APTA American Physical Therapy Association | APTA Combined Sections Meeting

Safe Mobilization of Patients with Post-Surgical and Chronic Wounds

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Disclosure

- The information in this presentation is for your own personal educational use and should not be altered or shared unless written permission is obtained from the author/speaker.

- Speakers have no conflict of interest, or relevant financial relationship to disclose

Learning Objectives

- Understand etiology for pressure injuries, discuss prevention, treatment and bed positioning to allow for proper healing, while also promoting safe bed mobility, transfers, mobilization and chair positioning to maximize PT intervention
- Explain various post-traumatic surgeries including fasciotomies and amputations, and discuss safe mobilization of patients with amputations utilizing limb protectors
- Describe what to expect when evaluating post-burn patients, including pain expectations, positioning, skin mobility and preventing contractures across joints
- Explain the importance of timely gravity dependence/dangle protocol following lower extremity reconstruction, and discuss physiology of muscle flaps and their effect on mobility

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Common Post-Surgical Lines, Tubes and Drains

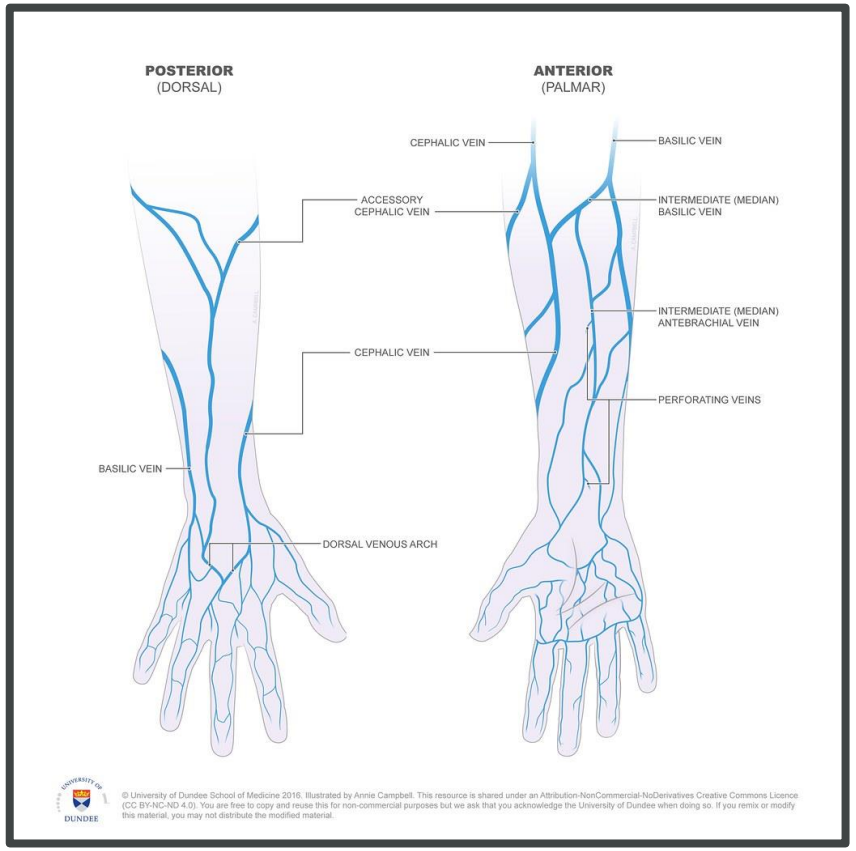
Marie R. Adams, PTA, BA

Lines, Tubes & Drains

- Crucial to be aware of all connections to prevent anything from getting pulled out
- Limit mobility if connected to IV pole or wall suction
- Some mobility is contraindicated depending on what is connected
- Need nursing assistance with disconnecting and connecting

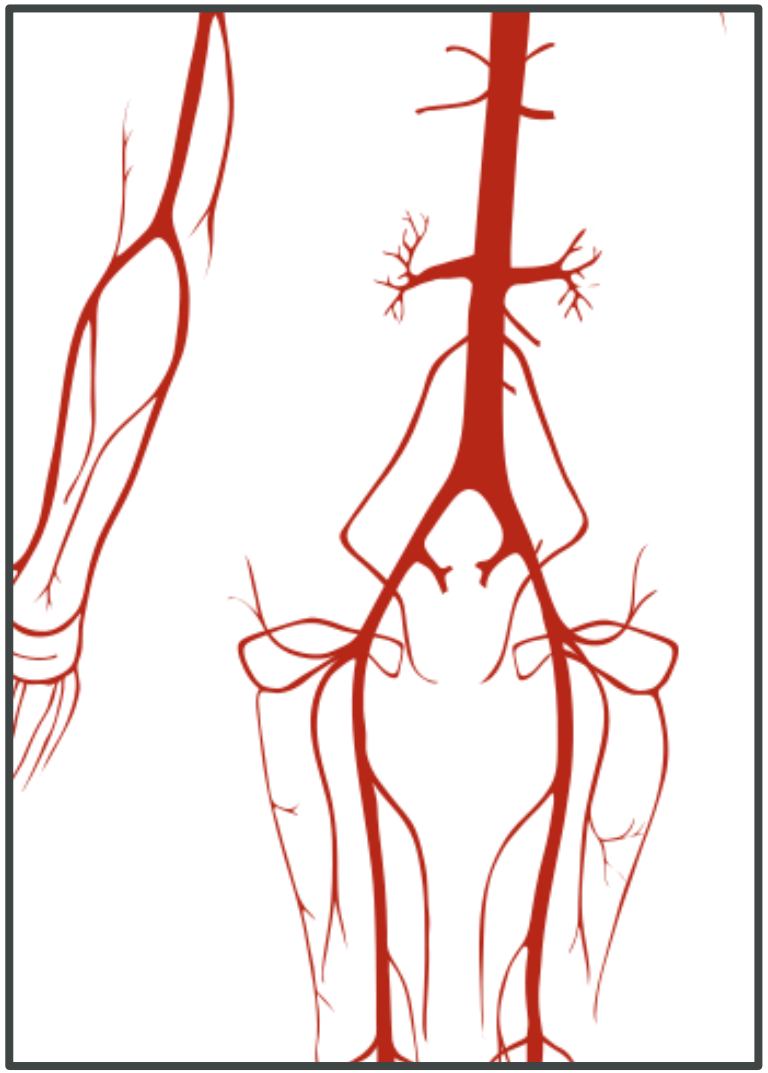
Lines – Peripheral IVs

- Inserted in a vein
- Various locations
  - Most common: hand, arm, neck
  - Uncommon: foot, leg, scalp
- Can administer fluids, blood and medications
  - Not chemotherapy drugs or strong antibiotics
- RN could disconnect IV during therapy (except blood thinners)
- **Mobility**: ALLOWED with PRECAUTIONS
  - Patient or provider may need to push IV pole if running



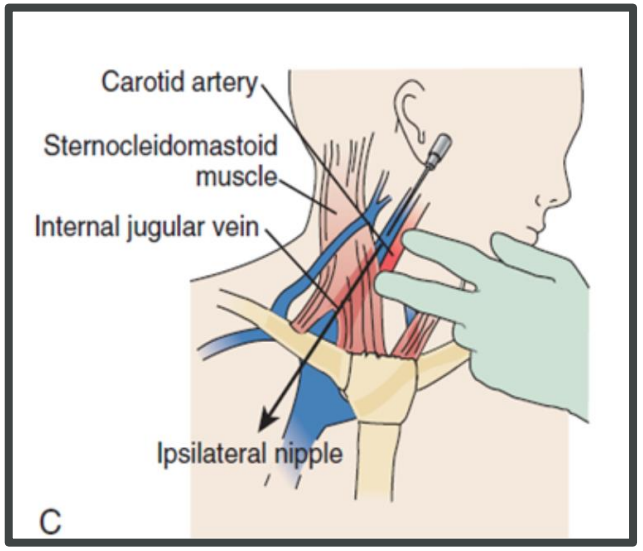
Lines – Arterial Line

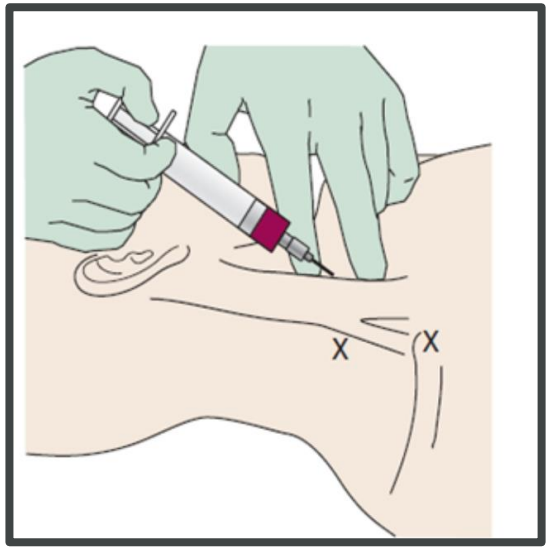
- Inserted in an artery for critically ill patients
- Usually radial or femoral artery
- Used to obtain accurate blood pressure readings
- Used to obtain blood gases and other labs
- **Mobility**: Bed mobility ONLY; other mobility NOT ALLOWED



Lines – Central Venous Catheter

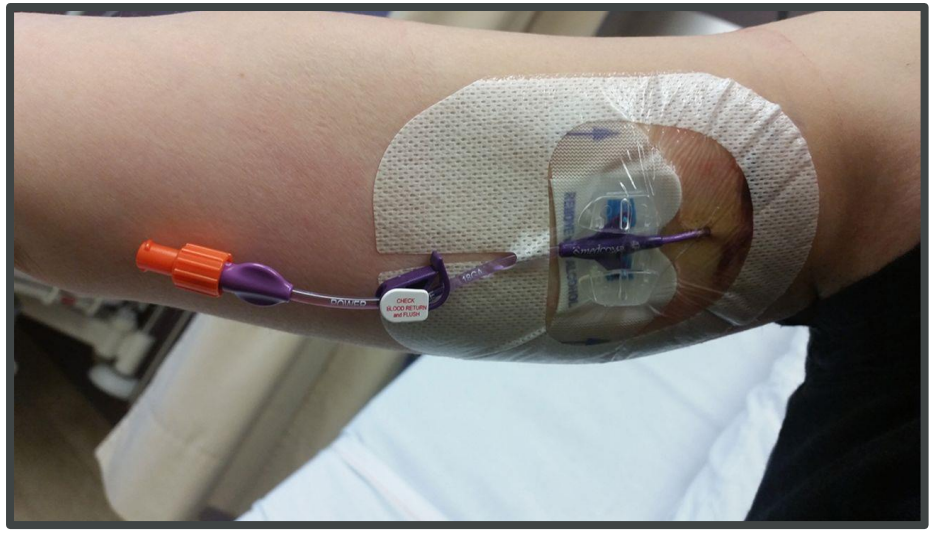
- Inserted in a vein and connects to a vessel that delivers blood to heart or superior/inferior vena cava
- Usually in jugular or subclavian vein (sometimes femoral)
- Single or multiple lumens
- Meant for stronger medications
- **Mobility**: ALLOWED with PRECAUTIONS
  - Patient or provider may need to push IV pole if running





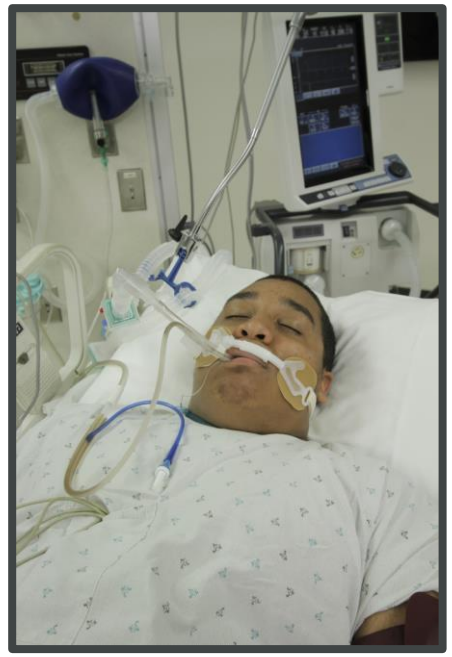
Lines – Peripherally Inserted Central Catheter (PICC)

