FOUR CLASSES OF CHRONIC ULCERS

- PRESSURE ULCERS
- DIABETIC FOOT ULCERS (neuropathic)
- VENOUS ULCERS
- ARTERIAL ULCERS

Epidemiology of chronic wounds

- PRESSURE 10% acute hospital pts, 23% nursing home pts
- VENOUS 1.5% adult population at some time 500,000 new ulcers year 1150 ulcers/million prevalence
- ARTERIAL 25% of elderly have PVD 1% develop critical ischemia 225 ulcers/million prevalence
- DM FOOT 6% US population have diabetes 15% get foot ulcers at some time 2.5% get ulcers each year 375,000 new ulcers per year in US

Incidence of Common Chronic Wounds

<table>
<thead>
<tr>
<th>Ulcers</th>
<th>Number per Year</th>
</tr>
</thead>
<tbody>
<tr>
<td>Diabetic Neuropathic</td>
<td>&gt; 340,000/yr</td>
</tr>
<tr>
<td>Venous Stasis Ulcers</td>
<td>&gt; 500,000/yr</td>
</tr>
<tr>
<td>Pressure Ulcers</td>
<td>&gt; 2.1 million/yr</td>
</tr>
</tbody>
</table>

Magnitude of the Pressure Ulcer (PU) Burden on Public Health

- Estimated 63% increased incidence since 1992
- At least 10% of acute hospitalized pts develop some form of PU
- $43,000 to treat each episode – 2007 statistics suggest approx 11 billion dollar cost assuming about 250,000 new stage III and IV ulcers
New Regulatory Environment for PU

- As of October 1, 2008, HCFA (Medicare) will not reimburse for the costs of new PU acquired while a patient is in hospital
- Within 24 hours of admission a physician must document the absence or presence of any skin ulcers or lesions
- Nursing must document within 12 hours of admission and then every shift Braden scale scores [on horizon]

Quality of Care for Hospitalized Medicare Patients at Risk for Pressure Ulcers
2001 survey of 6 measures employed to prevent PU

- N = 2425 hospitalized pts
- Daily skin assessment -94% compliance
- Use of pressure reducing device – 7.5%
- Documentation of risk – 22.6%
- Repositioning for a minimum of 2 hours – 66.2%
- Nutrition consult – 34.3%
- Staging class I and II + ulcers – 21 and 31%

Arch Intern Med. 2001;161:1549-1554

Diagnostic evaluation

- Location, depth, quality of surrounding skin, edema
- PRESSURE - usually over prominences (trochanter, ischial tuberosity, heel) that bear weight in bed-ridden
- DM - involve pressure points involved in walking (1st mtp joint, heel, 5<sup>th</sup> metatarsal) on plantar aspect of foot – frequent associated bony deformity – clawing or Charcot
- VENOUS - in gaiter (anteromedial aspect of leg) area, are shallow, surrounding skin has hyperpigmentation ± hypopigmentation and chronic dermatitis (LDS). Edema and weeping are prominent
- ARTERIAL - ulcers may be at any site, often multiple -- e.g., above and below ankle, expose bone or tendon, black infarcted skin or toes, minimal inflammation
Etiology of Pressure Ulcers

- Decreased patient mobility (e.g., spinal cord injury, coma, weakness, stroke)
- Pressure + decreased tissue tolerance + friction + shear + moisture
- Fecal and urinary incontinence-macerate and damage skin independently
- Malnutrition, infection, edema are frequent contributing factors
- Common sites: heel, sacrum, trochanter—all bony prominences that bear weight in supine position
Capillary pressure = 32 mmHg

Location of pressure sores
- Trunk 4%
- Upper limbs 3%
- Sacrum 31%
- Trochanters 10%
- Buttocks 27%
- Lower limbs 5%
- Heels 20%

Stage 1
- NON-blanchable area of redness
- Intact skin
- Any observable change in the skin
  - Temperature
  - Consistency
  - Sensation
Nonblanchable erythema is NOT what you see here.
The reactive hyperemia: blanch area with digital pressure if area blanches and then refills within several seconds, this is a normal compensatory mechanism and not a Stage 1 pressure ulcer.

