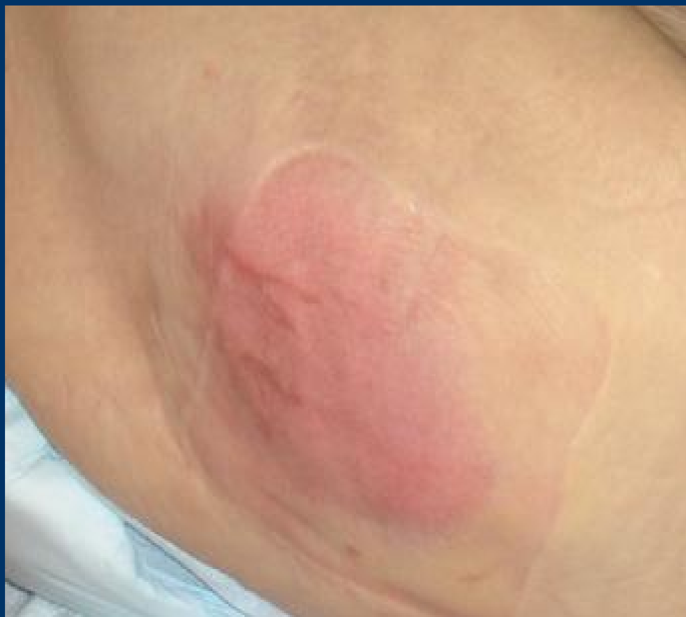
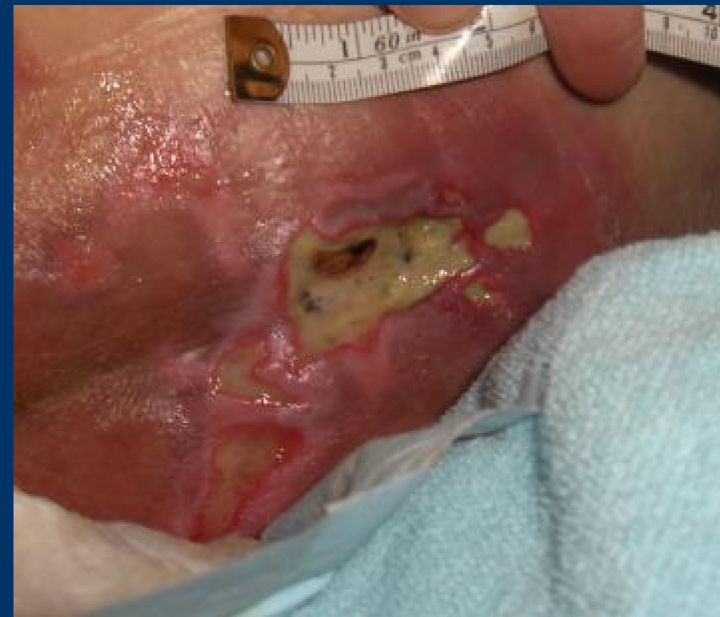
The Shear Friction of pressure ulceration in aged care





Mr. Tal Ellis – WoundHeal Australia, HWIG conference 2007

Introduction

- In Australia it is estimated that about 60,000 people have pressure ulcers (Porter& Cooter, 1999) (figures vary in the literature)
- About $350 million dollars per year are spent on caring for people with pressure ulcers (Lewin et al, 2003)
- Despite advances in health care and medical technology these wounds continue to occur amongst the elderly, the immobile, people suffering denervation or severe illness