- Special central venous catheter
- Inserted in basilic or brachial vein and connects to superior vena cava
- Patients who have difficult veins
- Single, double or triple lumens
- **Mobility**: ALLOWED with PRECAUTIONS
  - Patient or provider may need to push IV pole if running
  - PINK BAND: Cannot use for blood pressure



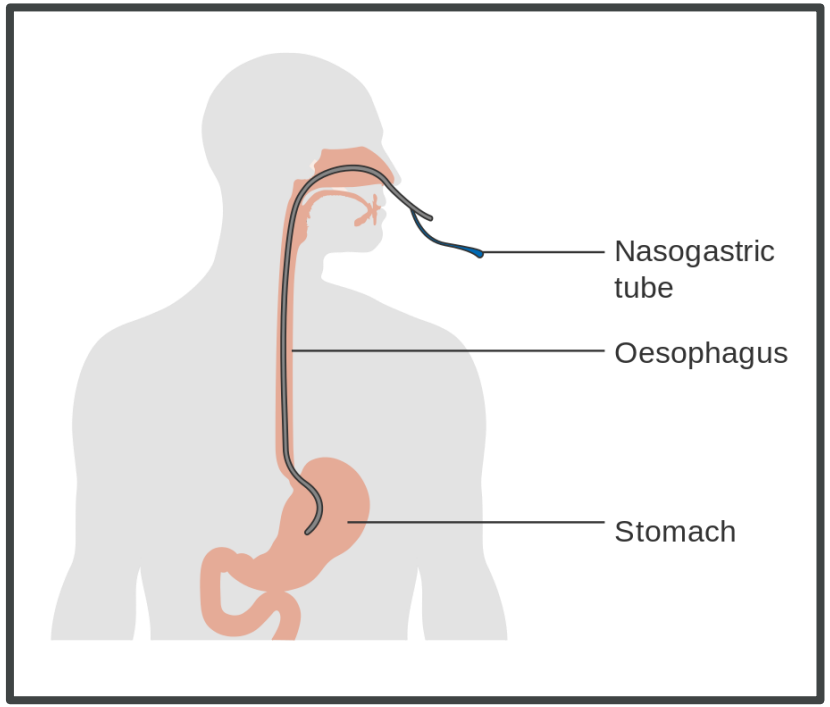
Tubes – Endotracheal & Orogastric (OG)

- **Endotracheal**
  - Inserted in mouth and ends in trachea
  - Connected to ventilator that pushes air in and out of lungs
- **Orogastric**
  - Inserted in mouth and ends in stomach
  - Administer tube feeds or medications
  - Remove gastric contents
- Usually in ICU setting
- **Mobility**: bed mobility ONLY
  - Usually needs another person to assist with lines



Tubes – Nasogastric (NG)

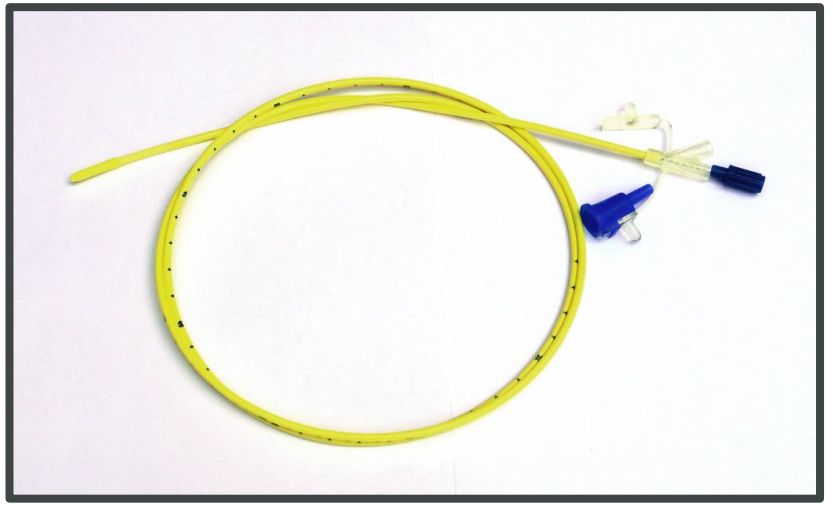
- Inserted in nose and ends in stomach
- Remove gastric contents and decompression of stomach at low intermittent suction (LIS)
- **Mobility – Wall suction**
  - ALLOWED but limited to only in room
  - Nursing staff could disconnect and reconnect at end of session
- **Mobility – Clamped**
  - ALLOWED with NO RESTRICTIONS
  - Make sure that device is secured to patient's gown with safety pin



Tubes – Dobhoff (Enteric Feeding Tube)

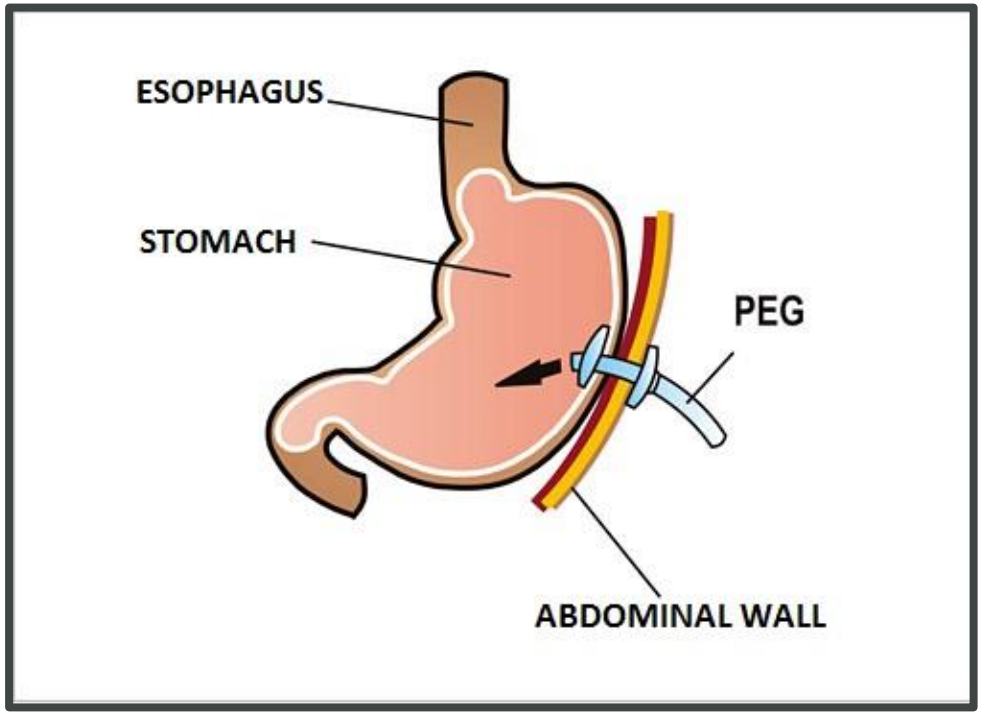
- Inserted in nose and ends in stomach or small bowel
- Smaller diameter than NG tube
- Could remain for weeks to months but usually temporary
- Provide enteral feeding for nutrition
- Prevention of translocation of gut bacteria

- **Mobility**: ALLOWED with PRECAUTIONS
  - Patient or provider may need to push IV pole if feeds are running



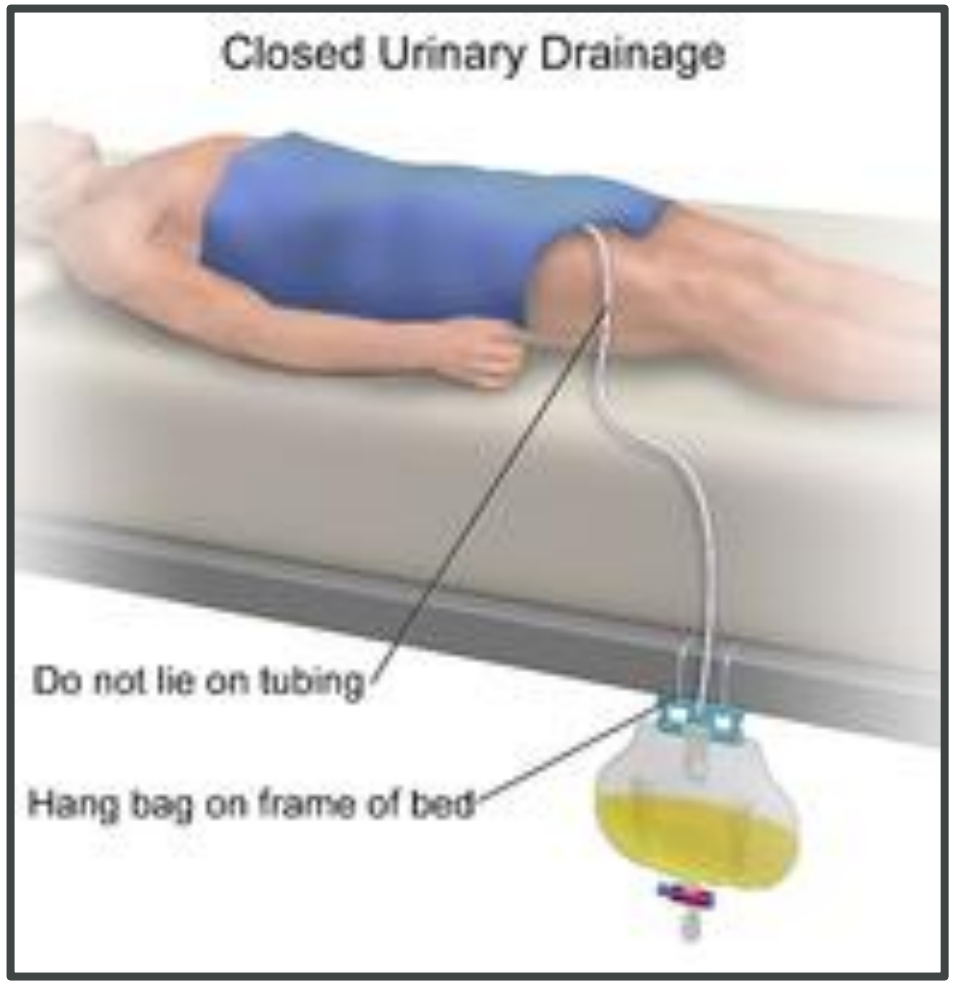
Tubes – Percutaneous Endoscopic Gastrostomy (PEG) or Jejunostomy (PEJ)

- Inserted through abdominal wall to stomach (PEG) or jejunum (PEJ)
- Provides long-term nutrition
- Medications can be administered through tube
  - Patients may not be able to orally consume
- **Mobility**: ALLOWED with PRECAUTIONS
  - Patient or provider may need to push IV pole if feeds are running