Stage 2
- Shallow, superficial crater
- Involves the epidermis and/or the dermis.
- May also present as an abrasion, blister
- NO Subcutaneous fat is observed

Stage 2
- DOES involve the subcutaneous fatty layer, but does NOT go through the underlying fascia.
- Presents clinically as DEEP crater
- Subcutaneous fat IS Observed BUT NO muscle should be seen
Stage 4
- Extensive damage to the muscle, bone, or tendon
- Undermining and sinus tracts may also be associated

Stage 4
- Overlying Eschar or Slough...
  - For Ulcers covered with dead, necrotic tissue, (eschar or slough):
    - Some might stage this as a stage IV
    - BUT According to NPUAP, should be classified as “UTD” (unable to determine), until tissue is debrided

“Stage V”
- Newly created diagnostic category – deep tissue injury “DTI” icd-9 code 701.20
- Wound whose depth cannot be assessed
- Often identified immediately after episode of unremitting pressure
- May look like bruise – ecchymosis or hematoma
- Initially may look like Stage I or II but actually is Stage III or IV
WOUND HEALING REFLECTS AN EQUILIBRIUM

### Advanced Wound Healing: what works
- **basics** – debride, drain, relieve pressure, address nutrition and systemic factors
- **Surgery** – close wound, amputation, flaps, skin grafting, SEPS
- **Switch to moist wound environment**
- **Treat occult infection** – anaerobes in particular
- **Topical compounds and devices** – antimicrobial, debriding, proliferative
- **Pletal [cilostazol] for ischemic wounds [sometimes]**
- **Negative pressure therapy** – KCI “V.A.C.”, other systems

### Management of Pressure Ulcers
- **Pressure relief** – frequent turning, foam mattresses, air-fluidized beds
- **Local care** – debridement, drainage, wet to dry dressings
- **control of infection** – antibiotics
- **Treat systemic factors** – nutritional support
- **Surgical care** - flaps

### PROGNOSIS FOR CHRONIC ULCER HEALING
- **VENOUS** 75% heal with compression by 6 months (50% recurrence),
- **ARTERIAL** 25% heal with local care, remainder require bypass (75% successful) or amputation
- **DM FOOT** 25-50% heal by six months with local care and pressure relief, 25% lead to amputation
- **PRESSURE** 30% healed at three months with local care and pressure relief
Algorhythm for preventing pressure ulcers - I

• **Risk assessment** – use an objective scale such as Braden to identify pt at risk – factors include chair and bed dependence, immobility or deformity, nutrition, illness severity, pt’s ability to communicate

• **Skin care and early treatment** - bathing, skin moisturizers, manage incontinence and excess moisture, nutritional support, rehab for mobility

Algorhythm for preventing pressure ulcers - II

**Mechanical Loading and Support Surfaces**

• reposition every 2 hours in bed, 1 hour in chair

• At risk pt needs pressure reduction bed

• Use lifting devices rather than dragging pt

• Protect boney prominences with pillows and pads from contact with bed

• Pillow under calf to protect heel

• Avoid elevation of head or hip >30°

Cultural and Racial Factors

• Most important predictive factor for in hospital pressure ulceration is Braden Scale

• Predictive value has been show to be independent of race [black vs. white, hispanic vs. white]

• In general, older age, but not race, culture, gender, or ethnicity holds up as predictive for pressure ulceration

• Important to appreciate modesty [Arab, Muslim, Latin, Asian cultures] may be a barrier to physical examination and identification of skin breakdown