Topic of Discussion

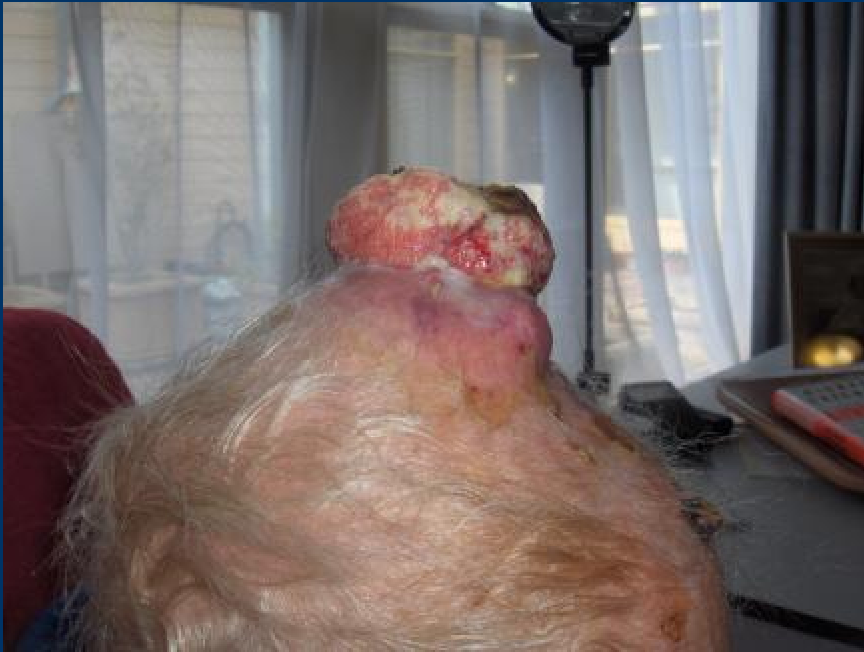
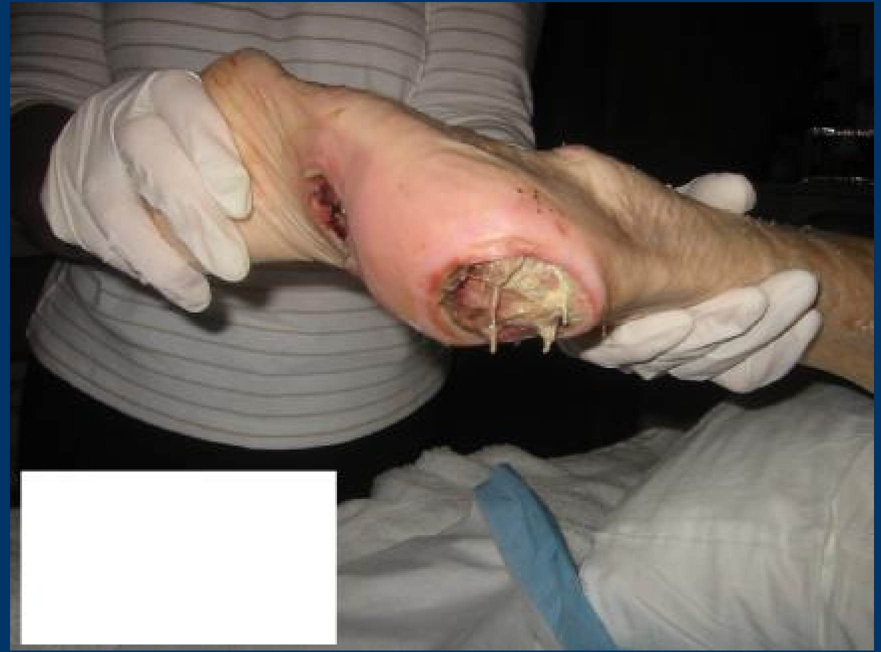
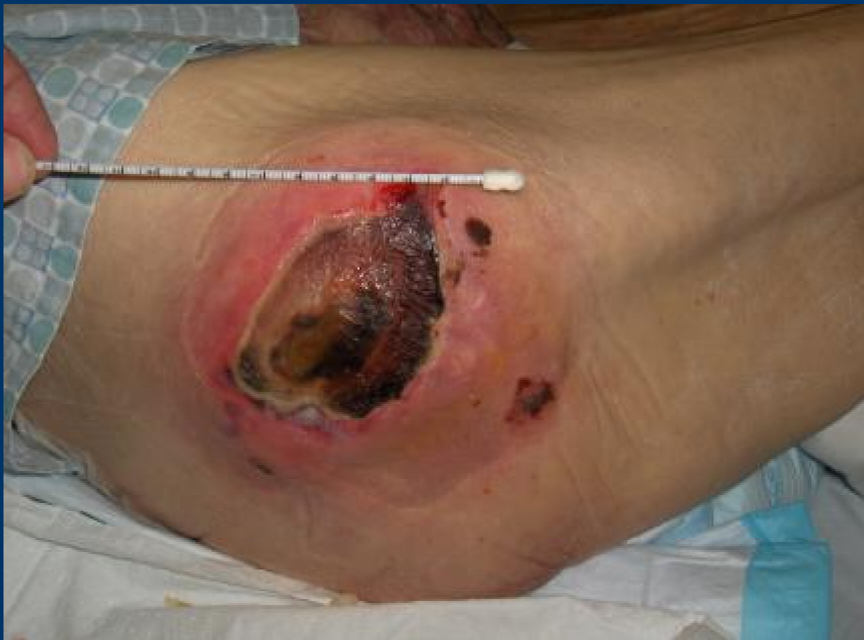
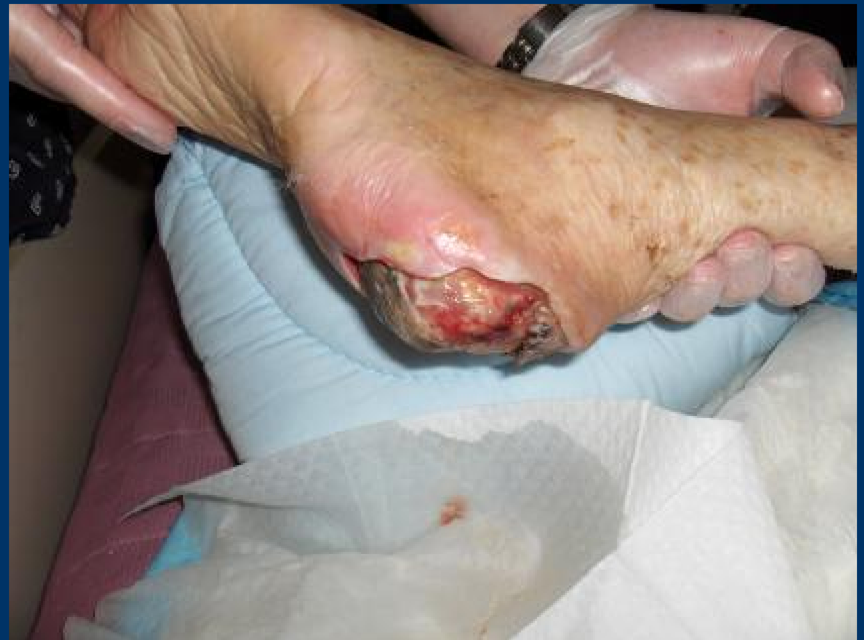
- Pressure ulcers in aged care – PRIME
- Historical factors underpinning our understanding of Pressure Ulcers
- Pathophysiological factors
- Shear, pressure and tissue

Wounds as a health issue in 21st Century…

- The number of older people in Australian society is growing
- As of the 4th of October, 2006, Australia's population was estimated to be: 20,675,018 (ABS Austats: Population Clock).
- Of this population, approximately 2,700,000 or about 13% of people are estimated to be aged over 65 years (Australian Health and Ageing System – The Concise Factbook – June, 2005).
- By 2041 this figure is expected to rise to 5.5million representing 22% of the total population (ABS Austats: Population Projections: Projections of the aged population).
- Approximately 250,000 older Australians currently live in Residential Aged Care (Hon C. Pyne, Advertiser, March, 2007)

Wounds as a health issue in 21st Century…

- One research report (Sussman, 2003) indicates that 25% of people in Residential Aged Care Facilities (RACF's) have a wound
- Based on 2007 figures (Hon C. Pyne) this would equate to about 62,000 older Australians in RACF's who have a wound at any one time…
- Without accounting for potential change and using current population predictions this figure rises to more than 80,000 in 2041 (ABS Austats: Population Projections: Projections of the aged population)

Cost modelling – Residential Aged Care

- A review of the literature for the last 10 years reveals a number of costing models for wound management and in particular, Pressure Ulcers

- As stated, Australia-wide figures suggest that the cost is around 350m p/a,

- Figure based largely on costs in the acute sector where Graves (2004) work indicates that PU's extend hospital stay by 4.3 days

- The incidence and prevalence of PU's in RACF's has not been widely studied/published in Australia and therefore costs are unlikely to have been included within the currently published literature

PRIME study (Santamaria et al, 2005) initially showed
a Pressure Ulcer prevalence of 26% in High Care
Nursing Homes = 20,000 = $20,000,000

Pressure ulcers in aged care - status…

- Majority of the PRIME study PU's were stage 1 or 2 – no data extracted on conversion from S1 to S3 or 4
- Whilst % is not known there is no doubt that some wounds do worsen
- The skin of older people is especially vulnerable - when forces combine the risk of wounding increases
- What role does shear play in worsening S1 or 2 wounds in aged care?

Historical aspects

The occurrence of pressure ulcers has long been recognised though varying explanations have come and gone in prominence

Historical aspects

- During the 18th and 19th centuries pressure ulceration was seen in the opium dens prevalent throughout Europe
- This eventually led to the term "Hippie"

Historical aspects

- 1868 – Jean Martin Charcot
  - **Published a report on the development of pressure ulcers immediately following spinal cord injury (Meehan, 2000)**
  - **Theorised that occurrence was due to loss of nerve supply causing decrease in tissue nutrition – failed to take account of the influencing mechanical factors**

Historical aspects

- 1930: Landis – described capillary closing pressure
  - 32mmHg at arteriolar end – 15mmHg at venular end of capillary (Bates-Jensen, 1998)
- Second World War marked a change in our understanding of how factors interplay to create Pressure ulcers (Krasner, 1997)
- 1950's – mechanical forces routinely recognised for their role in the development of pressure ulcers (Krasner, 1997)

Definition of Pressure Ulcer

- Summarising from the literature:
- A localised area of tissue necrosis resulting from compression of tissue between a bony prominence and an external surface for a period of time
- Definitions limited in that they do not really account for the sum of factors that lead to the development of pressure ulcers

Causative Factors

- Pressure ulceration is the end result of the interplay between a variety of factors
- These factors can be divided in to 2 major categories:
  - **Extrinsic**
  - **Intrinsic**

Extrinsic factors

- **Pressure**

Extrinsic factors

- **Friction –** force exerted when one surface is rubbed against another

Extrinsic factors

- Moisture – disrupts or changes integrity of skin; overcomes protective quality of keratin

Extrinsic factors

- **Shear force –** tissue moving in opposite directions!

Forces combine…

- Too simplistic to describe pressure ulcers as resulting from prolonged pressure alone
- NB: if intensity is very high, then duration need only be short; if intensity of pressure is low but constantly applied over a prolonged period then tissue damage will occur
- If pressure, shear and friction combine the tissue damage can be more severe and deeper
- Evidence needed to quantify additive effects…

Shear force and skin

- “Shear: An action or stress resulting from applied forces which causes or tends to cause two contiguous internal parts of the body to deform in the transverse plane (i.e., shear strain)”.

(EPUAP combined committee working doc, April 2006;http://www.epuap.org/review7_2/page6.html)

The literature…

- Bader DL, Barnhill RL, Ryan TJ (1986) examined the effect of surface forces on skin capillaries and discovered that relatively little shear force needed to be applied in order to completely close capillaries

- They found that if the shear force was maintained or repeated then tissue damage and eventual necrosis occurred

- M. Zhang and VC. Roberts (1993) also examined the effect of external shear forces applied to skin and found that skin blood flow was significantly reduced in line with increased force application

- In practice this means that a person suffering illness and sitting in bed or seated at an angle in a chair (or similar apparatus) will be at increased risk of capillary closure when shear forces are applied to the skin

Pressure, shear and tissue…

- Pressure application to tissue tends to be relatively gradual whereas shearing is traumatic and instant.

- For example when a person sits up in bed the skin against the mattress tends to remain static whilst the internal tissue below skin moves downward with gravity, rolling the capillary bed between the skin and bone.

- The shearing force created under this circumstance is significant and if sustained will lead to deep tissue damage.

Pressure, shear and tissue…

- Certain types of Pressure Ulcers are more likely to be caused by shear force than others

- The sacrum is most vulnerable to shear force when compared with other body areas

- When sitting (semi-upright in bed) or slumped in a chair the sacrum is subject to a great deal of shear force – far greater than is necessary to occlude the capillaries of this tissue region

- Chair surfaces and bed sheets tend to “grip” the skin, holding it in one place whilst the weight of the body is forced downward by gravity

Pressure, shear and tissue…

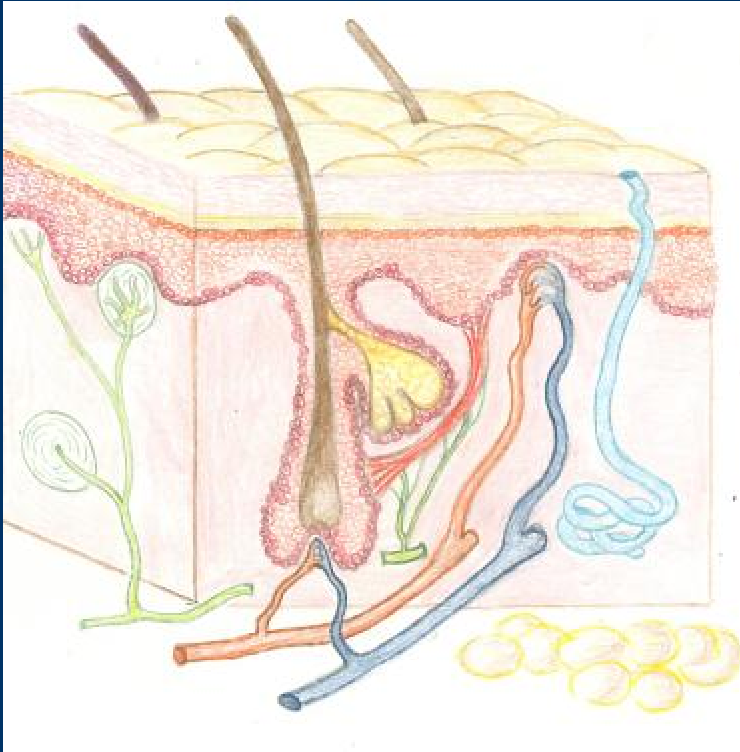
- In patients who have suffered weight loss, are dehydrated or immobile, the sacrum is particularly vulnerable

- Whilst turning or *re-positioning* can help to alleviate effects of the time shear force is applied to the sacrum, any period of time in a semi-seated position will exert enough force to close capillaries and cause damage in the vulnerable person

The position most “fowler”…

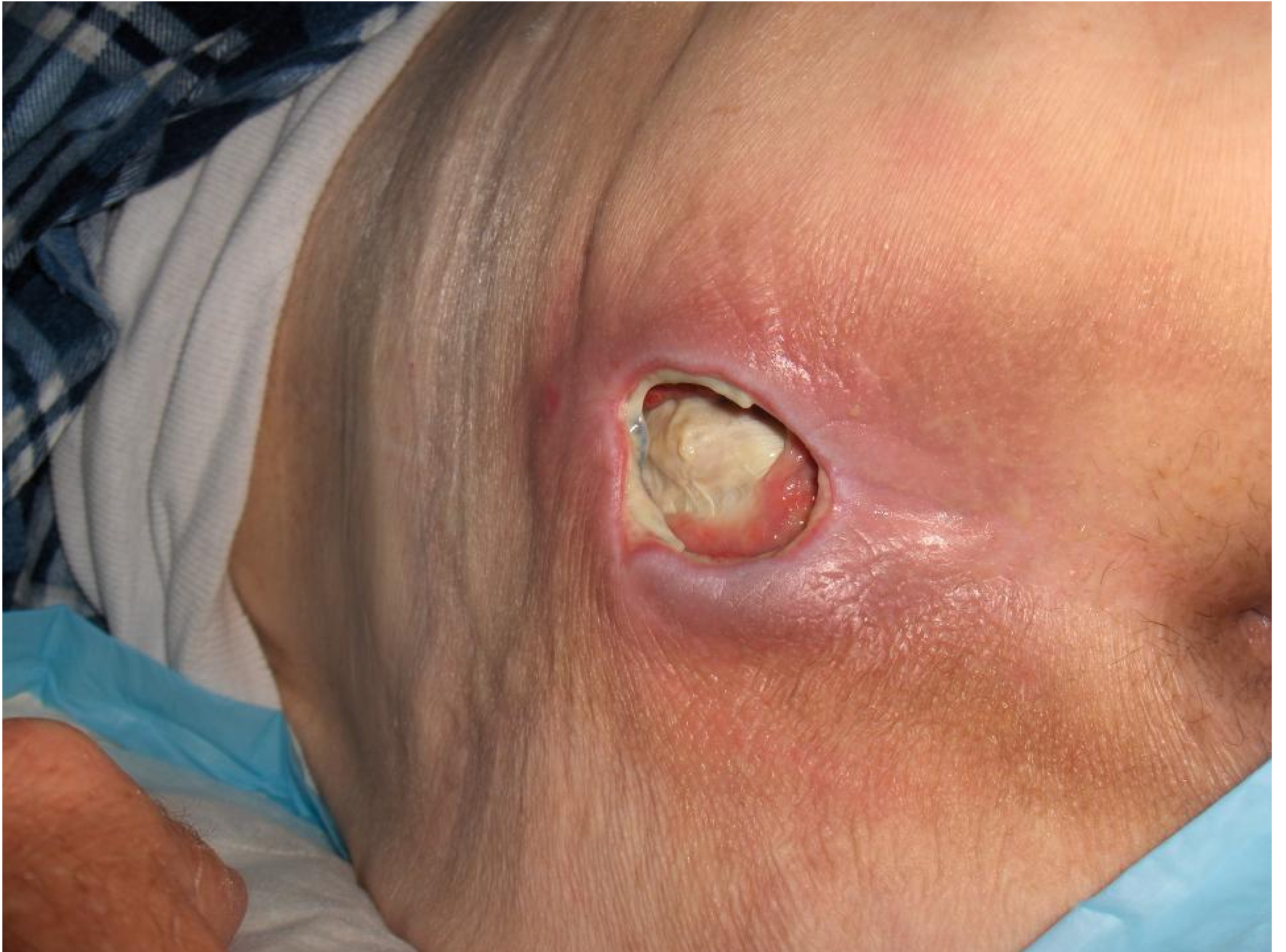
Picture courtesy of Shear Comfort

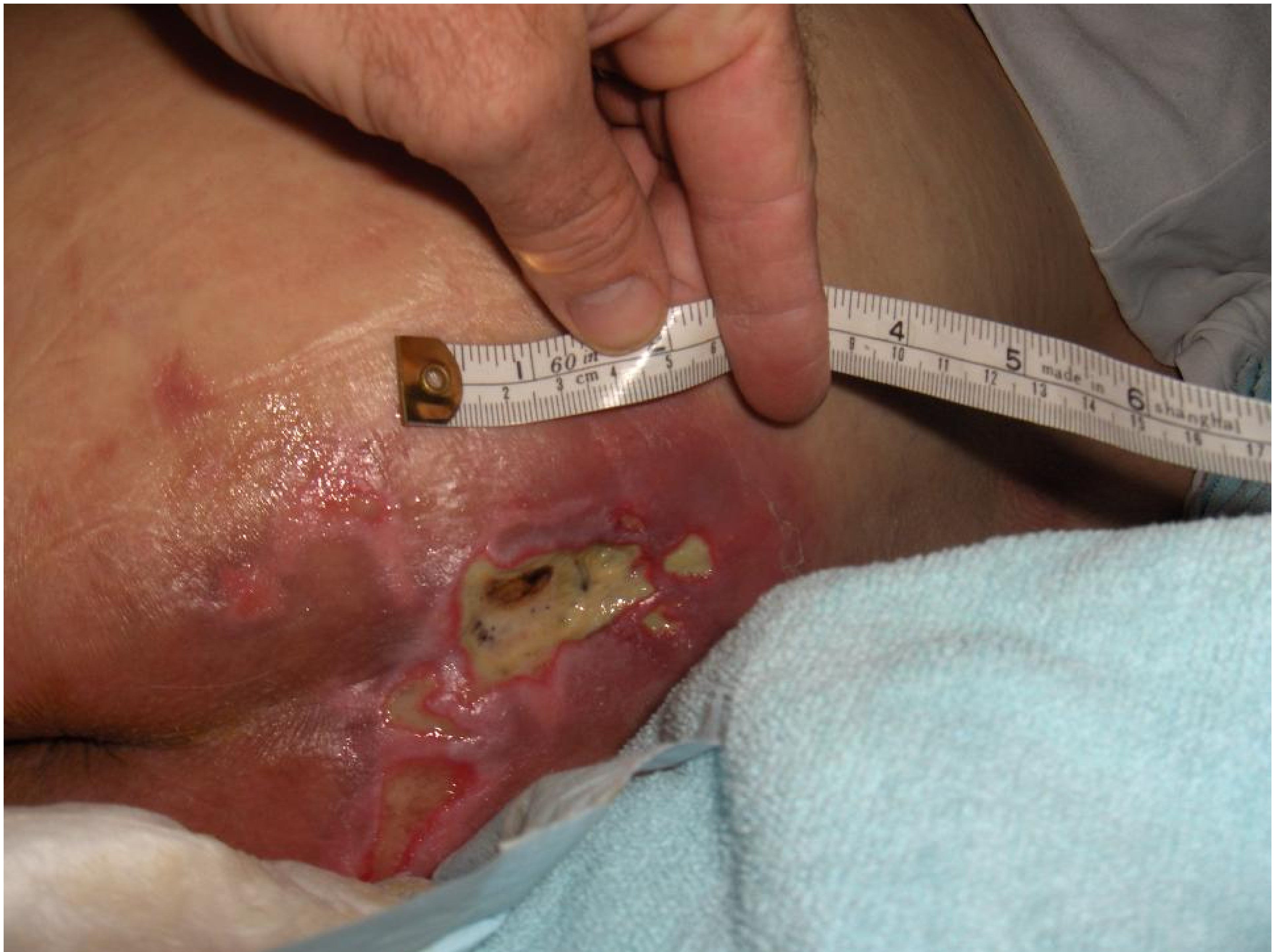
- Patients who are assessed as being at risk for Pressure Ulceration should not be placed in the semi-seated position for any longer than is absolutely necessary and at the very least, should be seated on an appropriate surface at all times.



Normal skin and subcutaneous tissue

Compressed skin and subcutaneous tissue

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made in shanghai

Shear force and severity

- Sato, M, Sugama, J (2006) “Prognosis of stage 1 pressure ulcers and related factors” International Wound Journal 3:4 December pgs 355-362

- Study examined 31 Pressure Ulcers (S1) on 30 patients and determined prognostic characteristics

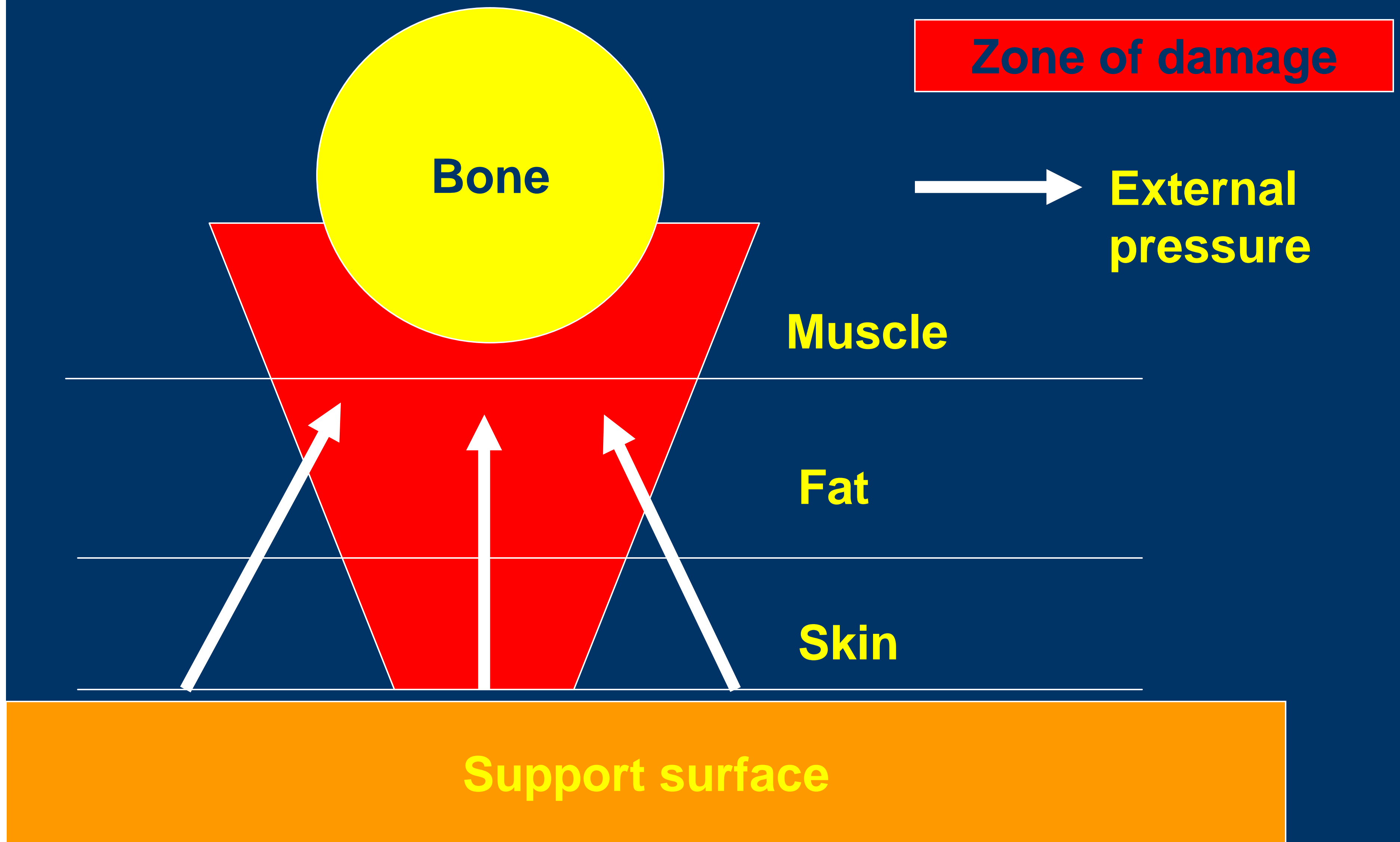
Shear force and severity

- They determined four key characteristics that were prognostic for Deep Tissue Injury (DTI)
  - Double erythema
  - Non blanchable erythema across whole area
  - Erythema away from bony prominence
  - Expanding erythema in 24 hrs post observation

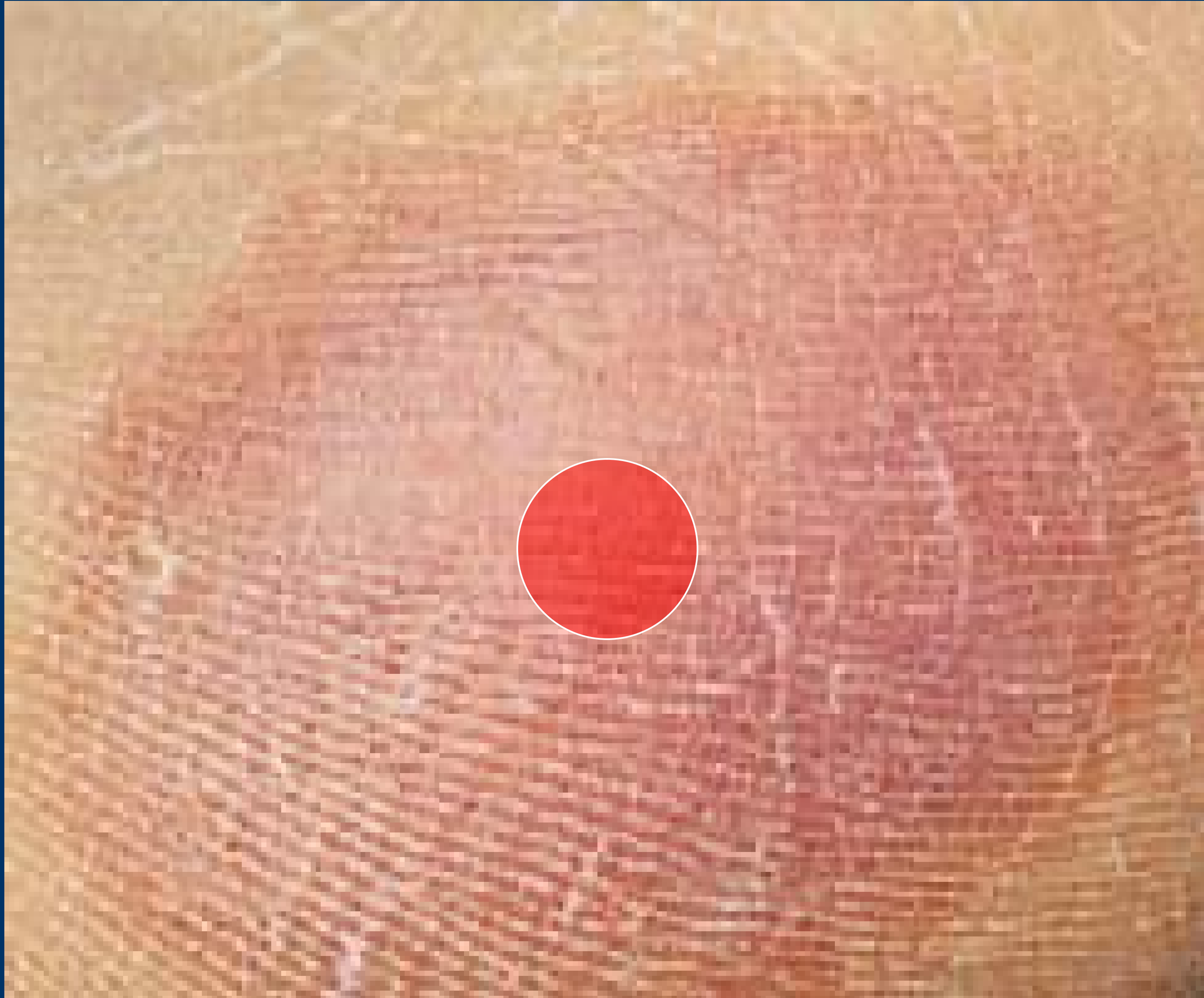
Shear force and severity

- Erythema away from bony prominence:
  - Indicates additional forces contributing to wound
  - Pressure alone results in erythema over the prominence
  - Erythema away from prominence indicates that tissue has moved

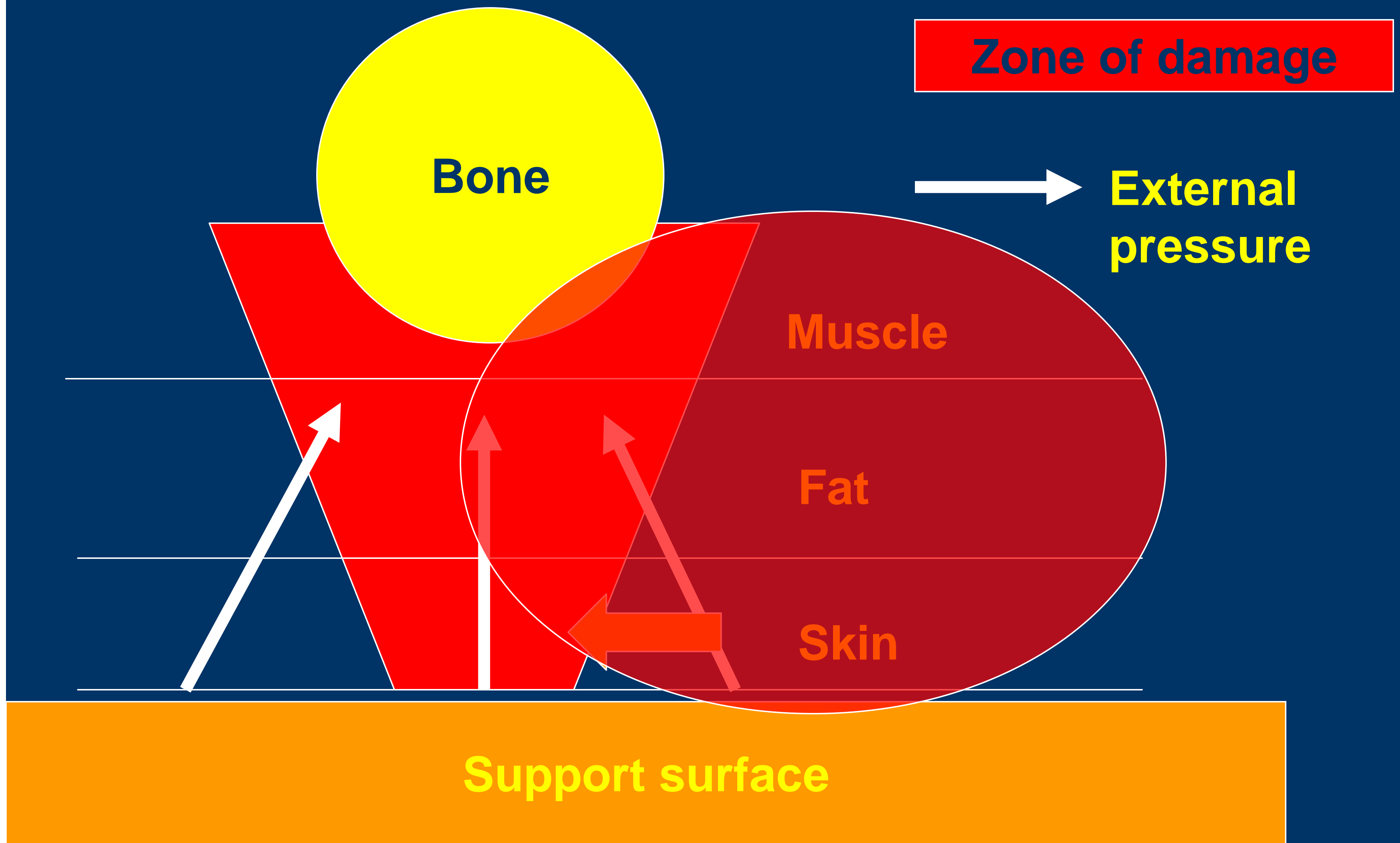
Pressure Gradient at bony prominence



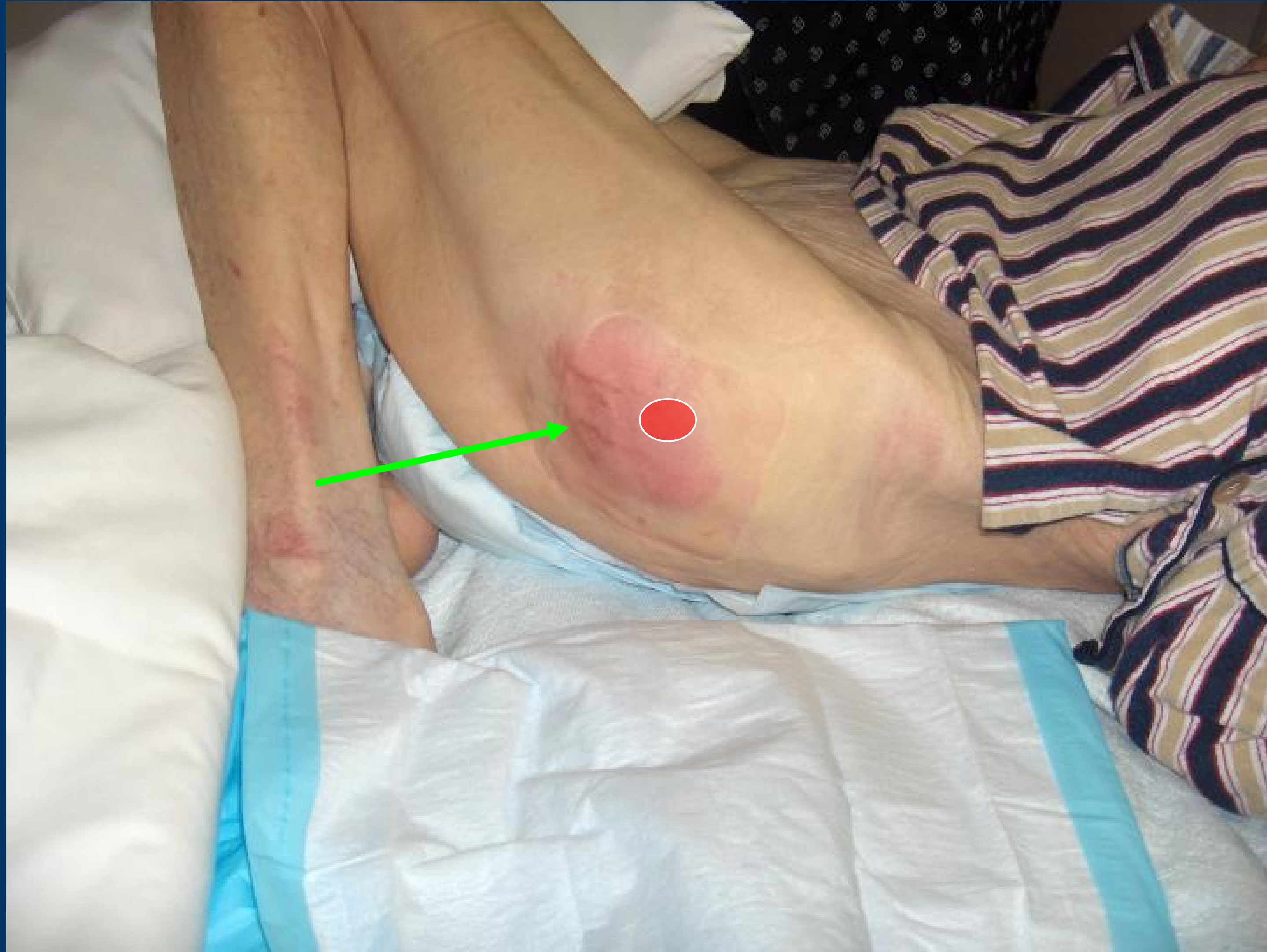
Stage 1 PU –
erythema over prominence



Pressure, shearing and bony prominence

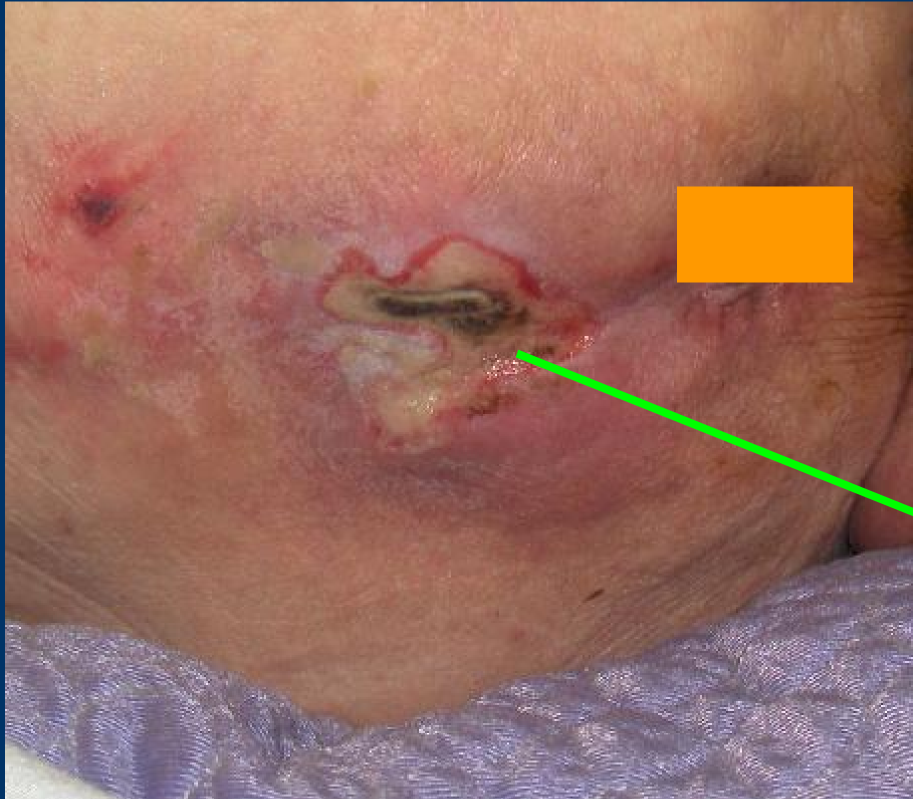


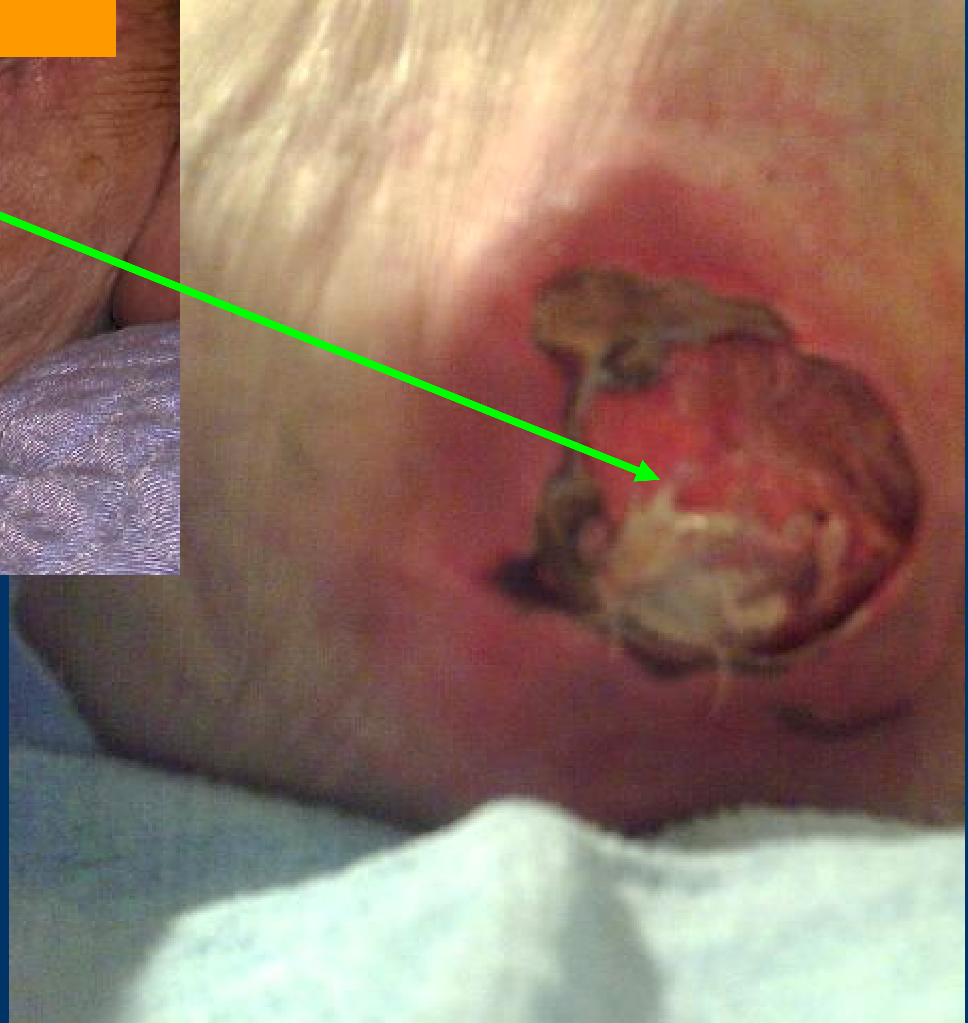
Stage 1 PU –
erythema away from bony prominence



Interpretation…

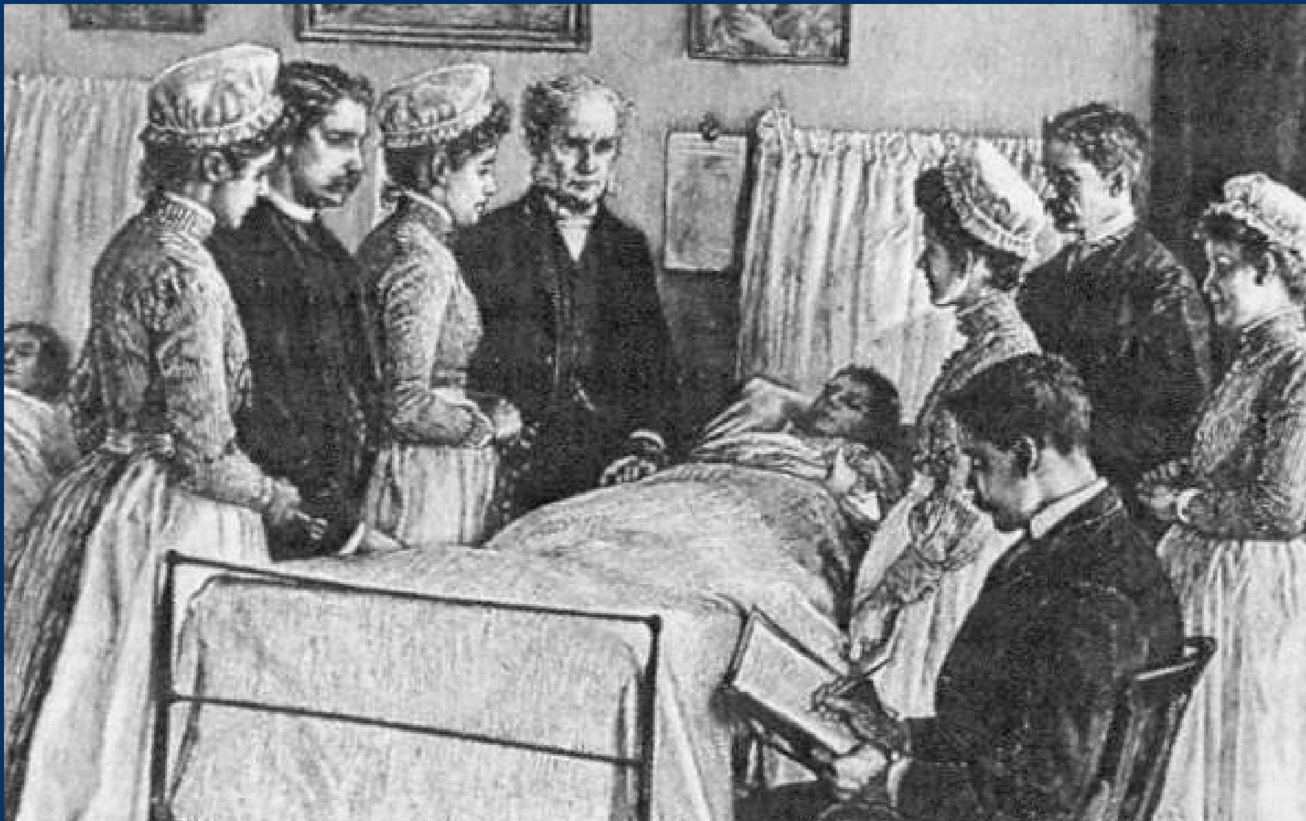
- Force is necessary to shift tissue that is naturally over a bony prominence
- This force is SHEARING
- Capillary compression: serious interruption to blood flow
- Additive force to the pressure already being applied to tissue – amplifies damage





Turning v repositioning

- 2 hourly turns are poorly supported in literature and practice – still widely practiced in RACF's



Turning v repositioning

- Each person must be individually assessed
- Repositioning model needs to be adopted: research
- Re-position the person and check every few minutes to see how long the redness lasts – it should resolve within 5 minutes
- If it doesn't then you need to reposition more frequently and/or get a different surface for support

Support Surfaces

- Pressure relieving v Pressure reducing
- Pressure relieving: active surfaces eg alternating air-loss mattresses
- Pressure reducing: load spreading, reducing pressure over specific points

Conclusion

- The number of pressure ulcers occurring in RACF's demands that HCP's understand the impact of all factors in their development
- Whilst shear force is recognised in risk assessment tools more emphasis needs to be afforded the effect of this force on tissue
- PU severity is increased and models are being developed to facilitate assessment – incorporate in to practice

Ackowledgements

- Hunter Wound Interest Group
- Huntleigh Health Care
- Smith and Nephew

- The people we care for…

The latest in pressure
and shear reduction!