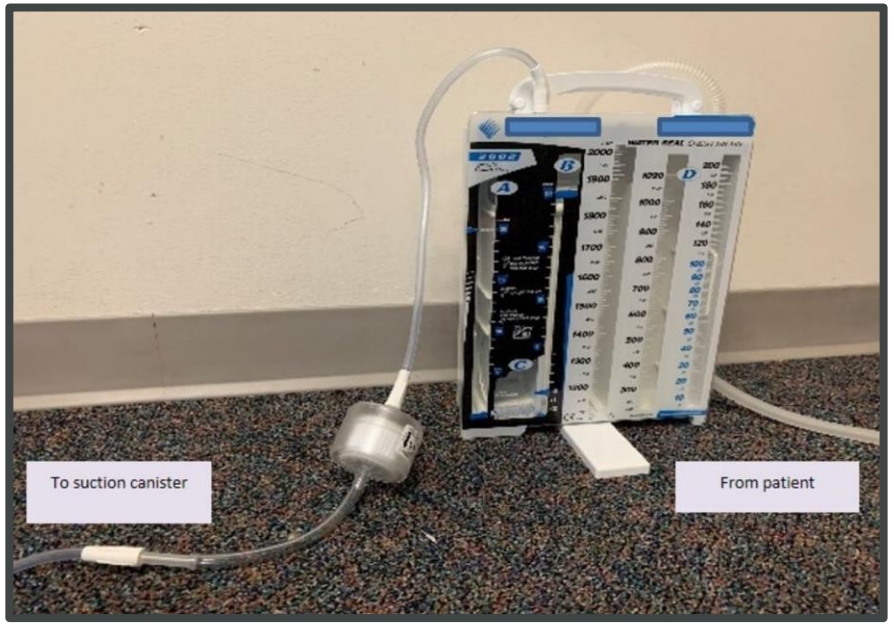
Tubes – Foley Catheter

- Inserted into urethra to the bladder
  - Balloon inflated internally to keep in place
- Keeps bladder decompressed
- Prevents wound contamination
- Secured by leg strap or statlock
- **Mobility**: ALLOWED with PRECAUTIONS
  - Patient or provider needs to carry or secure to AD



Tubes – Chest Tube

- Drain to remove air or fluid from pleural space
- Allow lung to function correctly
- Connected to chest drainage container
  - Needs to be below patient's chest
- Wall suction or water seal creates negative pressure to remove air or fluid
- **DO NOT TIP CONTAINER** (measuring purposes)



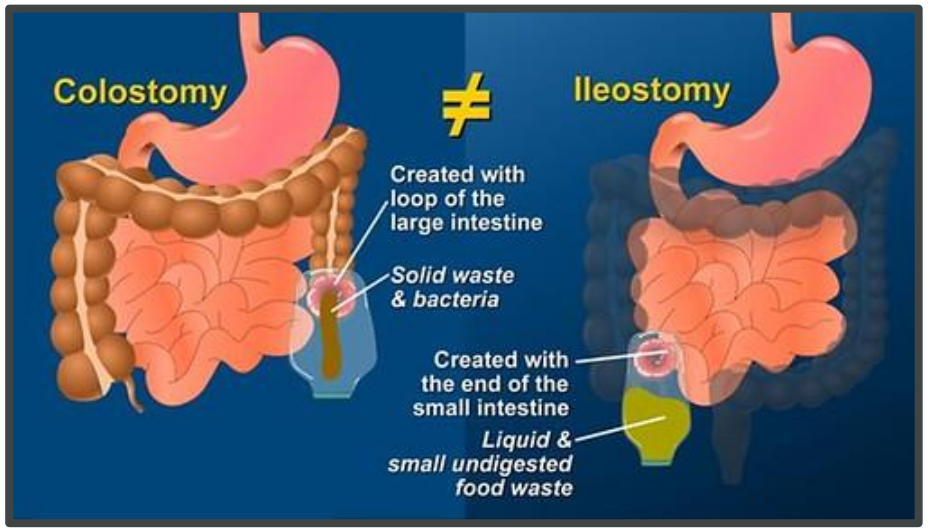
Tubes – Chest Tube

- **Mobility – Wall suction**
  - ALLOWED but limited to only in room
  - If mobility is allowed by provider, there would need to be an order for water seal
  - Nursing staff needs to disconnect and reconnect at end of session
- **Mobility – Water seal**
  - ALLOWED with PRECAUTIONS
  - Make sure that device is carried or supported on RW

Ileostomy & Colostomy Bags

- Pouch or bag used to collect stool from stoma (opening in wall of body)
  - Ileostomy – removal of small intestine
  - Colostomy – removal of large intestine/colon
- Temporary or permanent

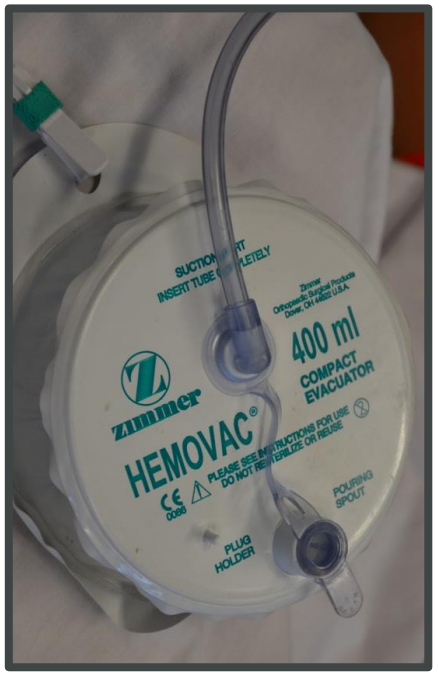
- **Mobility**: ALLOWED with PRECAUTIONS
  - Bag should be emptied if more than half full to prevent leaking or detachment
  - Gait belt should **NOT** be used on new ostomy creations



Drains – Hemovac

- Inserted to eliminate fluid from surgical site
- Usually removed 1-3 days after surgery
- Should be compressed → if not, notify nursing
- Compression creates negative pressure which allows fluid to move from site
- Various locations
  - Most common: neck, breast, back, knees

- **Mobility**: ALLOWED with PRECAUTIONS
  - Make sure that device is secured to patient's gown or is carried by provider



Drains – Jackson-Pratt (JP)

- Inserted to eliminate fluid from surgical site
- Compression creates negative pressure which allows fluid to move from site
- Bulb grenade shape
- Placed in OR by surgeons and usually removed at bedside

- Can be placed anywhere
  - Most common: abdomen, breast, chest, legs
- **Mobility – Wall suction**
  - Nursing staff needs to disconnect and reconnect at end of session
- **Mobility – Bulb suction**
  - Make sure that device is secured to patient's gown with safety pin
- If connected to wall suction, there are usually orders for bulb suction for mobility

Drain – Percutaneous (Perc)

- Inserted to remove fluid from a specific area or monitor/prevent obstructions
- Connected to flat collection bag
- Reasons for placement:
  - Abscesses, urinary obstructions (nephrostomies), biliary obstructions, leaks
- Placed in OR by surgeons or Interventional Radiology

- **Mobility**: ALLOWED with PRECAUTIONS
  - Drain should be emptied if more than half full
  - Make sure that device is secured to patient's gown with safety pin

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Negative Pressure Wound Therapy and Mobility

Thomas Shaughnessy, PT, DPT, CWS

Negative Pressure Wound Therapy

- Negative non-compressive dressing placed over wounds
- Benefits
  - Fluid removal
  - Angiogenesis
  - Constant suction on tissues accelerates growth
  - Can be used on a variety of wounds

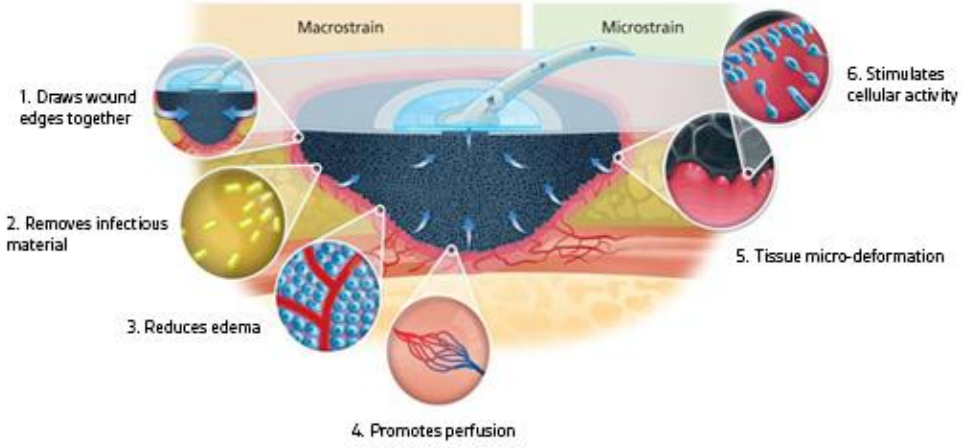

Fig. 1 KCI Microstrain, 2022

Negative Pressure Wound Therapy

- Alarms
  - Leak detected – airtight seal has been lost
    - Can happen during transfers, especially on sacral wounds with “shearing” to side of bed
    - Patch leak with extra NPWT drape/tegaderm
    - Call wound care
    - If leak can not be fixed, a WTD should be placed until the wound team or primary team can replace dressing

Negative Pressure Wound Therapy

- Blockage Detected – blockage in tubing, compression of tubing
  - Check dressing to make sure foam is not “puffed up” - if puffy, replace dressing
  - Check that clamps are open & patient is not lying on tubing
  - Check line for coagulated blood
- Low pressure alert – device is not running at set pressure
  - Lower device to floor
  - Check tubing as with blockage alarm
  - Call wound care or primary team

Negative Pressure Wound Therapy

- Mobility
  - Device can be hooked onto IV pole, WC or RW
  - Handle for carrying
    - Heavy
  - Plugs into wall to charge, battery life 8-10 hours
  - Ambulatory
  - Can be disconnected from suction for NO MORE THAN 2 hours if tubing is restrictive

Open Abdomen Negative Pressure Therapy System

Fig 2. GD Medical 2022

- Indicated for temporary bridging of the abdominal wall openings where primary closure is not possible and/or repeated abdominal entries is necessary
- The intended use of this system is for use in open abdominal wounds with exposed viscera
- Most often applied in the OR
  - Surgical conditions including peritonitis, intra-abdominal trauma and mesenteric ischemia

Open Abdomen Negative Pressure Therapy System

- Goals of the system
  - Manage critically ill patient at risk of developing systemic complications by controlling both the abdominal contents and the opening that gives access to the abdominal cavity
  - Eventually achieve delayed primary closure
  - Minimize herniation
  - Improve patient comfort and *promote ambulation!*

Fig 3. Acelity 3M KCI Abthera, 2022

Open Abdomen and Mobility

- There are no restrictions with patient with an open abdomen
  - Just remember their fascia is not closed!
- Try to restrict increasing intra-abdominal pressure
  - Log rolling
  - Restrict bending over, heavy lifting
  - Utilizing abdominal binder is *always recommended* when OOB

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Abdominal Surgery

Thomas J. Shaughnessy, PT, DPT, CWS

Exploratory Laparotomy (Ex-Lap)

Fig 4. Shaughnessy, 2019

- Can be used to explore:
  - Abdominal blood vessels, abdominal cavity organs, female reproductive organs, lymph nodes or membranes in the abdominal cavity
  - Typically end up with NPWT
    - Leave the incision open (closed fascia) to heal from the “inside-out”
- Things to look for:
  - Retention sutures
  - ABThera® – this means the fascia is not closed!
  - Abdominal binder
  - Ostomy bags

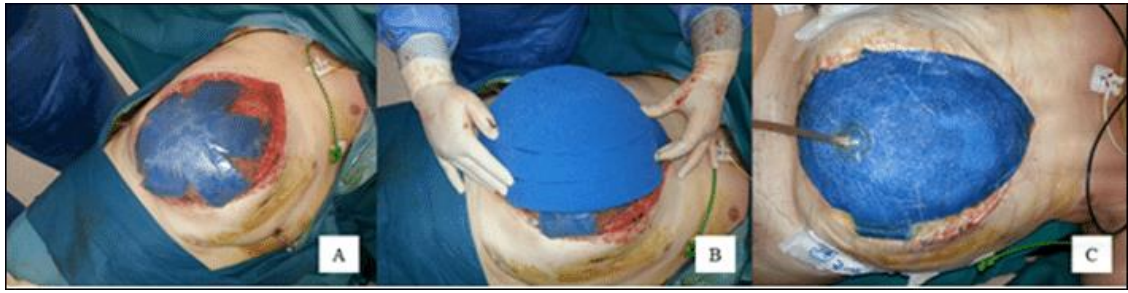

Fig 5. Research Gate, 2016

Exploratory Laparotomy (Ex-Lap)