**SENSORY PERCEPTION**

1: completely limited
2: very limited
3: slightly limited
4: no impairment

<table>
<thead>
<tr>
<th>Limited ability to feel or</th>
<th>turning</th>
<th>pain over most of body</th>
<th>limited feeling over</th>
<th>50% of body has some sensory impairment</th>
<th>of limbs</th>
</tr>
</thead>
</table>

**MOISTURE**

1: constantly
2: occasionally
3: rarely
4: rarely

<table>
<thead>
<tr>
<th>Incontinence</th>
<th>Sweat</th>
<th>Moist</th>
<th>Linen</th>
</tr>
</thead>
<tbody>
<tr>
<td>moist</td>
<td>moist</td>
<td>moist</td>
<td>rarely</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
</tr>
</thead>
<tbody>
<tr>
<td>ALWAY'S</td>
<td>DAMP</td>
<td>LINEN</td>
<td>CHANGED</td>
</tr>
<tr>
<td>EVERY</td>
<td>SHIFT</td>
<td></td>
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</table>
### Activity

<table>
<thead>
<tr>
<th></th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
</tr>
</thead>
<tbody>
<tr>
<td>Walks</td>
<td>Bedridden</td>
<td>Chair Fast</td>
<td>Occasionally</td>
<td>Frequently</td>
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### Nutrition

<table>
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<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
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</thead>
<tbody>
<tr>
<td>Very Poor</td>
<td>Inadequate</td>
<td>Adequate</td>
<td>Excellent</td>
<td></td>
</tr>
<tr>
<td>(&lt;1/3 of meals)</td>
<td>(&lt;1/2 of meals)</td>
<td>(&gt;1/2 of meals)</td>
<td>Eats Most of Meals</td>
<td></td>
</tr>
<tr>
<td>5 Days IV or or or</td>
<td>clears</td>
<td>&lt;Optimum Tube</td>
<td>Adequate Tube/TPN</td>
<td></td>
</tr>
<tr>
<td>or or or</td>
<td>Feeding</td>
<td>Regimen</td>
<td></td>
<td></td>
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</table>

### Friction and Shear

<table>
<thead>
<tr>
<th></th>
<th>1</th>
<th>2</th>
<th>3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Problem</td>
<td>Friction and Shear</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Needs Assistance</td>
<td>No Apparent</td>
<td></td>
<td></td>
</tr>
<tr>
<td>to Move</td>
<td>Problem</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Slides Down in Bed</td>
<td>Potential Problem</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Spasticity</td>
<td>Needs Some Help</td>
<td></td>
<td></td>
</tr>
<tr>
<td>CONTRACTURES</td>
<td>Moving</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Slides Sometimes</td>
<td>Lists Up</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Spasticity</td>
<td>Completely</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Turning of Patients

- Required for at-risk pts – immobile, contractures, feeble, non-communicating
- Gold standard is every 2 hours
- Do pressure reduction beds reduce need for turning?
- Rule of 30° for pelvis/trochanters
- Ankle protection

**Prevent Heel Pressure Ulcers**

“Floating” heels off end of pillow
Surfaces and Pressure/Shear/Friction

- Lack of RCT data to distinguish best mattresses for given problem
- When patients adequately turned and positioned, hard to see mattress benefits
- Pressure reduction redistributes weight away from boney prominences, but pressure is still > 32mmHg
- Pressure relief devices reduce pressure below 32mmHg

Types of Support Surfaces

- Pressure Reduction versus Pressure Relief
- Dynamic versus Static
- If dynamic: air versus fluid
- Overlay devices
- Replacement Mattresses [pressure reduction]
- Specialty Beds [pressure relief]

Specialty Beds

- Low-air-loss beds
- Air-fluidized bed
- Both reduce pressure < 32 mm Hg
- Reduce shear and friction
- Some reduce moisture
- With proper adjustment, performance is comparable
- Air-fluidized has best RCT data support
**Overlays**
- Egg crate is example of static foam overlay
- Foam is cheap, light, disposable
- Traps moisture, ?? Efficacy
- Air and gel overlays available
- Static air cell probably most common – considered as pressure-reduction surface—probably effective vs normal bed, requires maintenance

