“Pressure – breakdown, staging and redistribution”

Jassmine S. Safier, BSN, RN, CMSRN, CFCN

Rick Murdoch PT CWS FACCWS

Objectives

- Describe the pathophysiology of pressure ulcer formation.
- Identify patients at risk for skin breakdown. Low, Moderate, or High risk.
- Describe the methods and goals of debridement
- Describe pressure mapping.
- Describe various methods of pressure redistribution.
- Outline sitting guidelines
- Understand the Algorithm for pressure ulcer management.

Factors Influencing Ulcer Formation

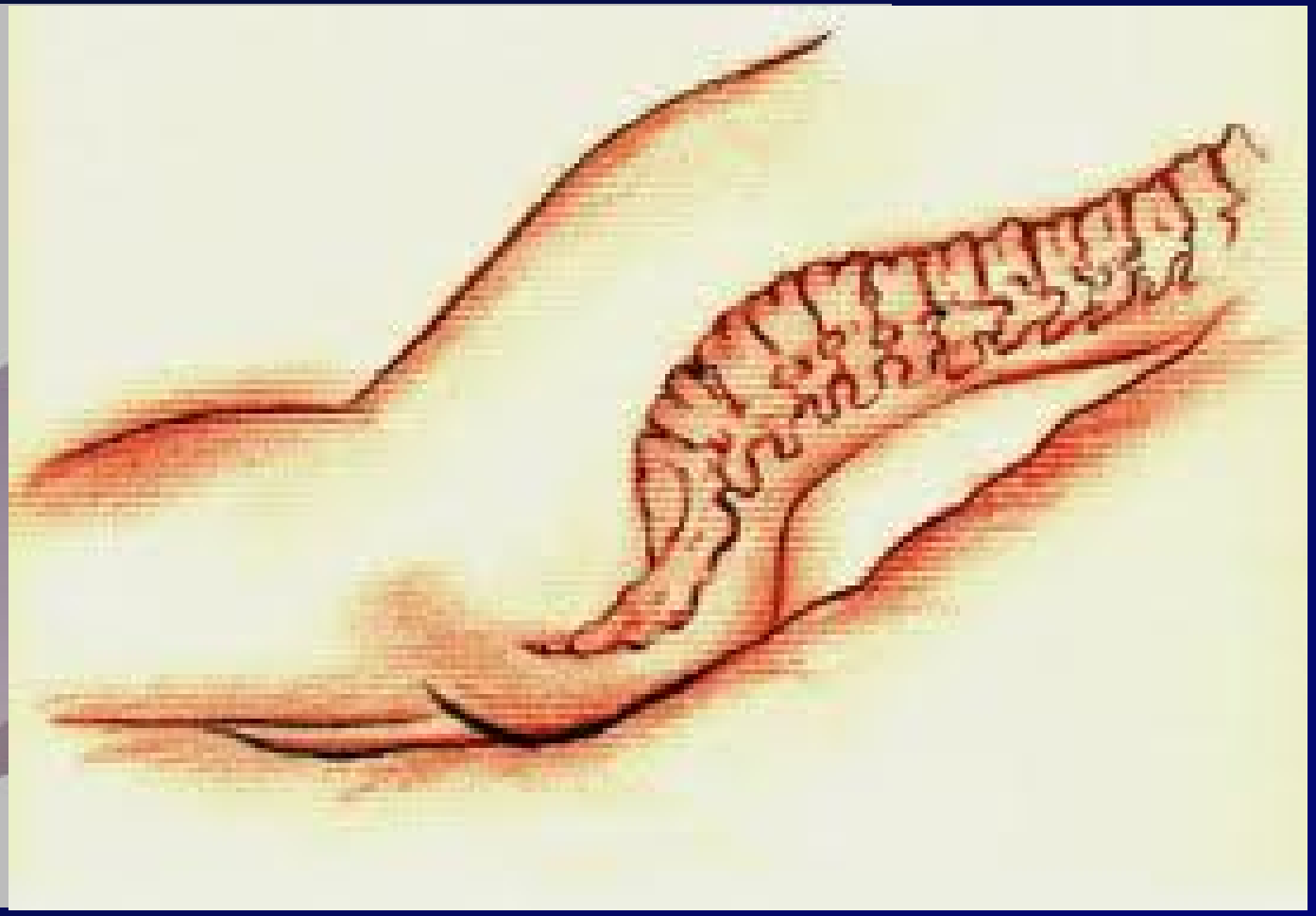
- Causative forces
  - Friction
  - Shear
  - Moisture
  - Pressure
  - Time
- Methods of determining risk
  - Braden Scale
  - Norton Scale
- Interventions
  - Based on severity
  - Debridement
  - Pressure mapping
  - Pressure Redistribution
  - Sitting Guidlines

Friction

Friction is the force resisting the relative motion of solid surfaces, fluid layers, and material elements sliding against each other. There are several types of friction:

- Dry friction resists relative lateral motion of two solid surfaces in contact. Dry friction is subdivided into static friction("stiction") between non-moving surfaces, and kinetic friction between moving surfaces.
- Fluid friction describes the friction between layers of a viscous fluid that are moving relative to each other.[1][2]
- Lubricated friction is a case of fluid friction where a lubricant fluid separates two solid surfaces.[3][4][5]
- Skin friction is a component of drag, the force resisting the motion of a fluid across the surface of a body.
- Internal friction is the force resisting motion between the elements making up a solid material while it undergoes deformation.[2]