- Retention sutures
  - Can be either vertical or horizontal
  - Provide reinforcement for abdominal wounds, but may cause more post-operative pain
  - May be left in for 10-24 days
    - 3 weeks is average
  - Do not impact the ability of the patient to mobilize

Photos courtesy of Thomas Shaughnessy, PT, DPT, CWS

Exploratory Laparotomy (Ex-Lap)

- Physical limitation
  - Five pound (5lb) lifting restriction for the first six weeks

- Getting out of bed
  - May have increased abdominal pain
  - Do not have any flexion restrictions
  - Do not have any mobility restrictions

Mobility Recommendations following Abdominal Surgery

- Position of comfort
  - Low fowlers (HOB 15º-30º)
  - Reduces surgical site tension
    - Especially important following dehiscence
    - Patient fear, pain
  - Towel roll for bracing, coughing, Valsalva
- Supine to sit
  - Log rolling
- Ambulation
  - Abdominal binder following surgery
  - 6 MWT

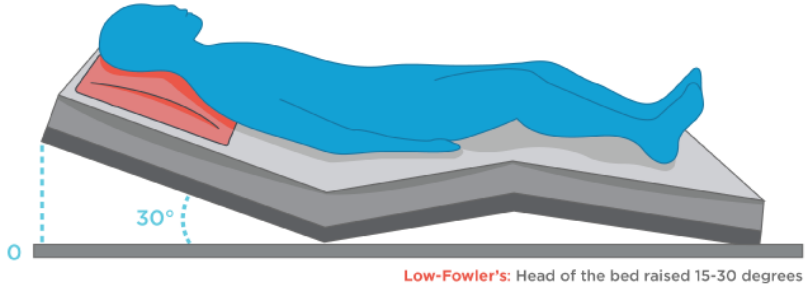

Fig 7. Permobil, 2017

Abdominal Surgery Mobility with Binder

- Saeed, 2019
  - 150 abdominal post-surgical patients
    - 10 excluded
    - 70 control with no abd binder
    - 70 with abd binder
  - Significantly improved post-operative pain and mobility (6MWT; POD4, 7)
    - No significant difference on POD 1
  - No significant difference in LOS

Fig 8. Ali Med, 2022

Abdominal Surgery Mobility with Binder

- Saeed, 2019

Visual analogue scale pain score		Postoperative day 1	Postoperative day 4	Postoperative day 7
Group	Binder	3.64 ± 1.92	1.52 ± 2.03	0.86 ± 1.81
	Non-binder	6.08 ± 1.78	4.11 ± 2.60	2.99 ± 2.01
p-Value		<0.001	<0.001	<0.001

6MWT distance (m)		PreOp mean	POD1	POD4	POD7
Group	Binder	299 ± 33	120 ± 26	214 ± 40	242 ± 38
	Non-binder	308 ± 42	109 ± 30	162 ± 31	200 ± 50
p -Value		0.278	0.0762	<0.001	<0.001

Abdominal Surgery Mobility with Binder

- Goals of Use
  - Reduce pain
  - Improve ambulation
  - Support strained tissues/muscles
  - If abdominal surgery left patient with NPWT, the binder will also prevent accidental removal of dressing
    - Stepping on tubing, caught on/under bed during transfers, etc.

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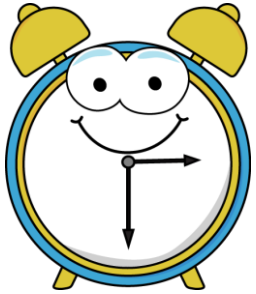
Pressure and Diabetic Injuries

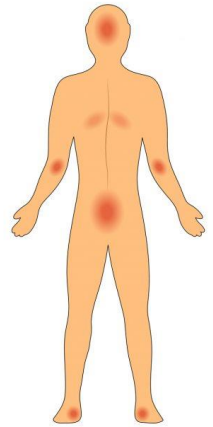
Thomas J Shaughnessy, PT, DPT, CWS

Pressure Injuries



- Time-Pressure Relationships
  - Ulceration can develop after only 2 hours of pressure applied at 500 mmHg and after 9 hours of pressure applied at 150 mmHg
    - 500 mmHg is equal to 9.6 pound-force per square inch
  - Older adults often have compromised CV function, which decreases mean capillary pressure, resulting in lower occlusive pressures and increased risk of ichemia

Pressure Injuries



Pressure ulcer

dangerous body area

Fig. 9 Rosenfeld, 2021

- Hygiene – skin clean and dry
  - Dampness from sweat, urine or excess water can cause maceration, making the kin more vulnerable to PU
- Skin Checks – should be check twice daily
  - Look for areas of redness that do not blanche
- Weight shifts – try to completely relieve pressure on the skin of the buttocks every 15-30 minutes for at least 1 full minute
  - WC push-up, forward weight shift
- Sleeping positions – change frequently and try and spend time on sides to completely relieve posterior
- Nutrition
  - Eat well-balance meals, protein is good
  - Drink non-caffeinated and non-alcoholic beverages to keep skin hydrated

Photo courtesy of Thomas Shaughnessy, PT, DPT, CWS

Sacral Decubitus Ulcers

- Pressure injury definition
  - A localized injury to the skin and/or underlying tissue usually over a bony prominence, as a result of pressure, or a combination of pressure and shear
- Can vary in time to form from individual to individual
  - Key factors
    - Health status, ability to change position, maintaining upright sitting position without slumping or sliding*

Sacral Decubitus Ulcers

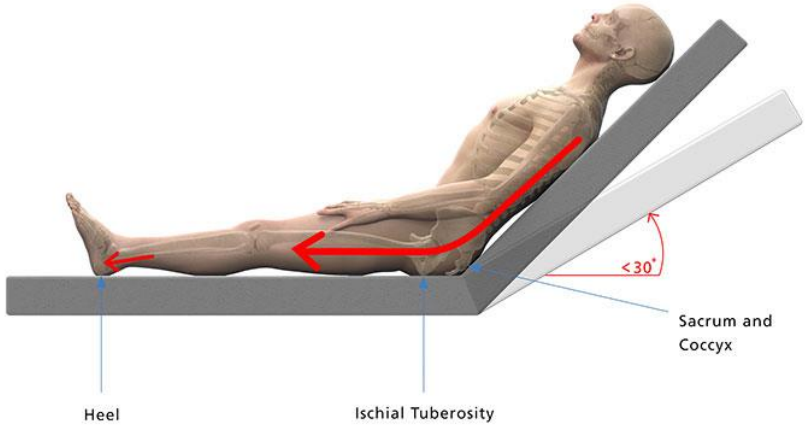


Fig 11. Research Gate, 2017

- Shear
  - Caused by the interplay of gravity and friction
  - Parallel force that acts to stretch and twist tissues and blood vessels at the bony tissue interface
    - Affects deep blood vessels and deeper tissue structures
  - Most common position for shear
    - Semi-fowlers position with HOB greater than 30 degrees
    - Patients' skeleton slides down toward the foot of the bed but the sacral skin stays in place
    - This produces stretching, pinching and occlusion of the underlying vessels, resulting in ulcers with large areas of internal tissue damage and less damage at the skin surface

Sacral Decubitus Ulcers

2/24/22
4.5cm x 1.7cm x 2.1cm

OR debridement =>
3/2/22

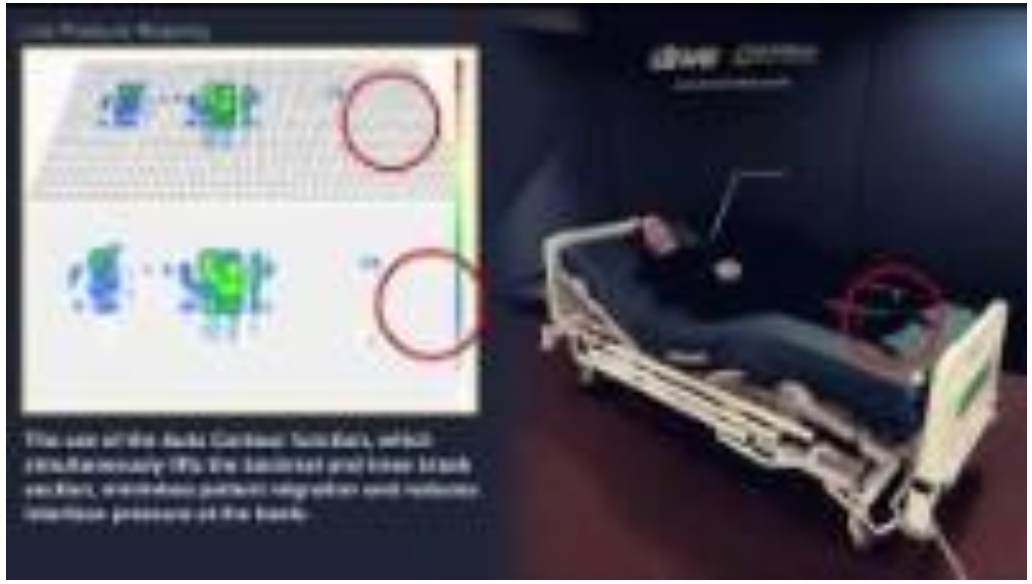
3/3/22
10.4cm x 11cm x 3.4cm

Photos courtesy of Thomas Shaughnessy, PT, DPT, CWS

Sacral Decubitus Ulcers

- How to position
  - In bed: keep HOB LESS THAN 30 degrees! (or chair position)
    - This helps to distribute the pressure across the upper and mid back, posterior arms and posterior upper legs
    - Decreases shear forces of patient sliding down the bed
    - Seated position transfers pressure to thighs
    - Support LEs to decrease shear

Fig 14. Drive Devilbiss Healthcare, 2021



Sacral Decubitus Ulcers

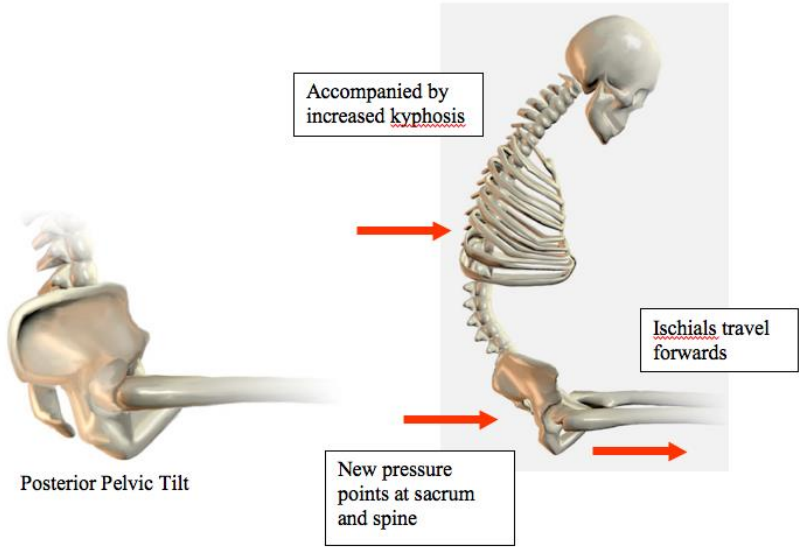


Fig 15. Body Heights, 2022

- How to position in sitting
  - Chair height: able to place feet on the floor with ankle in neutral
    - This makes sure the patient does not “slouch” down in the chair
    - Slouching increases posterior pelvic tilt, increases thoracic kyphosis and increases pressure on sacrum
  - Chair depth: if the depth is too long, this may cause sliding down in the seat in order to reach the front edge of the seat with their knees
    - Recommendation of minimum 2.5cm – 5 cm clearance between the edge of the seat and back of the knees
  - Chair seat back angle: Increase in chair back incline may promote pelvic tilt and sliding down in chair

Sacral Decubitus Ulcer

- Proper positioning
  - Upright chair with arm rests
  - Clearance of posterior knees
  - Neutral pelvis
  - Head support
  - Feet flat on floor
    - (indicated by angle of tibia)
  - Not covered in this section
    - Chair width, cushion preference, pressure redistribution