**Dynamic air cell overlay**
Use in low to moderate risk patient, allows positioning

**Low-Airloss-Beds**
- Bed frame connected to air pillows
- Head and foot may be raised/lowered
- Transfer in and out of bed easier
- May reduce frequency of turning required
- Motors USED TO BE noisy
- Surface of bed is slippery

**Air-fluidized Beds**
- Developed for burns
- Frame contains silicone particles pumped with air to create a liquid-like surface
- Pt floats with ~1/3 body above sheet
- Keeps pt warm and dry,
- Antimicrobial properties
- “Clinitron bed”
Air-fluidized Beds

**PRO**
- Less positioning needed
- More comfort
- Reduces shear and friction
- Helps with moisture

**CON**
- Risk of dehydration
- Bed may be too hot
- Wounds may dessicate
- Difficult for nursing
- Transfers and positioning are difficult
- Catheters and drains get blocked
- Too big and heavy for home use

Choice of beds
- Low risk patients need no pressure reduction
- Intermediate to high risk pts need pressure reduction with replacement mattress beds
- Pressure relief [low-air-loss/air-fluidized] for patients with multiple wounds/multiple sites, or wound is not healing
- Maximum pressure relief [air-fluidized] bed would be for pt s/p surgery to close pressure ulcer
- Low-air-loss usually better choice for ICU patient or one with pulmonary problems

Local Care Options/Issues
- Stage 1 – pressure relief alone is sufficient
- Stage 2- moisture barriers and foams/hydrocolloids may be helpful [Baza, Xenaderm, Duoderm]
- Stage 3 – everything on the shelf may play a role – preventing secondary infection is critical so antimicrobial devices important
- Stage 4 – usually surgery, negative pressure can stabilize the situation, but not routinely heal the wound

? Effects of Negative Pressure that promote wound healing?
- Increased blood flow in wound tissue
- Increased clearance of bacteria and decreased bacterial burden
- Stimulation of cellular proliferation
- Reduced edema
- “cleaning the wound”
Pressure Ulcer trials –I

Boston University

- 28 pts with 41 wounds. Negative pressure was compared to Healthpoint (HP) gel products
- 22 patients with 35 full-thickness ulcers completed 6 weeks therapy
- 2 wounds (10%) in the VAC group (N = 20) and 2 (13%) in the HP group (N = 15) healed completely
- Mean reduction in wound volume was 42.1% with HP and 51.8% with VAC (p = 0.46)
- Mean PMN and lymphocyte count per high-power field decreased in the VAC group and increased in the HP group (p = 0.13, p = 0.41 respectively)
- Mean number of capillaries per high-power field was greater in the VAC group (p = 0.75)
- There were 15 cases of biopsy-proven osteomyelitis underlying the ulcers; three (37.5%) improved with VAC and none improved with HP (p = 0.25)


Pressure Ulcer trials –II

Basel study

- 22 spinal cord injury patients with pelvic pressure ulcers randomized to either saline gauze TID vs V.A.C® therapy at 125 mm Hg. Negative pressure dressing changed at 2-7 days – when canister full
- Time to reach 50% of initial wound volume was identical: 27 ± 10 days with negative pressure vs. 28 ± 7 days with moist gauze
- Authors judged the methods equal in forming granulation tissue, but negative pressure was more comfortable


CONCLUSIONS

- PATIENTS AT RISK FOR PRESSURE ULCERS CAN BE IDENTIFIED
- NURSING INTERVENTION [TURNING] IS EFFECTIVE –PREVENT FULL THICKNESS INJURY
- HEEL ULCERS ARE SILENT ENEMY
- DEBRIDEMENT AND STAGING SHOULD ORDINARILY BE DONE
- ADVANCED CARE FOR FULL THICKNESS [STAGE III AND IV] MAY BE REQUIRED

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