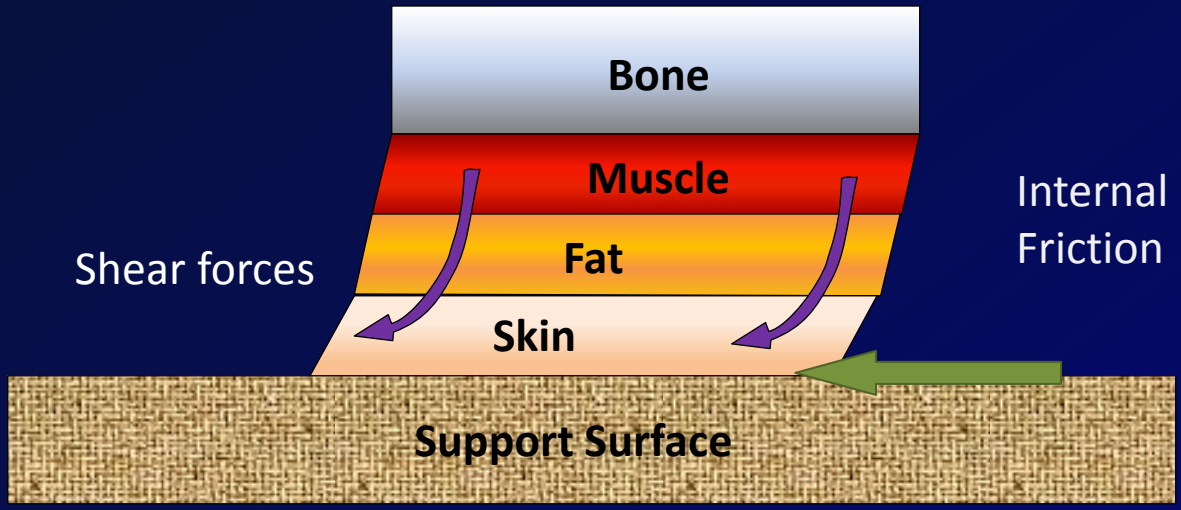
Dry Friction



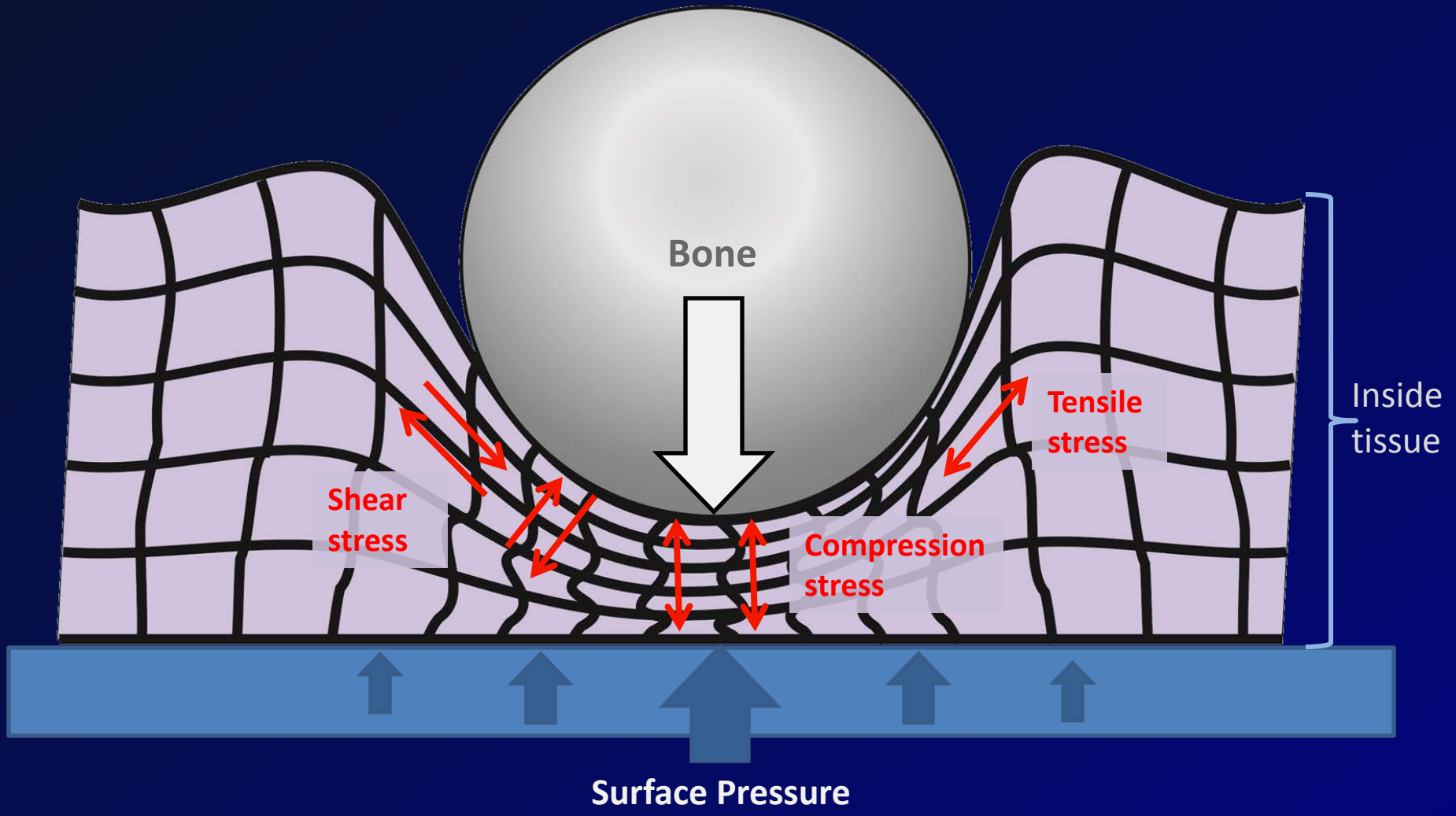
Visualizing Shear

shearing force

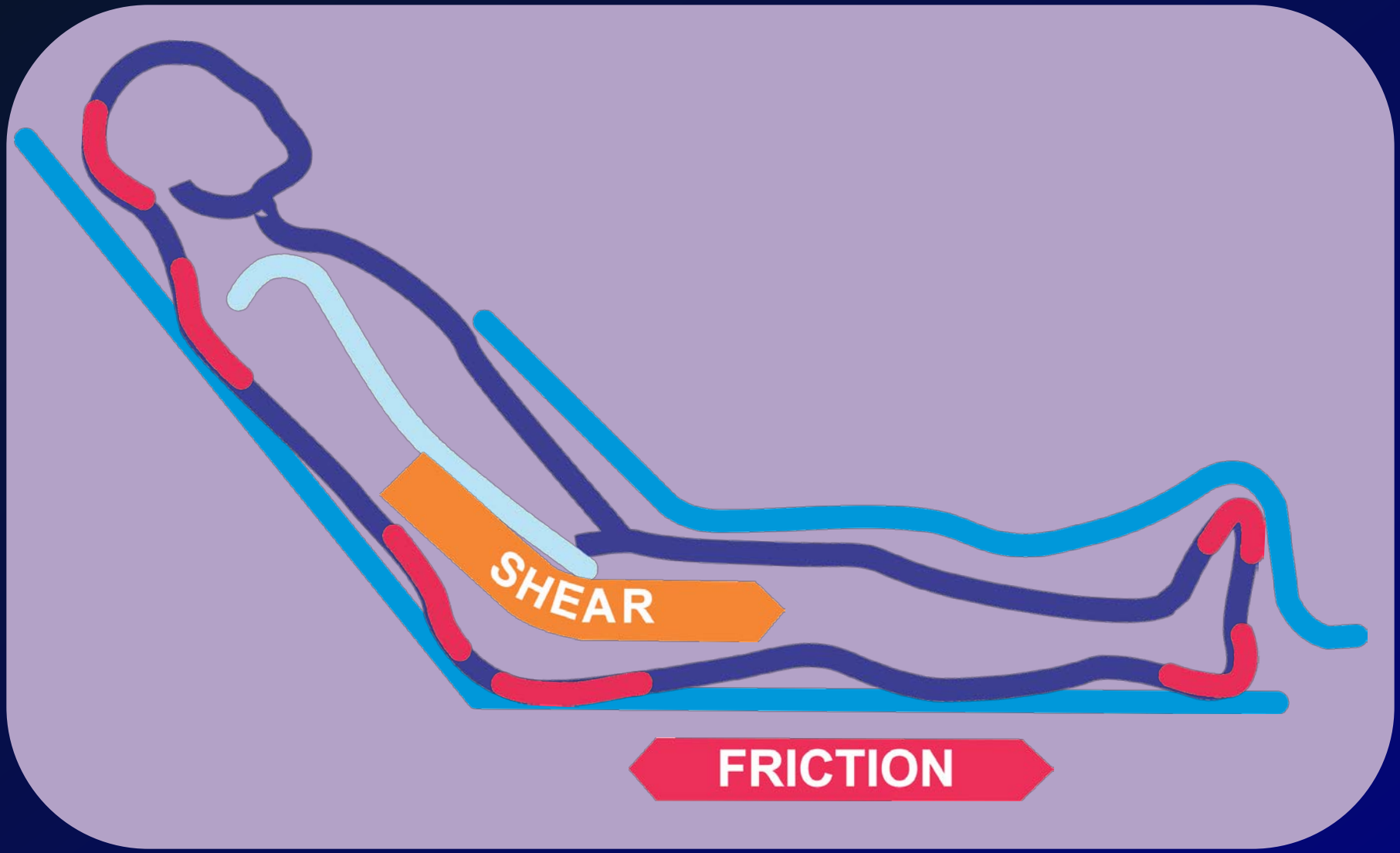
Action in opposite directions within the same plane, but not collinear, causing one portion of an object to slide, displace, or shear with respect to another portion of the object



Distribution of stresses inside tissue from the view of biomechanics



Friction / Shear



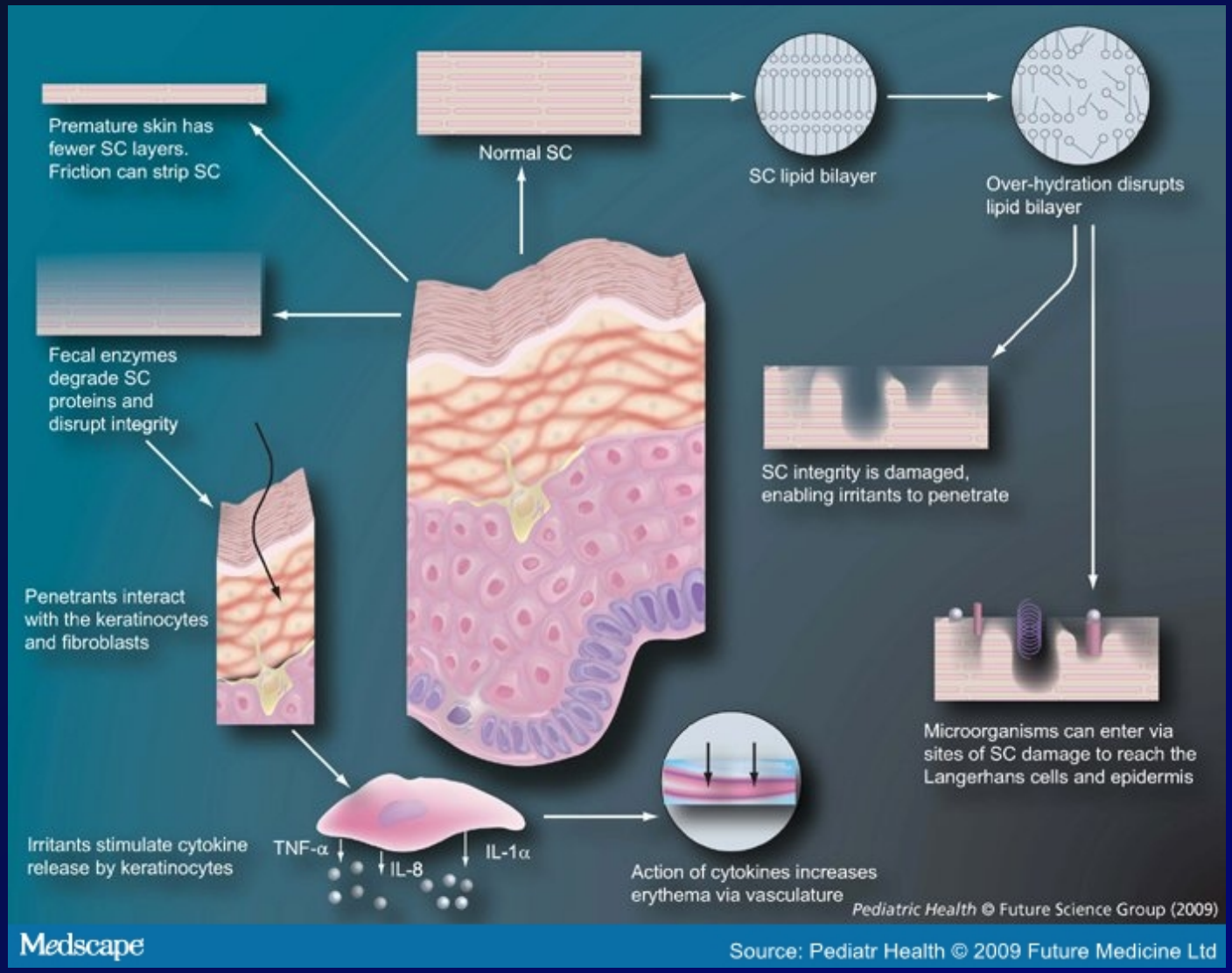
Maceration

Moisture-associated skin damage (MASD)

- Sources of maceration
  - Urine
  - Stool
  - Sweat
  - Wound drainage
  - Saliva
  - Mucus
- Effects of maceration
  - Local skin softening and swelling
  - Softening and swelling leads to greater susceptibility to friction and sheer
  - Presence of proteolytic enzymes breaks down bonds between cells
  - Breakdown due to overaggressive cleansing or use of adhesive's
  - Exposure of more fragile deeper layers of skin tissue
  - Increase susceptibility to bacterial invasion

Maceration

Moisture-associated skin damage (MASD)

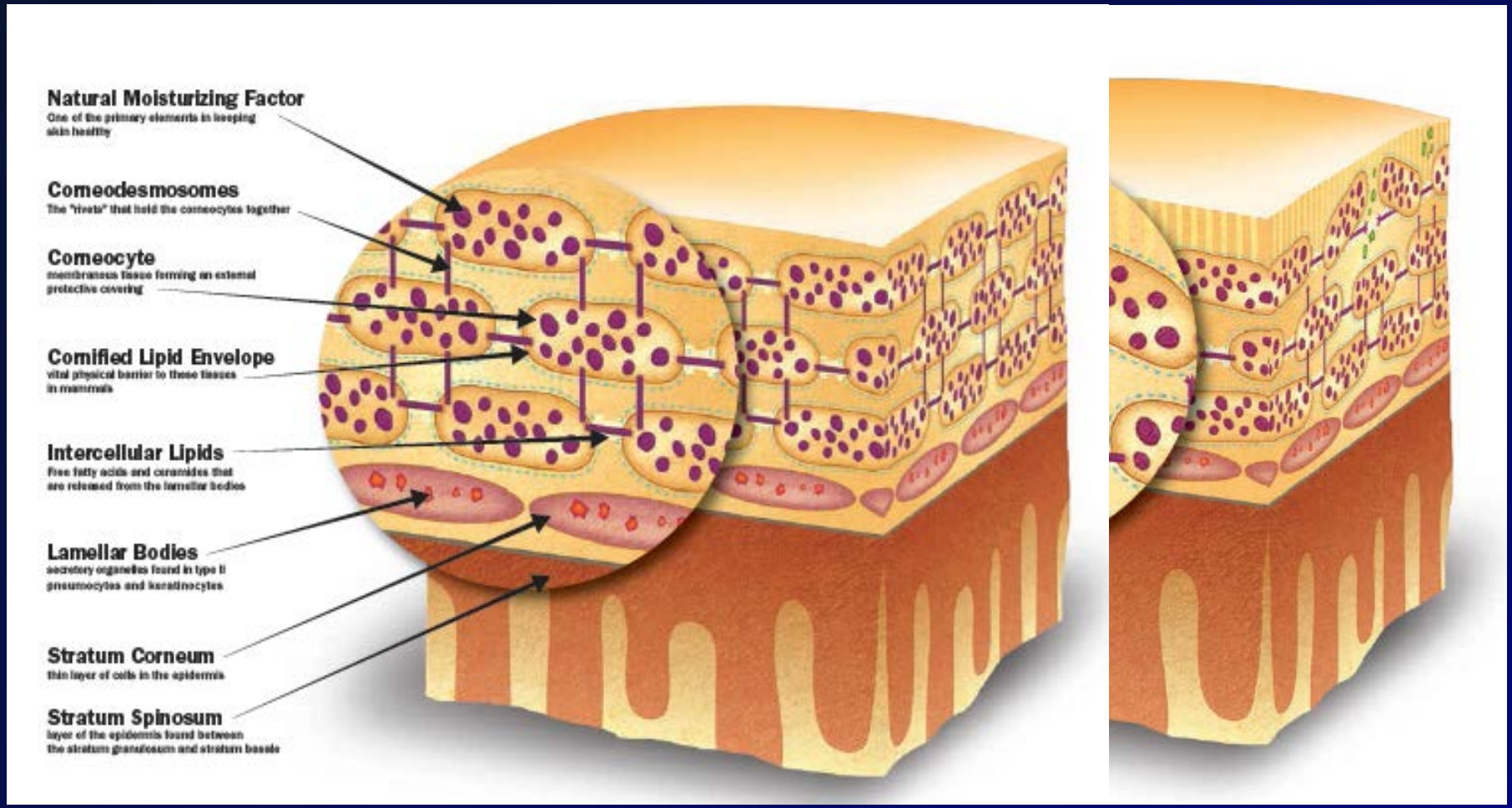


Maceration

Moisture-associated skin damage (MASD)

Normal Skin

Over Hydrated Skin

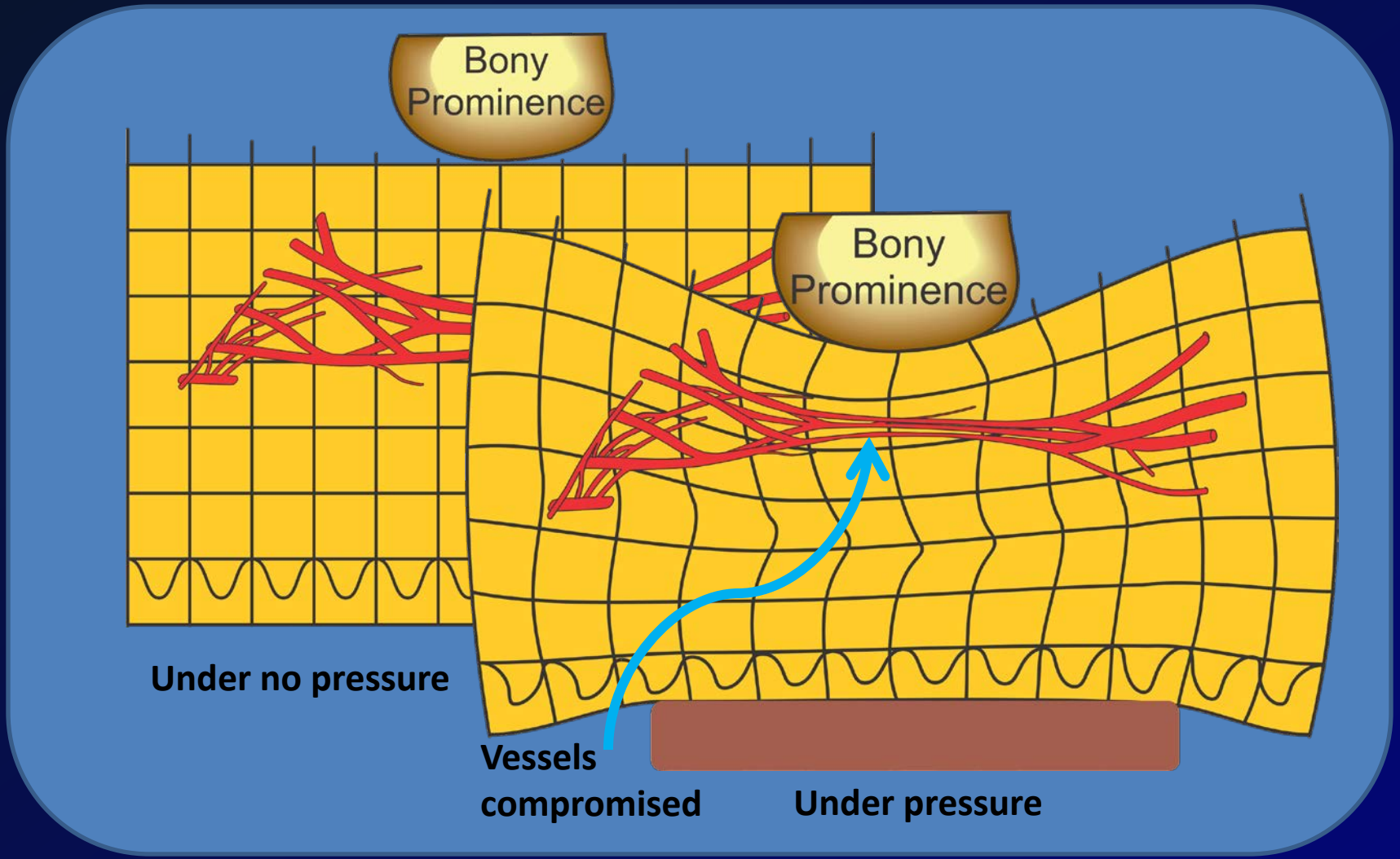


Maceration

Moisture-associated skin damage (MASD)

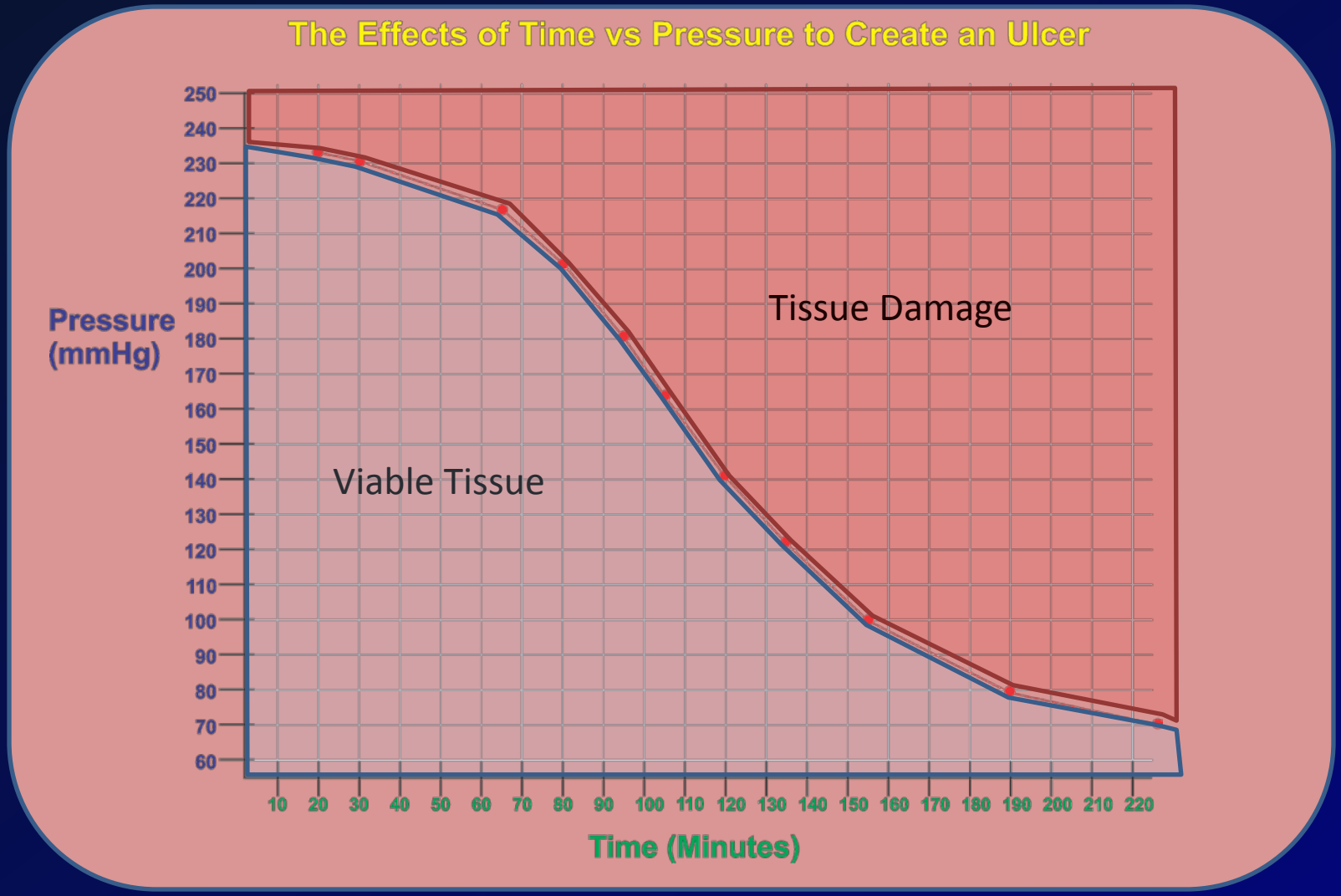
Maceration has the effect of causing breakdown of the tissues directly as well as making the tissues more venerable to other stresses. It also increases the friction coefficient which makes even mild friction more destructive.

Pressure


Bony Prominence
Bony Prominence
Under no pressure
Vessels compromised
Under pressure

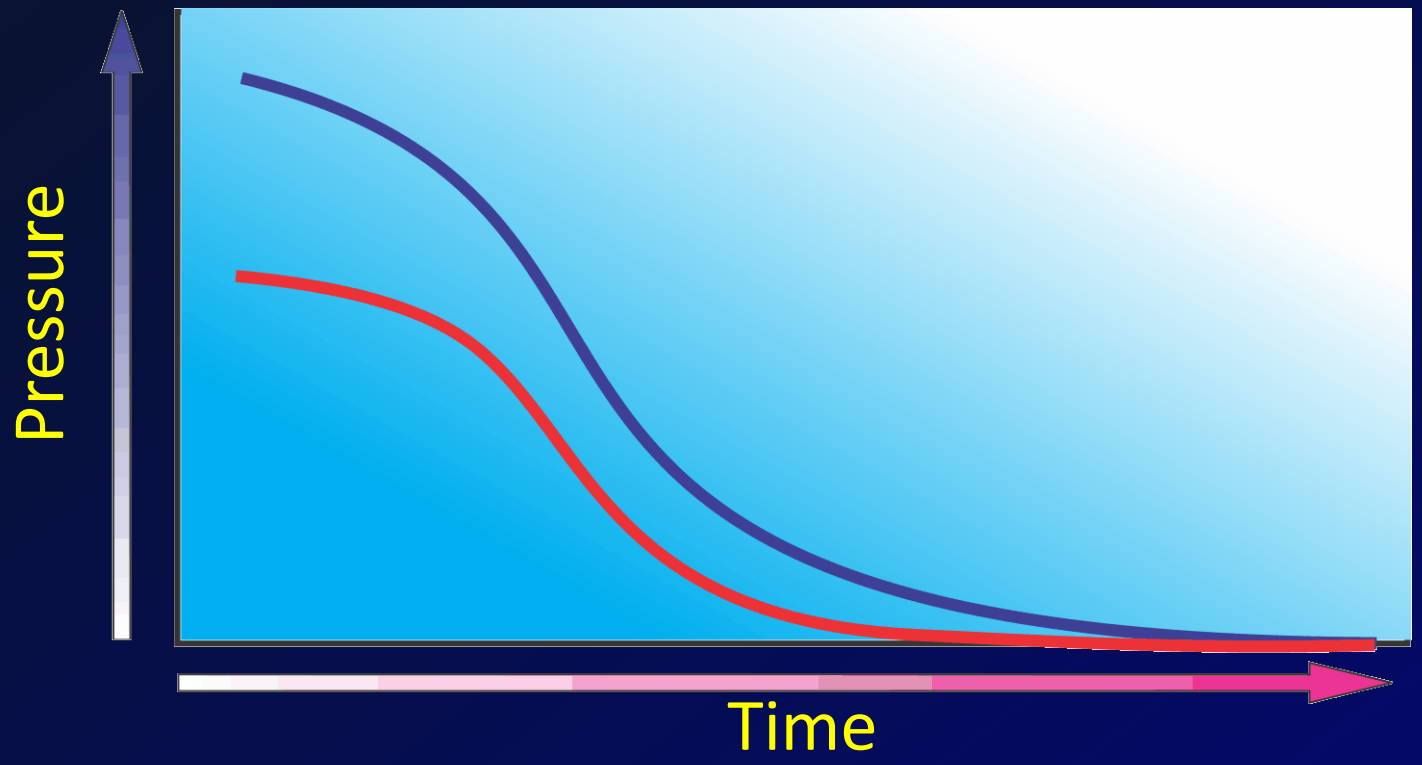
Time & Pressure

Reswick-Rogers



Ganz et al (2006)

Adaptation of the Reswick-Rogers curve to show the effect of reduced tissue tolerance



- Above the line, the magnitude and duration of pressure is likely to cause pressure damage. Below the line, pressure damage is unlikely to occur
- Pressure-time curve shifts to the left and down when skin and tissue tolerance is reduced, lowering the pressure and durations required to induce pressure damage

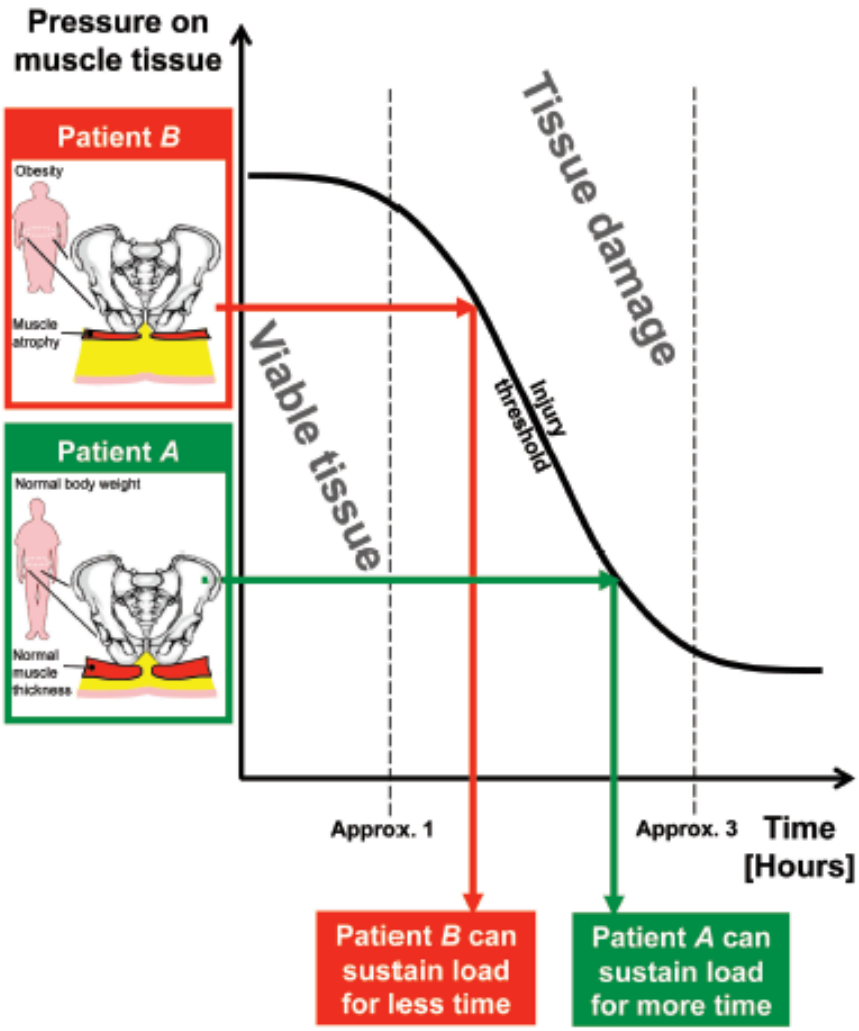
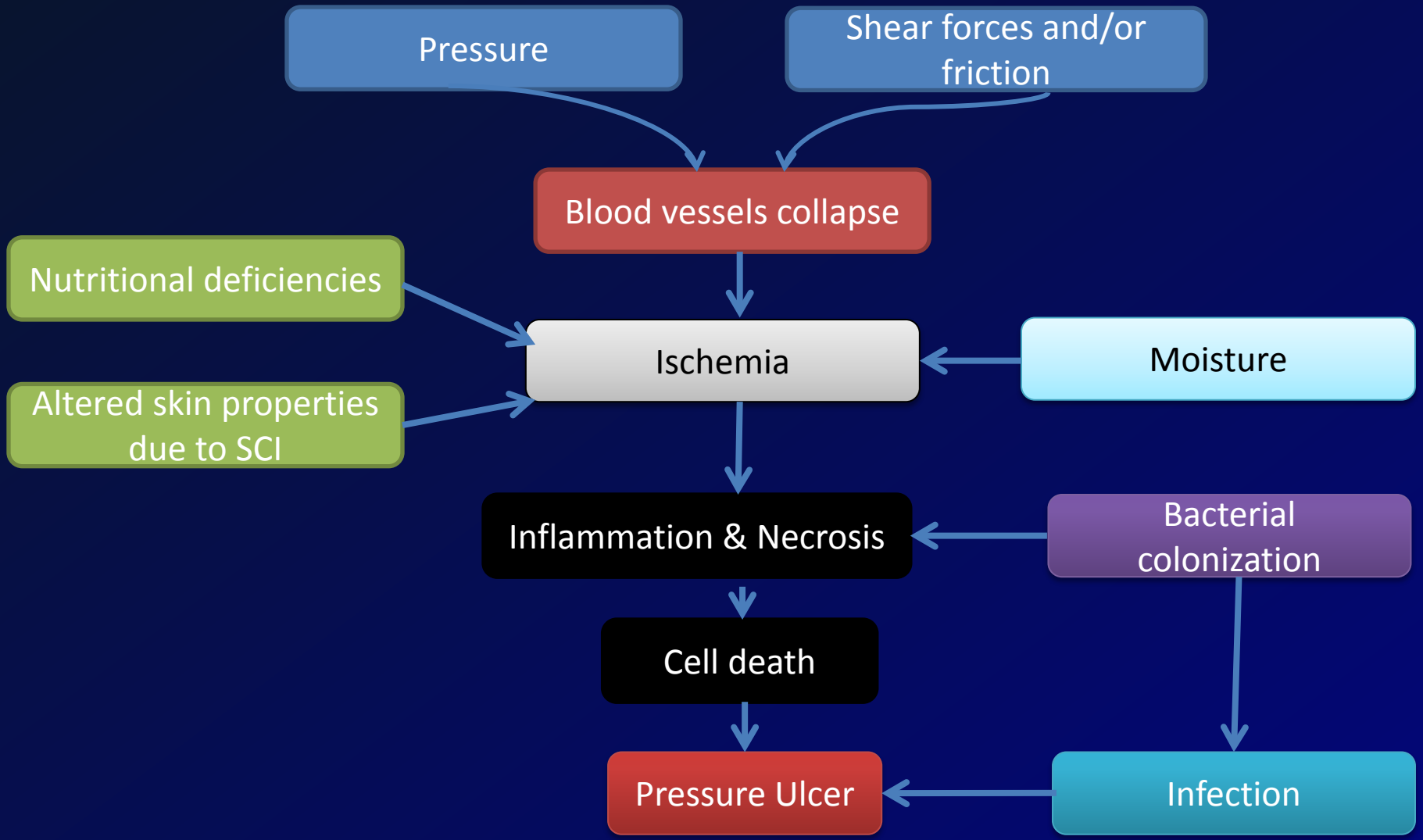
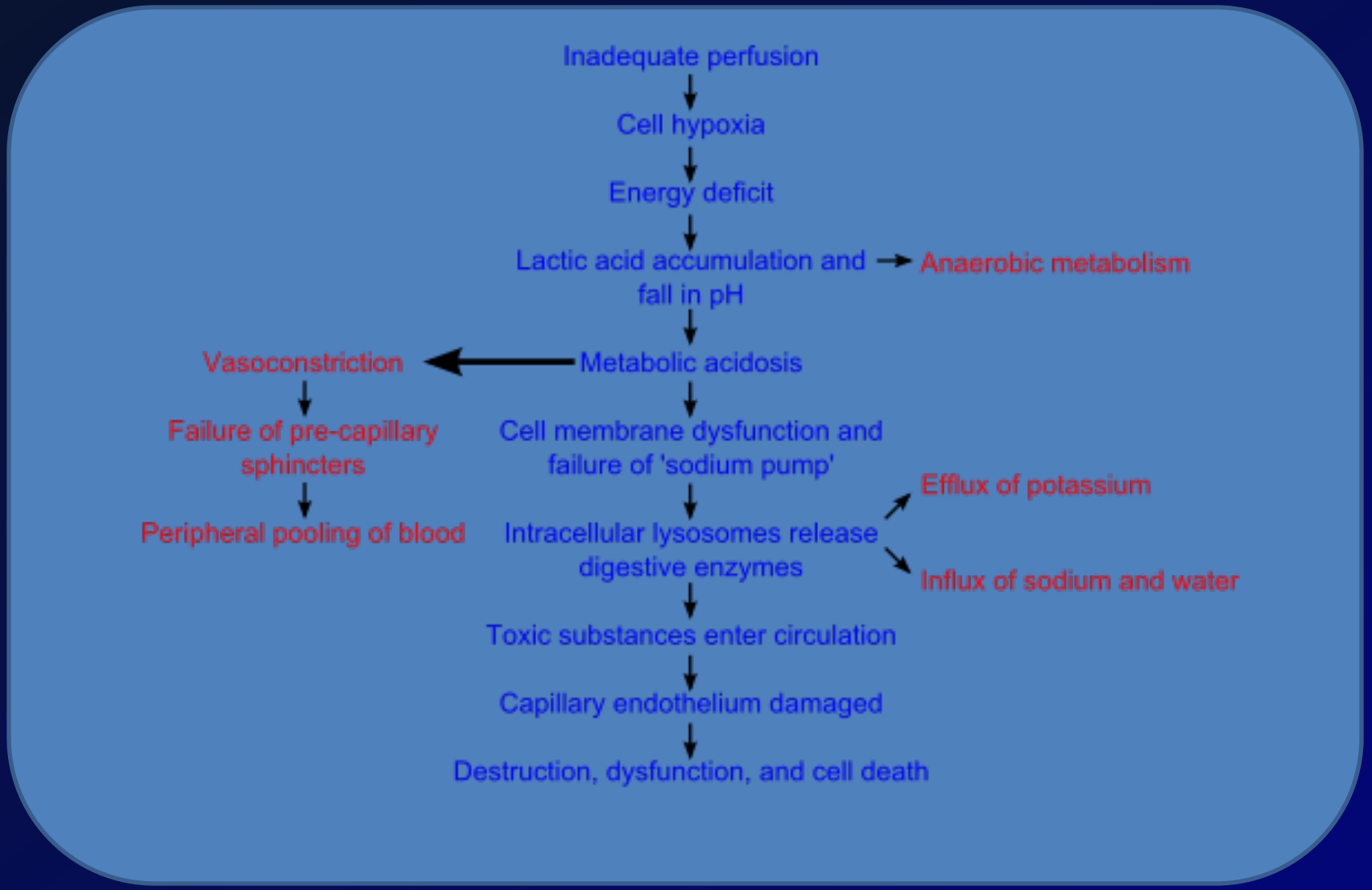


Figure 1. *Suggested effects of the individual anatomy on the time to develop a serious pressure ulcer (PU) or deep tissue injury (DTI), based on the pressure-time injury threshold obtained in animal studies by Linder-Ganz et al.[20] Individuals who are obese and/or have atrophied muscles are expected to develop DTI during a shorter period of time compared to persons with normal bodyweight and normal muscle thickness. Epidemiological studies indicate that an individual with spinal cord injury (SCI) is likely to gain weight and lose muscle tissue over the years post-SCI; therefore, he/she theoretically shifts from the condition of patient A to that of patient B, likely shortening the time for him/her to develop a PU or DTI under sustained loading. The seated buttocks are depicted as an example where internal tissue loads are expected to be higher than when laying down.[34] The theory suggesting that increased bodyweight and loss of muscle mass shorten the time for DTI onset[35] is hypothesized to hold for a supine position as well.*

Pressure - Friction - Shear



Cellular Effects of Pressure/Shear



Assessment tools

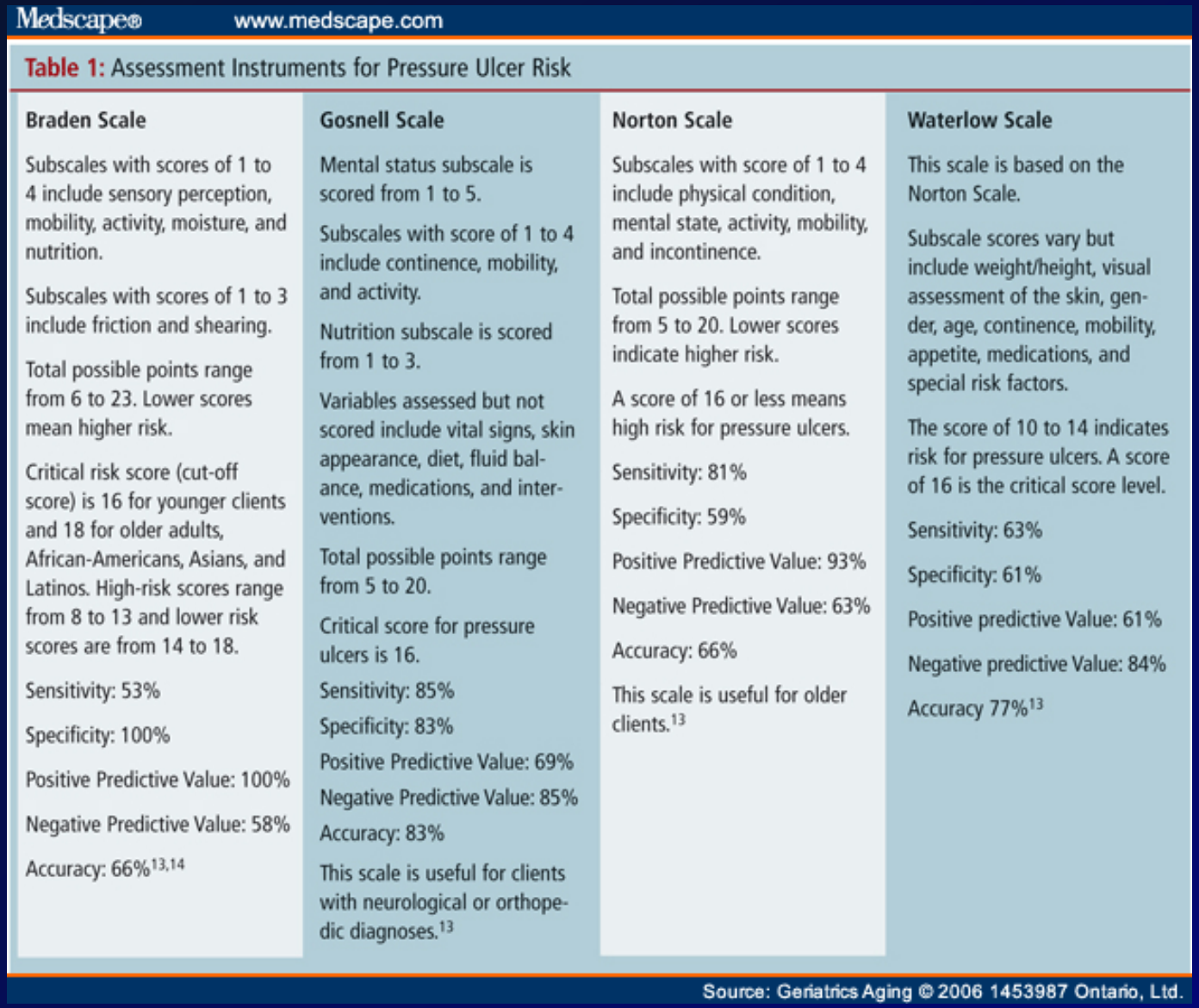


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Table 1: Assessment Instruments for Pressure Ulcer Risk

Braden Scale

Subscales with scores of 1 to 4 include sensory perception, mobility, activity, moisture, and nutrition.

Subscales with scores of 1 to 3 include friction and shearing.

Total possible points range from 6 to 23. Lower scores mean higher risk.

Critical risk score (cut-off score) is 16 for younger clients and 18 for older adults, African-Americans, Asians, and Latinos. High-risk scores range from 8 to 13 and lower risk scores are from 14 to 18.

Sensitivity: 53%

Specificity: 100%

Positive Predictive Value: 100%

Negative Predictive Value: 58%

Accuracy: 66%[13,14]

Gosnell Scale

Mental status subscale is scored from 1 to 5.

Subscales with score of 1 to 4 include continence, mobility, and activity.

Nutrition subscale is scored from 1 to 3.

Variables assessed but not scored include vital signs, skin appearance, diet, fluid balance, medications, and interventions.

Total possible points range from 5 to 20.

Critical score for pressure ulcers is 16.

Sensitivity: 85%

Specificity: 83%

Positive Predictive Value: 69%

Negative Predictive Value: 85%

Accuracy: 83%

This scale is useful for clients with neurological or orthopedic diagnoses.[13]

Norton Scale

Subscales with score of 1 to 4 include physical condition, mental state, activity, mobility, and incontinence.

Total possible points range from 5 to 20. Lower scores indicate higher risk.

A score of 16 or less means high risk for pressure ulcers.

Sensitivity: 81%

Specificity: 59%

Positive Predictive Value: 93%

Negative Predictive Value: 63%

Accuracy: 66%

This scale is useful for older clients.[13]

Waterlow Scale

This scale is based on the Norton Scale.

Subscale scores vary but include weight/height, visual assessment of the skin, gender, age, continence, mobility, appetite, medications, and special risk factors.

The score of 10 to 14 indicates risk for pressure ulcers. A score of 16 is the critical score level.

Sensitivity: 63%

Specificity: 61%

Positive predictive Value: 61%

Negative predictive Value: 84%

Accuracy 77%[13]

Braden Scale

BRADEN SCALE FOR PREDICTING PRESSURE SORE RISK

Patient's Name _____ Evaluator's Name _____ Date of Assessment

SENSORY PERCEPTION ability to respond meaningfully to pressure-related discomfort	**1. Completely Limited** 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.	**2. Very Limited** 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 ½ of body.	**3. Slightly Limited** Responds to verbal commands, but cannot always communicate discomfort or the need to be turned OR has some sensory impairment which limits ability to feel pain or discomfort in 1 or 2 extremities.	**4. No Impairment** Responds to verbal commands. Has no sensory deficit which would limit ability to feel or voice pain or discomfort.				
MOISTURE degree to which skin is exposed to moisture	**1. Constantly Moist** Skin is kept moist almost constantly by perspiration, urine, etc. Dampness is detected every time patient is moved or turned.	**2. Very Moist** Skin is often, but not always moist. Linen must be changed at least once a shift.	**3. Occasionally Moist** Skin is occasionally moist, requiring an extra linen change approximately once a day.	**4. Rarely Moist** Skin is usually dry, linen only requires changing at routine intervals.				
ACTIVITY degree of physical activity	**1. Bedfast** Confined to bed.	**2. Chairfast** Ability to walk severely limited or non-existent. Cannot bear own weight and/or must be assisted into chair or wheelchair.	**3. Walks Occasionally** Walks occasionally during day, but for very short distances, with or without assistance. Spends majority of each shift in bed or chair.	**4. Walks Frequently** Walks outside room at least twice a day and inside room at least once every two hours during waking hours.				
MOBILITY ability to change and control body position	**1. Completely Immobile** Does not make even slight changes in body or extremity position without assistance.	**2. Very Limited** Makes occasional slight changes in body or extremity position but unable to make frequent or significant changes independently.	**3. Slightly Limited** Makes frequent though slight changes in body or extremity position independently.	**4. No Limitation** Makes major and frequent changes in position without assistance.				
NUTRITION usual food intake pattern	**1. Very Poor** Never eats a complete meal. Rarely eats more than ⅓ 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 NPO and/or maintained on clear liquids or IVs for more than 5 days.	**2. Probably Inadequate** Rarely eats a complete meal and generally eats only about ½ 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. Adequate** Eats over half of most meals. Eats a total of 4 servings of protein (meat, dairy products) per day. Occasionally will refuse a meal, but will usually take a supplement when offered OR is on a tube feeding or TPN regimen which probably meets most of nutritional needs.	**4. Excellent** 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.				
FRICTION & SHEAR	**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.	**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.	**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.					
				Total Score				

Braden Scale

	1	2	3	4
1. Sensory perception	Completely limited	Very limited	Slightly limited	No impairment
2. Moisture	Constantly moist	Very moist	Occasionally moist	Rarely moist
3. Activity	Bedfast	Chair-fast	Walks occasionally	Walks frequently
4. Mobility	Completely immobile	Very limited	Slightly limited	No limitation
5. Nutrition	Very poor	Probably inadequate	Adequate	Excellent
6. Friction and shear	Problem	Potential problem	No apparent problem	
Interpretation of scores for development of pressure ulcer	15-18 - Mild risk of developing pressure ulcer			
	12-14 - Moderate risk of developing pressure ulcer			
	≤11 - Severe risk of developing pressure ulcer			

Norton Scale

NORTON SCALE							
Name	Date	Physical condition Good 4 Fair 3 Poor 2 Very bad 1	Mental condition Alert 4 Apathetic 3 Confused 2 Stupor 1	Activity Ambulant 4 Walk/help 3 Chair-bound 2 Stupor 1	Mobility Full 4 Slightly limited 3 Very limited 2 Immobile 1	Incontinent Not 4 Occasionally 3 Usually/urine 2 Doubly 1	Total score

Factor/score	*4*	*3*	*2*	*1*
Physical condition	Good	Weak	Ill	Very ill
Mental state	Alert	Apathetic	Confused	Stuporous
Activity	Ambulant	Walks with help	Chair bound	Bed-ridden
Mobility	Full	Slightly impaired	Very limited	Immobile
Incontinence	No	Occasional	Usually urinary incontinence	Double incontinence
Interpretation of scale	Score of >18 – low risk Score of 14-18 – medium risk Score of 10-<14 – high risk Score of <10 – very high risk			

Waterlow Scale

Build/Weight for Height	*Score*	*Skin type visual risk areas*	*Score*	*Sex & age (Years)*	*Score*	*Special risks*	
Average (BMI= 20-24.9)	0	Healthy	0	Male	1	**Tissue Malnutrition**	**Score**
Above average (BMI= 25-29.9)	1	Tissue paper (Frail)	1	Female	2	Terminal Cachexia	8
Obese BMI= >30	2	Dry	1	14-49	1	Multiple organ failure	8
Below average (BMI = <20)	3	Oedematous	1	50-64	2	Single organ failure (Resp, Renal, Cardiac)	5
(BMI=Wt in kg/Ht in m^2)		Clammy, Pyrexia	1	65-74	3	Peripheral vascular disease	5
		Discoloured grade I	2	75-80	4	Anemia <8gm%	2
		Broken/Spots grade 2-4	3	81+	5	Smoking	1
Continence	***Score***	***Mobility***	***Score***	***Appetite***	***Score***	***Neurological deficit***	***Score***
Complete/ Catheterised	0	Fully	0	Normal	0	Diabetes, MS, CVA	4 to 6
Urine Incontinence	1	Restless/Fidgety	1	Scarce/Feeding tube	1	Motor/Sensory	4 to 6
Fecal Incontinence	2	Apathetic	2	Liquid IV	2	Paraplegia	4 to 6
Urinary + Fecal Incontinence	3	Restricted	3	Anorexia/ Absolute diet	3		
		Bed bound e.g. traction	4			**Major surgery or trauma**	
		Chair bound e.g. wheel chair	5			Orthopedic/Spinal	5
						On table >2 Hrs	5
Interpretation						On table >6 Hrs	8
10+	At Risk						
15+	High Risk						
20+	Very High Risk						

Skin Changes as we Age

Structure	Changes
Skin	The skin is the largest organ of the body and is made up of three main layers: the epidermis, dermis and hypodermis. The skin has a number of very important functions; protection, sensation, thermo-regulation, secretion of sebum, sweat and cerumen and synthesis of Vitamine D. The skin is the body's largest main protective barrier against invasive micro-organisms, toxins and UV light. It also protects the internal tissues and organs and helps maintain hemostasis. The average thickness of the skin is 1-2 mm and this varies according to anatomical site.
Epidermis	The epidermis is very thin: approximately 0.1 mm. It receives oxygen and nutrients via the dermis as the epidermis does not have its own blood supply. The epidermis is firmly attached to the dermis at the demo-epidermal junction. As skin ages the epidermis gradually thins, particularly after the age of 70 with a flattening interface between the epidermis and the dermis. This reduces its resistance to shearing forces. Finning makes the skin more susceptible to the mechanical forces such as friction and shear.
Dermis	The dermis is composed of connective tissue and other components such as blood vessels, lymphatics, macrophages, endothelial cells and fibroblasts. A reduction in collagen and elastin makes it more susceptible to friction and shearing forces. During the aging process there's approximately 20% loss in the thickness of the dermal layer. This thinning of the dermis also causes a reduction in the blood supply to the area as well as reduction in the number of nerve endings and collagen. This in turn leads to a decrease in sensation, temperature control, rigidity and moisture control.
Hypodermis	The subcutaneous layer or hypo dermis lies below the dermis. This layer is made of adipose tissue and connective tissue. As skin loses its elasticity and strength, its protective function is reduced. Alterations in the vascularity and thickness of the hypo dermis with advanced age contributes to the skin susceptibility to trauma. In addition, the vascular capillaries become more fragile which can lead to vascular lesions such as ecchymosis (bruising) and senile purpura.