Fig 16. Posture Net, 2018

Diabetic Foot Ulcer (DFU)

- Open sore or wound that occurs in about 15% of patients with DM, often occurs on plantar aspect of foot
  - It is estimated that 50-84% of lower extremity amputations were preceded by a foot ulcer

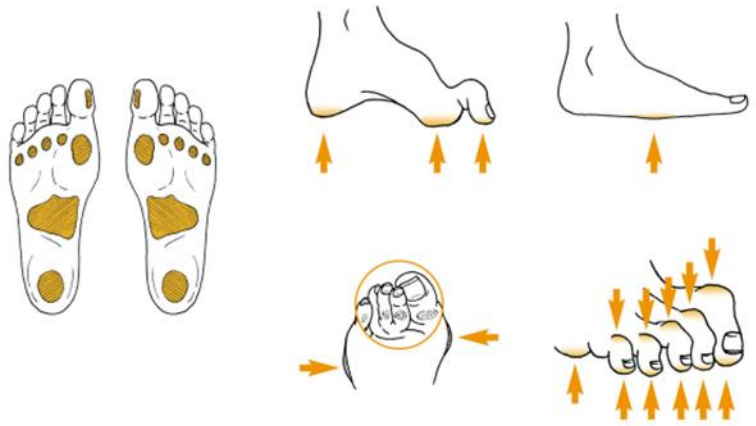


Fig 18. Schaper, 2020

Fig 17. Cooper, 2021

Diabetic Foot Ulcer (DFU)

- Offloading is the cornerstone in treatment
- Ulcers are caused by biomechanical stress
- Preferred offloading treatment (and gold standard) is non-removable offloading device (total contact casting)
  - Designed to fit closely with contour of leg
  - Majority of weight bearing is through tibial plateau, reducing force on the wound

Fig 19. Essity USA, 2022

Diabetic Foot Ulcer (DFU)

- TCC
  - Indications
    - Wagner grades 1 and 2
    - Offloading of active Charcot process
  - Contraindications
    - Infection
    - Deep wounds (Wagner grade 3)
    - Fluctuating edema
    - Claustrophobia

Grade 0	Intact skin
Grade 1	Superficial ulcer
Grade 2	Deep ulcer
Grade 3	Ulcer with bone involvement
Grade 4	Forefoot gangrene
Grade 5	Full-foot gangrene

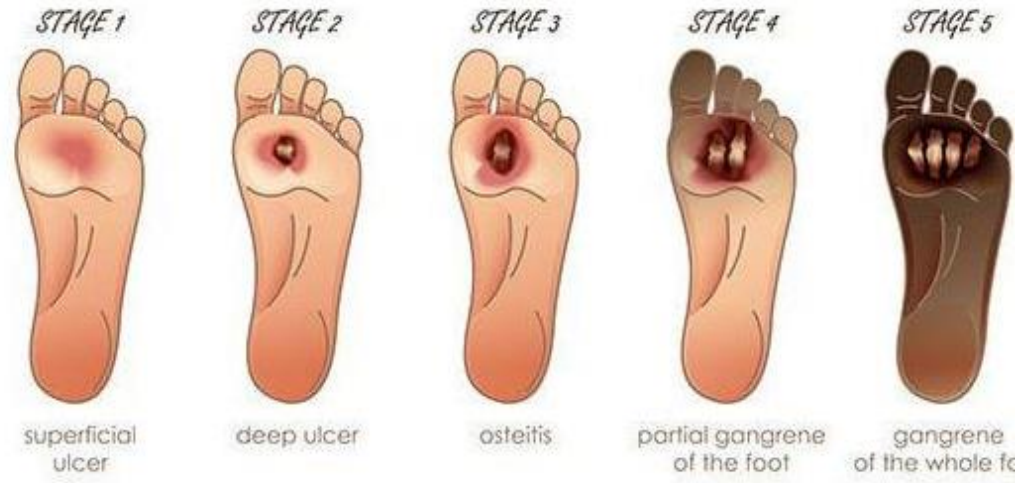


Fig 20 Franson, 2021

Diabetic Foot Ulcer

- When TCC is contraindicated or not tolerated:
  - Bivalve Casting (Removable)
  - Wedge shoes
  - Felt pad (cut out around the wound)
- Permanent Footwear
  - Patient should NEVER ambulate on an unprotected foot
  - Can be fabricated for sandals and easy slip-on shoes
    - May increase compliance when people awaken in the night to use the bathroom

DFU Ambulation Strategies

Fig 21. Eidelson, 2019

- Shuffling gait: reduces peak plantar pressures under 1st and 2nd metatarsals
  - Slower gait speed reduces ground reaction forces
- Increased hip flexion at push-off decreases forces through met heads and ankle
- Assistive devices
    - Cane, crutches or walker should be used in addition to offloading devices
    - Cane is most effective when used on contralateral hand
      - Reduces lateral pressures at greater magnitude than medial pressures
      - Contralateral use causes increased pressures unaffected great toe and 1st MTH

Fig 17. Cooper, 2021

Charcot Arthropathy

Fig 22. Baylor, 2021

- Relatively uncommon complication that can affect individuals with peripheral nerve disease
  - Hansens, syphilis, ETOH abuse, DM
  - Physical findings
    - Loss of protective sensation, edema, erythema, increased local temperature
      - Patient should rest with shoes off for 10 minutes then take temperature
    - Often misdiagnosed as cellulitis

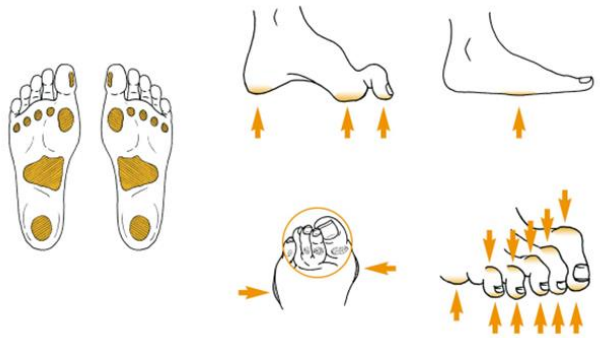


Fig 18. Schaper, 2020

Charcot Arthropathy

- *If the patient presents with a warm, swollen, neuropathic foot, the clinician should **assume** it is a Charcot fracture until otherwise diagnosed!*
  - 2 degrees Celsius constitutes a warm foot
- Immobilization should occur IMMEDIATELY
  - Non-weightbearing!!
  - Patients are typically off-loaded for 8-15 weeks
    - TCC or NWB

Charcot Arthropathy

Fig 23. Orthopaedia, 2018

- Initial treatment includes immobilization of the joint, reducing weightbearing to halt the inflammatory process and managing edema
- Most common offloading method is TCC
  - Cast typically changed every 1-2 weeks (fluctuating edema) until temperatures normalize (within 1 degree C of contralateral side for 2 consecutive weeks), edema is reduced and radiographic evidence of healing is present
    - Duration of treatment
      - 8-12 weeks if NWB
      - 18 weeks if PWB
      - Up to 12 months for certain location of Charcot fx

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Vascular Surgeries

Thomas J Shaughnessy, PT, DPT, CWS
Marie R Adams, PTA

Fasciotomy

Photos courtesy of Thomas Shaughnessy, PT, DPT CWS

Fasciotomy

- What is it?
  - Procedure in which vertical incisions are made, usually on the lower limbs (but can also be on upper limbs) to relieve acute compartment syndromes
    - Compartment syndrome in the lower extremities are most frequently the result from trauma, but can also be associated with reperfusion after ischemic injury, burns or prolong surgical positioning
- Incision is made above the affected muscle compartment, opening the restrictive fascia to relieve pressure and increase blood flow to muscles and nerves
- More than one incision may be required if multiple muscles are affected
- These are often true emergencies with the time from diagnosis to fasciotomy critical to help prevent muscle ischemia and necrosis
  - Muscle necrosis will occur in 3 hours of onset of ischemia with irreversible muscle and nerve damage occurring within 5 hours

Fasciotomy

Incisions

- Can be medial, lateral or both
  - Usually have moderate to heavy drainage
- Medial
  - Superficial posterior compartment
  - Deep posterior compartment
- Lateral
  - Anterior compartment
  - Lateral compartment

Table 1. *Compartments of the lower leg and the structures contained within.*

Compartments	Muscular and Neurovascular Structures Contained within the compartment
Anterior	Tibialis anterior, Extensor hallicus longus, Extensor digitorum longus and Peroneus tertius; Deep peroneal nerve (n.), Anterior tibial artery (a.) and vein (v.)
Lateral	Peroneus longus and brevis; Superficial peroneal n.
Superficial Posterior	Gastrocnemius, soleus, and Plantaris; Sural n
Deep Posterior	Popliteus, flexor hallucis longus, Flexor digitorum longus, and Tibialis posterior; Tibial n., Posterior tibial a./v. and the Peroneal a./v.

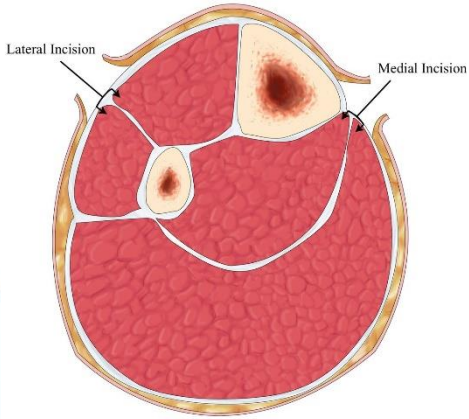
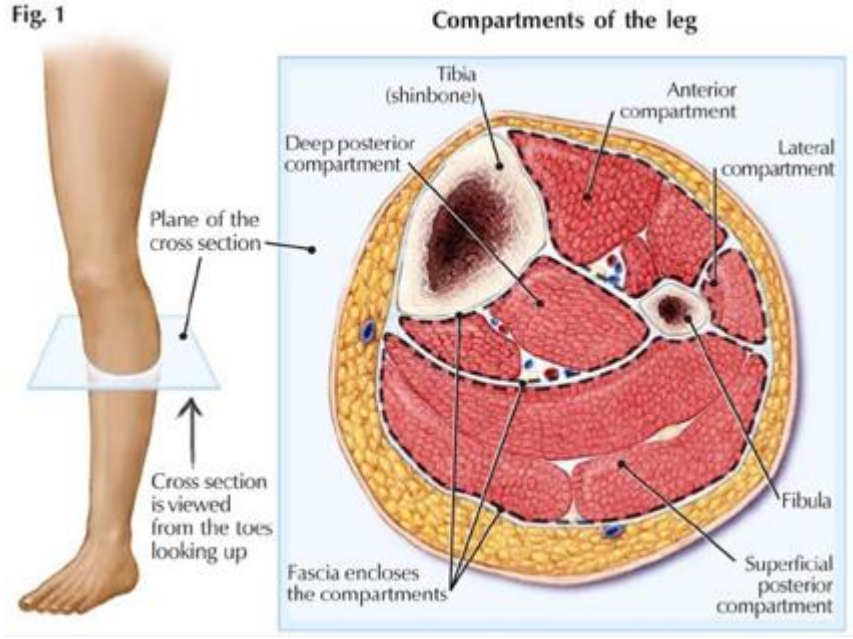


Fig 24. COSM, 2017



Fasciotomy

- Typically treated with NPWT and light compression for gross swelling
  - Heal by delayed primary closure
    - Closure versus STSG
    - See section on grafting for mobility implications following this procedure**
  - Early primary closure usually not possible due to edematous tissues
- Positioning
  - Elevation of limb – when in bed or chair
    - During surgery, the arterial supply has been restored to the limb and now the focus is on decreasing the edematous limb

Fasciotomy

- Implications for mobility
  - Patient can usually by OOB the following day as long as the wounds are closed or NPWT has been applied
  - If the compartment syndrome is due to fracture, patient will have a weightbearing restriction
    - If ischemic, often no weight bearing restriction
    - Often medically complex
      - May be intubated, sedated, have other surgeries, medically unstable
      - Often compartment syndrome is not CC
  - Foot drop can be present
    - Nerves take an ischemic insult
    - May be permanent or temporary
  - Pain may limit session
  - Eagerness to participate

Femoral-Popliteal Bypass Graft (Fem-pop)

- What is it?
  - A procedure used to treat femoral artery disease and bypass the blocked portion of the main artery in the leg using a piece of another vessel
  - Creates a wound in the groin region of the affected leg

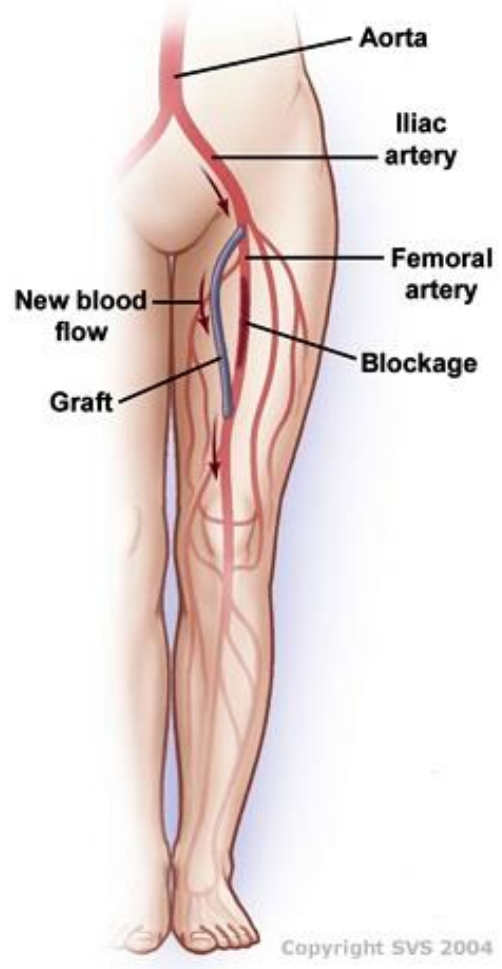


Fig 25. Starr, 2004

Fem-Pop Bypass

- A vertical incision about 10cm (4inches) long is made in the groin to expose the common femoral artery. This is the main artery supplying the leg, and is usually the point from which the bypass starts.
- A second incision of similar length is made to expose the artery below the blockage. This may be just above or below the knee and is on the inner side of the leg.
- Occasionally, the incision is lower in the calf, and may then be on either side.

Fem-Pop Bypass

- Things to look for:
  - Increased pain, redness, swelling or bleeding or other drainage from the leg incision
  - Coolness, numbness and/or tingling in the affected limb
    - Initial numbness may be temporary due to cutting of small nerves of the skin
    - Usually subsides in a few months
  - Chest pain, nausea and/or vomiting, heavy sweating or fainting

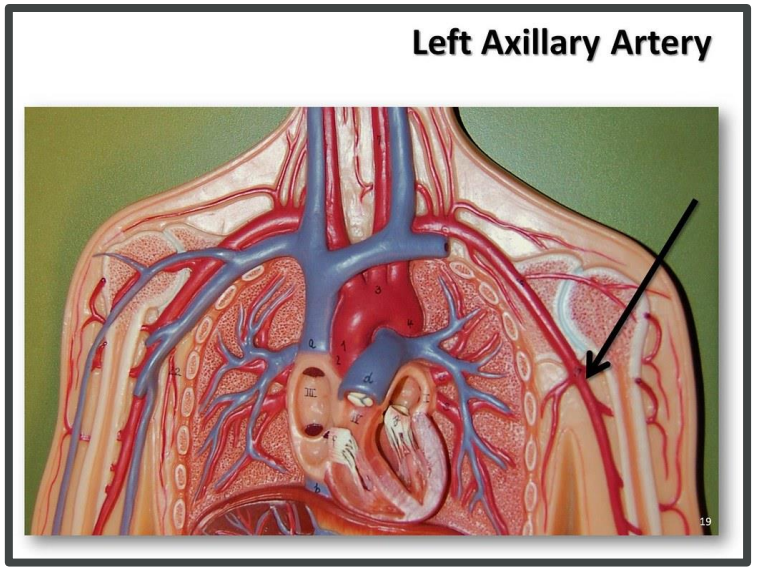
Photo courtesy of Thomas Shaughnessy, PT, DPT, CWS

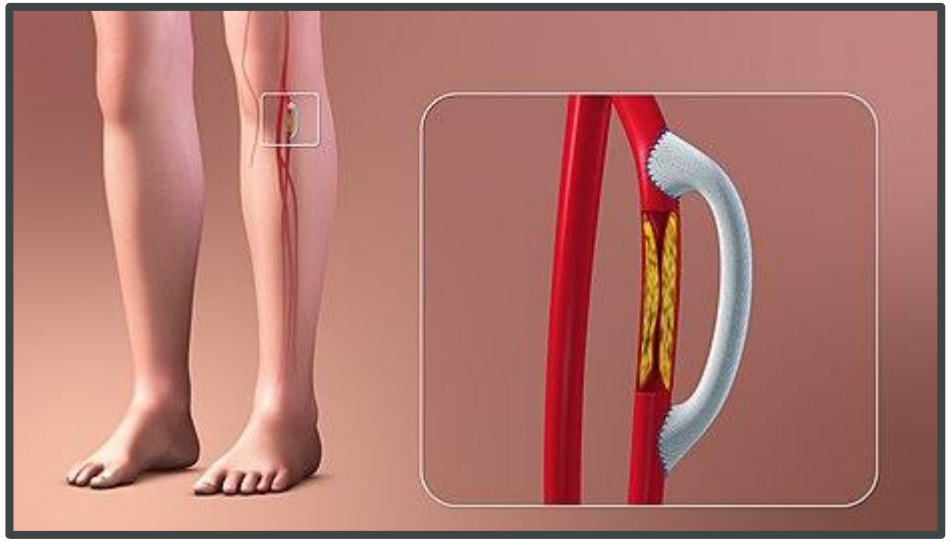
Fem-Pop Bypass

- PT Considerations
  - May have increased pain at surgical site
    - NPWT may be present
    - Expect moderate serous output!
  - Avoid heavy lifting and frequent stretching at first
  - Ambulation is encouraged, no risk of mobilization
    - Combined with rest
  - Driving: Safe to drive when patient is able to perform an emergency stop
    - This will normally be 2-4 weeks after surgery
- Return to work 6-12 weeks after surgery

Axillary-Femoral Bypass (Ax-fem)

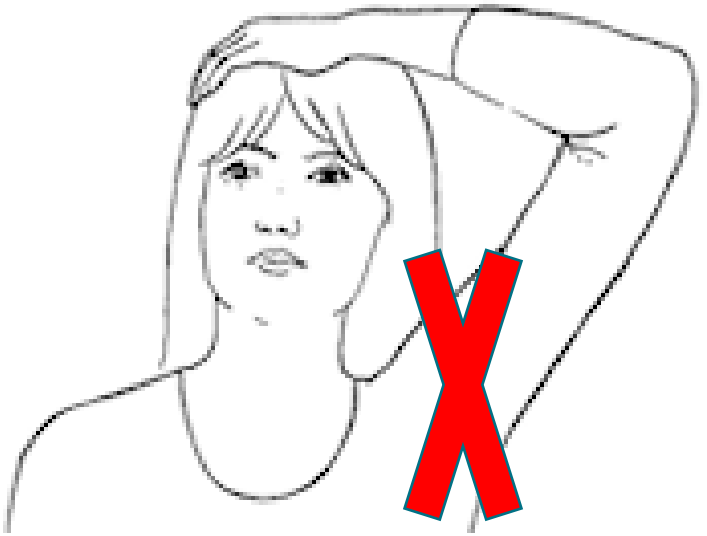
- Surgical procedure to create a new pathway for blood to flow to lower extremity due to poor blood flow
- Bypasses the area of blocked or narrowed artery
- Incision located in shoulder and groin
- Tube connects the axillary artery (in shoulder) to femoral artery (in leg)





Axillary-Femoral Bypass (Ax-fem)

- **Mobility**: ALLOWED with RESTRICTIONS
- For affected extremity:
  - NO SHOULDER flexion/abduction above 90 degrees
  - This can dislodge the graft/tubing
  - Surgeon decides for length of time but typically, it is forever
  - Patient usually needs education from all providers after surgery
- No weight bearing restrictions for UE or LE
- Allowed to use AD



Amputations – Most Common

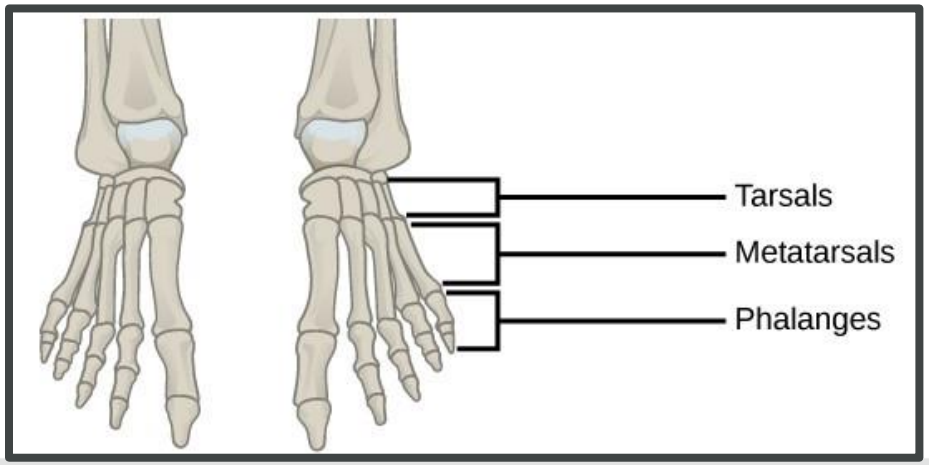
- **Toes**
  - One or multiple
- **Trans-Metatarsal (TMA)**
  - All toes at trans-metatarsal level
- **Trans-Tibial (BKA)**
  - Through the tibia and fibula
- **Trans-Femoral (AKA)**
  - Through the femur

- **Why?**
  - Peripheral Vascular Disease (PVD)
  - Trauma
  - Co-morbidities
- Completed by orthopedic or vascular surgery
  - Different protocols or weight bearing restrictions

Amputations – Toe(s) & Trans-Metatarsal (TMA)

- **Mobility:** ALLOWED with RESTRICTIONS
- **Weight bearing restrictions:**
  - Surgeon dependent
  - Typically, NWB for 6-8 weeks. Then, post-op shoe or toe-offloading shoe with doctor's orders
  - Some doctors may allow toe-offloading shoe for heel WBing only right after surgery
  - CHECK ORDERS & NOTES

- **Device to be used:** RW or crutches
- Elevate affected limb
- Minimize amount of time limb is in dependent position
- May wear a heel-protective boot while in bed



Amputations – Trans-Metatarsal (TMA)

- **Open TMA**
  - Wound is not surgically closed with sutures
  - May have wound packing or NPWT
  - DEFINITELY NWB

- **Closed TMA**
  - Wound is surgically closed with sutures
  - Usually, NWB (surgeon dependent)
  - May be toe-offloading/heel WBing with proper footwear

Amputations – Trans-Tibial & Trans-Femoral

- May be open or closed
- Surgical dressing should be present
- Some providers may want compression wrapping
  - Dependent on surgical service
  - Ace wrap bandage or tubular support bandage may be used
  - Eventual progression to stump shrinkers once wound is healed

Amputations – Trans-Tibial & Trans-Femoral

- **Mobility:** ALLOWED with RESTRICTIONS
- **Weight bearing restrictions:**
  - NWB on residual limb
  - This includes while in bed! No pressure on distal end of limb
- **Device to be used:** RW or crutches
  - Minimize amount of time limb is in dependent position
  - Would benefit from wearing closed footwear on unaffected limb

Amputations – Trans-Tibial

- Protective limb covering/brace
  - Need orders from provider
  - Wearing schedule as per provider
  - For any mobility
    - Transfers, ambulation
  - Overnight schedule to prevent contractures
    - 10 PM to 6 AM

- During the day, encourage knee flexion mobility

Amputations – Trans-Tibial & Trans-Femoral

- **Trans-Tibial**
  - Depending on length of residual limb, may need a wheelchair limb support
  - Can use pillow under the length of residual to elevate
    - NOT UNDER THE KNEE! Could lead to knee flexion contractures

- **Trans-Femoral**
  - Protective limb covering/brace
  - Available for patients but uncommon due to difficulty of wear

Amputations – PT related concerns

- **Toes**
  - Depending on which or how many toes, can impede balance
  - Post-op shoe?
- **Trans-Metatarsal**
  - Decreased balance due to change in WBing restrictions
  - May have a soft cast padding after surgery (increased weight of dressing may limit mobility)
- **Trans-Tibial**
  - Protective device needs to be secure
  - Phantom limb (foot)
- **Trans-Femoral**
  - Surgical dressing needs to be secure (most commonly to fall off)
  - Phantom limb (foot/leg)
- May have drains or NPWT
- Pain at surgical site

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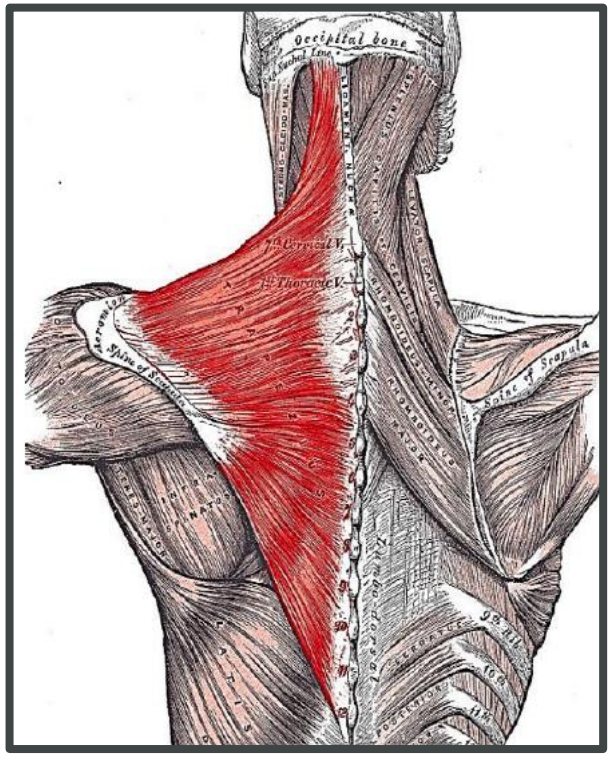
Flaps, Skin Grafts and Burns

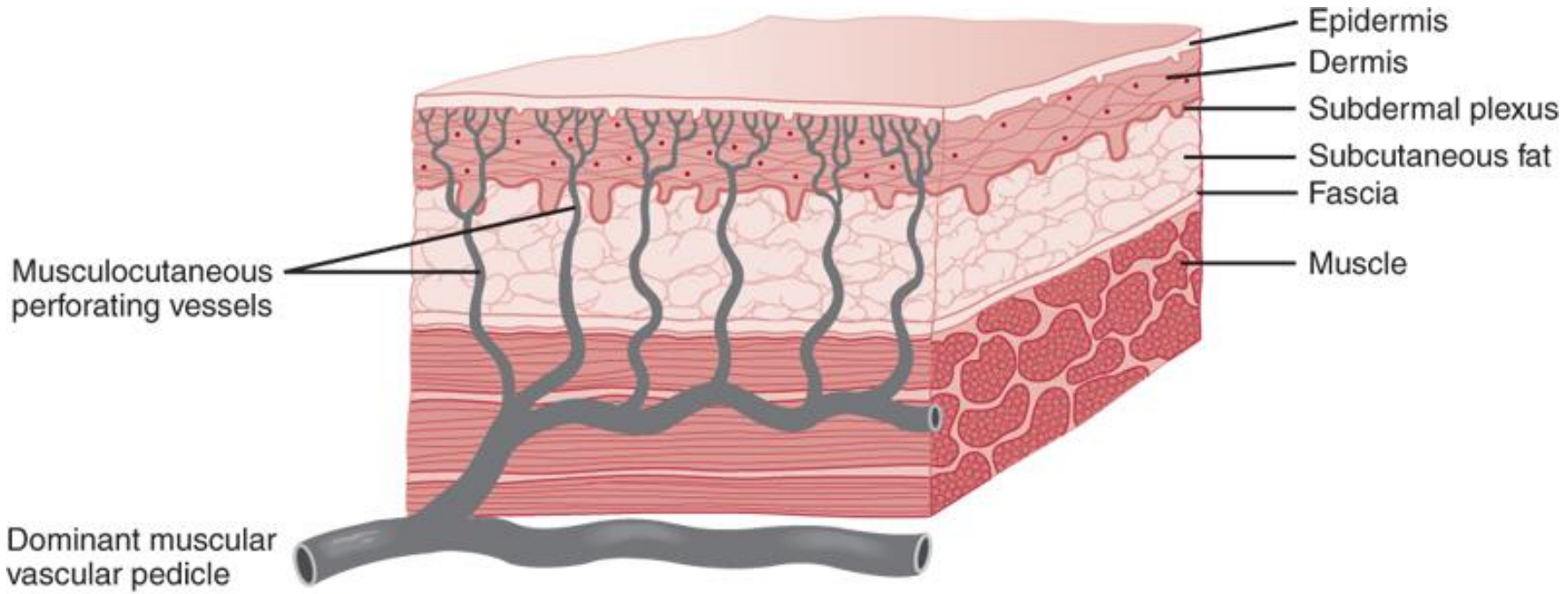
Marie R. Adams, PTA
Danielle T. Jeffreys, PT, DPT

Flaps

- Any tissue that retains part or all original blood supply after being relocated to a different area of the body
  - Includes skin and subcutaneous tissue
- Various types
  - Free flap, muscle flap, pedicled flap
  - Muscle flaps → latissimus dorsi, pectoralis major, rectus femoris, rectus abdominis, gluteus maximus, gastrocnemius
- Could happen for many reasons
  - Trauma
  - Wound closure



Flaps



Source: Gerard M. Doherty
Current Diagnosis & Treatment: Surgery, Fifteenth Edition

Musculocutaneous flaps perforating vessels.

Citation: Chapter 43 Plastic & Reconstructive Surgery, Doherty GM. *Current Diagnosis & Treatment: Surgery, 15e;* 2020. Available at: https://accesssurgery.mhmedical.com/ViewLarge.aspx?figid=242164895&gbosContainerID=0&gbosid=0&groupID=0&sectionId=242164724&multimediaId=undefined Accessed: May 12, 2022

Flaps – Dangle Protocol

- Patients hang reconstructed lower extremity in dependent position for a specific time each session
- This protocol is to allow the flap to gradually increase the venous pressure from gravitational forces
- Do not want to overload the flap with fluid or pressure

- Surgeon and institute dependent
  - Various start times from POD 2 to POD 28
- 14 days after surgery
  - 5 days of bedrest
  - After 5 days, lateral transfers only where LE is always elevated,
- Day 14, dangle protocol can start
- Reconstructed extremity is NWB

Flaps – Dangle Protocol

- Plastic surgery team, nursing staff and therapy work together to coordinate care
- One time during day shift, second time during night shift
- Pre-Dangle:
  - Remove all dressings
  - Apply gauze wrap over the flap
  - Wrap ace bandage from toes to knee with more pressure at the foot
    - Some providers want figure 8 pattern, others want spiral pattern
  - CHECK WITH PLASTIC SURGERY TEAM

Flaps – Dangle Protocol

- Dangle (TWICE DAILY)
  - Lower reconstructed extremity over the side of the bed for 3 minutes
  - Increase the length of time dangling the extremity by 30 seconds with each session → should continue up to 15 minutes
    - Session 1 – 3 minutes
    - Session 2 – 3 minutes and 30 seconds
    - Session 3 – 4 minutes
    - If patient has excessive throbbing that persists for more than 5 minutes when dangling, decrease the next session by 30 seconds
  - Elevate patients reconstructed extremity after dangle

Flaps – Dangle Protocol

- Re-evaluate flap (with nursing staff)
  - Remove ace wrap
  - Evaluate flap (typically with doppler)
  - Signs to evaluate after dangle: prolonged discoloration, increased edema
    - Nursing needs to contact plastic surgery team if signs don’t resolve within 15 minutes after dangle
  - Nursing usually completes wound care after dangle

Flaps – Dangle Protocol

- Therapy Considerations
  - Affected extremity is NWB
  - After 4-5 minutes → can attempt standing with AD
  - After 5-6 minutes → can attempt to ambulate with AD; stair climbing with portable stairs; bathroom transfers
  - After 8-9 minutes → can attempt to shower (with plastic surgery approval)
- After 15 minutes is achieved, most patients continue to be NWB (pending diagnosis) but can have affected extremity in dependent position as tolerated

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Burn Injury Recovery & Mobilization

Danielle T Jeffreys, PT, DPT

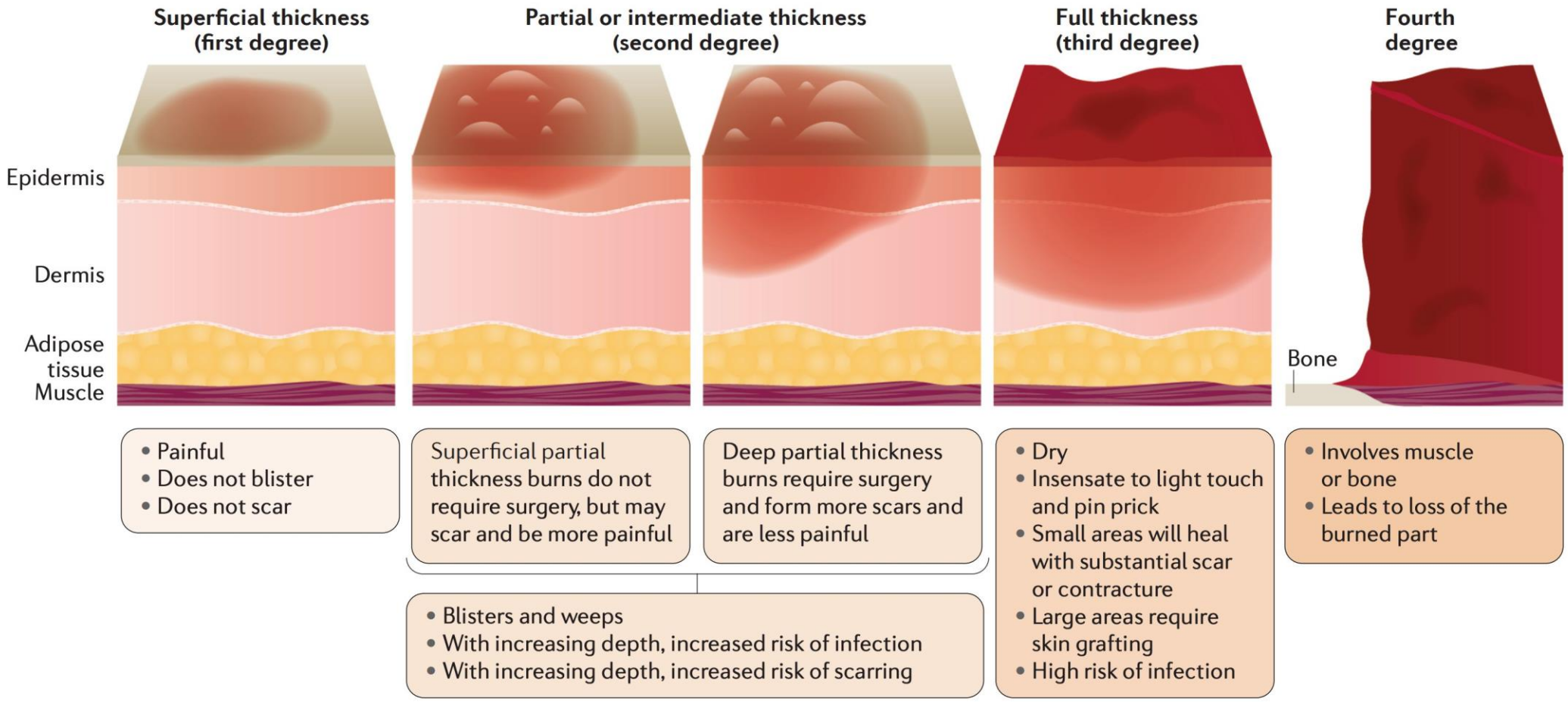
Objectives

- Discuss expectations of evaluating post-burn patients
- Understand PT/OT role in management of burn patients
- Post-operative considerations for mobility, including early mobility

Lehigh Valley Health Network Burn Center

- Lehigh Valley Regional Burn Center in one of 70 verified burn centers in the world
  - 67 are in the United States
  - 2 are in Canada
  - 1 is in Australia
- The American Burn Association (ABA) in conjunction with the American College of Surgeons (ACS) offers a program to verify that a burn center is meeting the highest current standards of care for the burn injured patient.

Classification of Burn Injuries



Jeschke, MG, van Baar, ME, Choudhry, MA, Chung, KK, Gibran, NS and Logsetty, S.

Classification of Burn Injuries

- **Superficial (First Degree)**
  - Involves only the epidermis
  - Causes erythema and edema
  - Will blanch
  - Painful secondary to intact nerve endings

Classification of Burn Injuries

- **Partial Thickness (Second Degree)**
  - Involves the epidermis and part of the dermis
  - Causes erythema, edema, blistering
  - Will blanch
  - Very painful secondary to intact nerve endings
    - Partial vs deep partial

Photos courtesy of Danielle T. Jeffreys, PT, DPT

Classification of Burn Injuries

- **Full Thickness (Third Degree)**
  - Involves the epidermis and all layers of the dermis
  - Causes blisters, erythema, edema
  - Skin may appear leathery or waxy,
  - Will look white, tan, or black
  - Will not blanch
  - Not painful secondary to destroyed nerve endings
  - Usually needs surgery to excise burn
  - If untreated, can lead to infection, severe dehydration, death

Photos courtesy of Danielle T. Jeffreys, PT, DPT

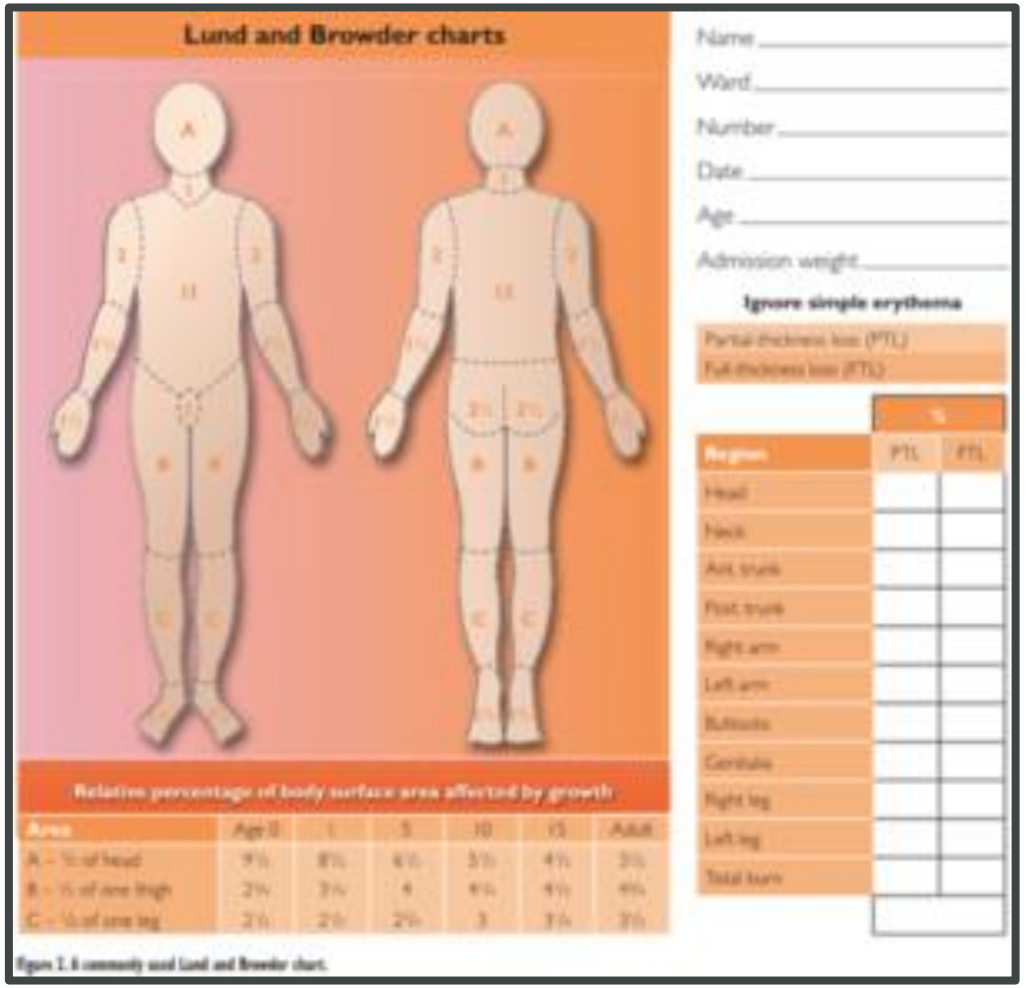
Classification of Burn Injuries

- **Full Thickness (Fourth Degree)**
  - Complete destruction of all layers of the epidermis, dermis, muscle, tendon, bone
  - Painless secondary to nerve destruction

Saied, Noha & Harfoush, Ahmed & Ayed, Tamer & Moustafa, Alaa & Hassan, Rania & Eldolify, Ezz & Abdelaziz, Hany. (2017).

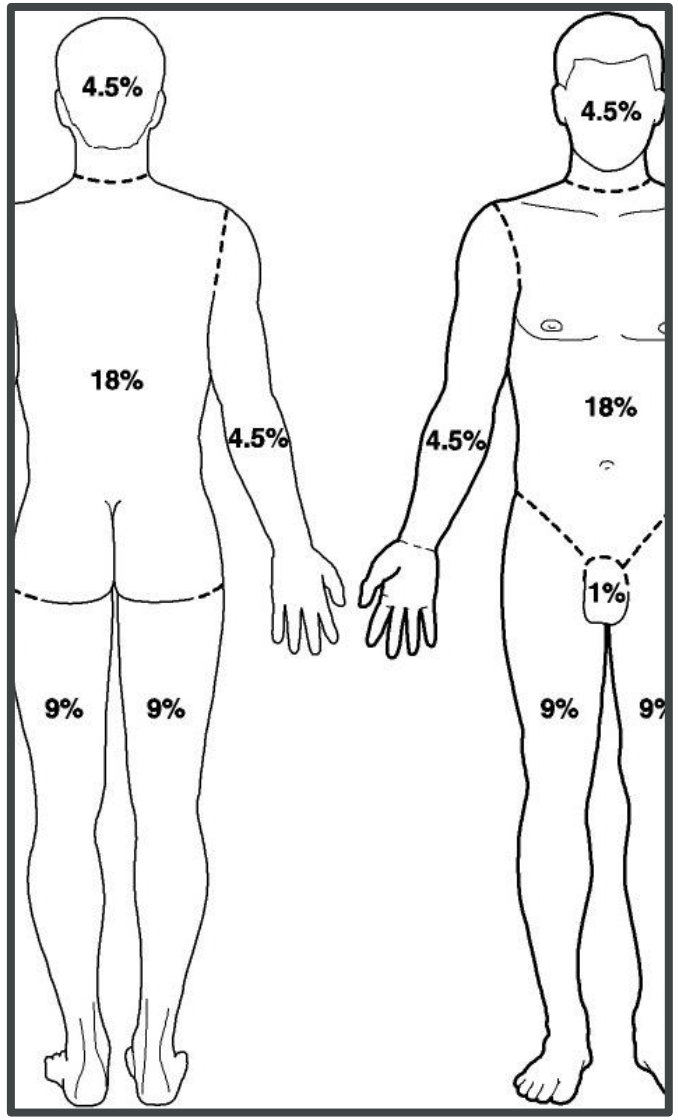
Lund-Browder vs Rule of Nines

- **Lund-Browder**
  - Method for estimating the extent of burns
  - Allows for the varying proportion of body surface in persons of different ages
  - It is used for children instead of the Rule of Nines
  - Children's heads occupy a larger area and lower limbs occupy a smaller area when compared to adults



Lund-Browder vs Rule of Nines

- **Rule of Nines**
  - Method for estimating the extent of burns
  - It is used for adults (% of total)
    - **Part** BSA
    - **Arm** 9%
    - **Head** 9%
    - **Neck** 1%
    - **Leg** 18%
    - **Anterior Trunk** 18%
    - **Posterior Trunk** 18%



Types of Burns

- **Inhalation**
  - Damage to the respiratory tract or lung tissue from heat, smoke, or chemical irritants
  - Also known as smoke inhalation injury
  - Inhalation injury resulting from fire remains one of the leading causes of death
- **Thermal**
  - Hot – flame, grease, scald, steam, contact
  - Cold – “frostbite” – exposure, contact
- **Radiation**
  - Cancer treatment
- **Friction**
  - Road rash, carpet burn, treadmill (abrasion + heat)
- **Chemical**
  - Concrete/cement (base), acids, hair dye, metals, air bag deployment
  - Acids coagulate while bases liquefy cells and tissue
- **Electrical**
  - High voltage contact – exit wound(s)

Types of Burns

Photo courtesy of Marie R. Adams, PTA, BA

Photo courtesy of Danielle T. Jeffreys, PT, DPT

Photo courtesy of Danielle T. Jeffreys, PT, DPT

Photo courtesy of Marie R. Adams, PTA, BA

Types of “Burns” –
Stevens-Johnson Syndrome & Toxic Epidermal Necrolysis

- Commonly caused by medications or infections
- Symptoms for both diseases include:
  - Peeling skin, fever, body aches, a flat red rash, and blisters and sores on the mucous membranes.
- Typically hospitalized in a burn unit, given fluids, and all suspected medications are stopped

- Skin peeling (slough) is the hallmark of these conditions
  - Involves the epidermis, which sometimes peels off in sheets from large areas of the body.
- **Stevens-Johnson Syndrome** causes only small areas of peeling skin
  - Affecting less than 10% of the body
- **Toxic Epidermal Necrolysis** causes large areas of peeling skin
  - Affecting over 30% of the body
- Involvement of 15 to 30% of body surface area is considered overlap of Stevens-Johnson Syndrome and Toxic Epidermal Necrolysis

Types of “Burns” –
Stevens-Johnson Syndrome & Toxic Epidermal Necrolysis

Types of “Burns” – Necrotizing fasciitis

- Rare bacterial infection that spreads quickly in the body
- Can cause death
- Accurate diagnosis, rapid antibiotic treatment, and prompt surgery are important to stopping this infection
- Public health experts believe *group A streptococcus (group A strep)* are the most common cause of necrotizing fasciitis

- Bacteria most commonly enters the body through a break in the skin, including:
  - Cuts and scrapes
  - Burns
  - Insect bites
  - Puncture wounds (including those due to intravenous or IV drug use)
  - