squeamish.
- Debrisoft, as endorsed by the National Institute for Health and Clinical Excellence (NICE), is a more recent innovation. It is a pad made of soft, polyester fibres secured and knitted together and cut at a special angle, length and thickness to effectively cleanse and debride skin and the wound bed. The product is quick and simple to use and is effective on acute wounds such as gravel rash and for mechanically removing slough from chronic wounds prior to assessment. The European Wound Management Association has published useful guidance on debridement.

Necrotic wound



Necrotic wounds

- The tissue in the wound is dead and presents as dry, leathery material from the destruction of cells and blood vessels, which may completely cover the wound and make assessment impossible.
- Aim of management: to rehydrate the tissue, stimulate autolysis and prevent infection.
- Dressings: the most commonly used is the amorphous or hydrogel dressing together with a semi-permeable secondary dressing, which is designed to release moisture to soften and ‘dissolve’ dead tissue. Alternatively, hydrocolloid dressings are also designed to create a warm, clean, moist environment in which autolysis will occur, and protect the wound. Autolysis relies on the inherent ability of the body through its enzymes, immune system and moisture to liquefy and eliminate necrotic and sloughy tissue. It is painless and only necrotic tissue or slough is liquefied when appropriate dressings are used; however, it can take a long time and may cause maceration of the wound and wound edges. Alternatively, the wound may be debrided surgically by a suitably qualified clinician, if this can be tolerated.

Infected wound

- **Aims**: reduce exudate,
- odour and promote
- healing
- Clinical signs of infection
- Swab wound – systemic antibiotics
- Treat symptomatically: exudate and odour control
- Change dressings daily

Granulating wound

- **Aims**: support granulation, protect new tissue, keep moist
- Assess depth and exudate levels
- Moist wound surface – non-adherent dressing
- Treat over-granulation
- Hydrocolloids, foams, alginates

Epithelialising wound

- **Aims**: to provide suitable conditions for re-surfacing
- , films, hydrocolloids
- Disturb as little as possible

Wound characteristics

- Exudate
- Odour
- Condition of tissue within the wound
- Condition of the surrounding skin

The surrounding skin

- Eczema
- Psoriasis
- Maceration/excoriation due to exudate or bowel contents
- Self-inflicted damage

Monitoring healing progress

- Wound dimensions
- Photography

- Wound assessment charts
- Frequency of assessment
- Plan of care
- Useful information
- Other methods

Bleeding

Severity of bleeding – the volume of the lost blood and time

Class of haemorrhagic shock				
	I	II	III	IV
Blood loss (mL)	Up to 750	750–1500	1500–2000	> 2000
Blood loss (% blood volume)	Up to 15	15–30	30–40	> 40
Pulse rate (per minute)	< 100	100–120	120–140	> 140
Blood pressure	Normal	Normal	Decreased	Decreased
Pulse pressure (mm Hg)	Normal or increased	Decreased	Decreased	Decreased
Respiratory rate (per minute)	14–20	20–30	30–40	> 35
Urine output (mL/hour)	> 30	20–30	5–15	Negligible
Central nervous system/ mental status	Slightly anxious	Mildly anxious	Anxious, confused	Confused, lethargic

source: http://lifeinthefastlane.com/2012/03/trauma-tribulation-025/

Dressing choice

- What is available?
- How do we choose?
- Does the patient have a say?
- Do we consider cost?
- Are choices restricted by a protocol?
- How do we evaluate?

Dressing choice

- The purpose of
- dressings:
- To aid debridement
- To remove excess exudate
- To control bleeding
- To protect a wound
- To support healing

- **The ideal dressing**
- A dressing that
- creates the optimum
- environment
- Wound debridement
- Wound cleansing
- Alternative therapies

Dressing choice

- Non-adherent wound contact materials
- Films
- Hydrogels
- Hydrofibre dressings
- Hydrocolloids
- Foams
- Alginates
- Miscellaneous

Film Dressing

- Film dressings
- Semi-permeable primary or secondary
- dressings
- Clear polyurethane coated with adhesive
- Conformable, resistant to shear and tear
- Do not absorb exudate
- Examples: Tegaderm, Op-site.

Hydrocolloids

Pectin, gelatin, carboxymethylcellulose and elastomers

- Environment for autolysis to debride sloughy or necrotic wounds
- Occlusive --> hypoxic environment to encourage angiogenesis
- Waterproof
- Different presentations e.g. Urgotul

Foam Dressings

- Advanced polymer technology
- Non-adherent wound contact layer
- Highly absorptive
- Semi-permeable
- Various types
- Adhesive and non-adhesive

Hydrogels

- Sheets or gels
- Starch and polyacrylamide (94% water)
- Low exudate, shallow wounds
- Re-hydrates necrotic tissue
- Secondary dressing needed
- May cause skin maceration

Alginates

- Seaweed dressings
- Form a gel over the wound
- Moderate to high exudate wounds
- Easily removed
- Can cause pain
- Help to debride a wound
- Different presentations

Debridement methods

Hydrogels

Hydrocolloids

Alginates

Hydrofibre dressings

Surgical

Wet to dry dressings

Whirlpool

Overview of various wounds and appropriate clinical dressings.

Variety	Description	Characteristics	Appropriate dressing
Diabetic foot ulcer	Caused by neuropathy and lower extremity vascular disease	Lack of supply of oxygen and blood in the wound bed; long-term stagnation in the inflammatory phase	Silver ion foam dressing, hydrofiber dressing, UrgoStart Contact dressing, Mepilex® Lite Dressing, hyaluronic acid, Biatain® Non-adhesive Dressing
Pressure injury	Caused by stress and tissue tolerance	A local injury to the skin or subcutaneous soft tissue occurring at the site of the bone prominence or the compression of the medical device	Foam dressing, hydrocolloids dressing, multi-layered soft silicone foam dressings, polyurethane film, Mepilex® Ag dressing, polyurethane foam dressing
Burn and scald	Tissue damage caused by heat	A large amount of exudate; prone to infection; severe cases can injure subcutaneous and submucosal tissues	Moist occlusive dressing (AQUACEL® Ag), ACTICOAT™ with nano silver
Chronic venous leg ulcer	Caused by high pressure of the blood in the leg veins	Lack of blood supply to the wound; a large amount of necrotic tissue and abnormal exudate on the surface of the ulcer, accompanied by multiple bacterial infections	Alginate dressing, AQUACEL® Ag dressing, Urgotul® Silver dressing, ALLEVYN® Hydrocellular foam dressings, Mepilex® foam dressing
Radiation dermatitis	Local skin lesions caused by radiation	Slow cell proliferation; decreased cytokine activity; decreased collagen content	Film dressing (Airwall), silver-containing hydrofiber, film dressing (3M™ Cavilon® No Sting Barrier Film), Mepilex®Lite dressing
Split-thickness skin grafting	None	Hypertrophic scars; hypopigmentation; hyperpigmentation	Polyurethane foam (ALLEVYN™), calcium alginate (Kaltostat®), AQUACEL® Ag (Convatec), Alginate Silver (Coloplast)

Tissue Viability

- Documenting wound care
- Potential for litigation
- Good staff communication
- Continuity of care
- To assess progress or deterioration
- Should be factual not subjective
- Wound assessment charts

Contraindications to Use of Skin Adhesives

- Jagged or stellate lacerations
- Bites, punctures or crush wounds
- Contaminated wounds
- Mucosal surfacesAxillae and perineum (high-moisture areas
-)Hands, feet and joints (unless kept dry and immobilized)

Application of Glue

- 1. Apply topical anesthetic as needed
- .2. Prepare wound with antiseptic
- .3. Appose wound edges
- .4. Crush Dermabond vial and invert.
- 5. Gently brush adhesive over laceration
- 6. Avoid pushing adhesive into wound.
- 7. Apply three layers of adhesive.

Steristrips

- Advantages of Adhesive vs. Sutures
- Maximum bonding strength at two and one-half minutesEquivalent in strength to healed tissue at seven days post repairCan be applied using only a topical anesthetic, no needlesFaster repair timeBetter acceptance by patientsWater-resistant coveringDoes not require removal of sutures

Steri-strips

- Sterile adhesive tapes
- Available in different widths
- Frequently used with subcuticular sutures
- Used following staple or suture removal
- Can be used for delayed closure

Staples

- Rapid closure of wound
- Easy to apply
- Evert tissue when placed properly

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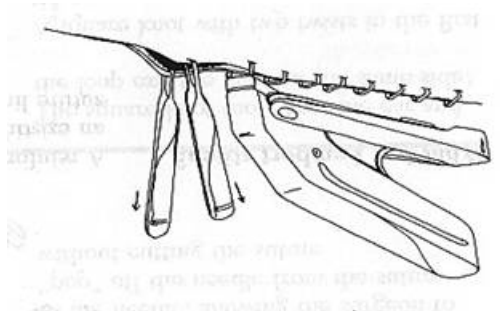

Conclusion

- Wound care is becoming more complex as the range of wounds increases
- Correction of the underlying causative factors is essential
- Key principles must be adhered to with regard to basic patient and wound assessment

References

- https://www.ncbi.nlm.nih.gov/pmc/articles/PMC7096556/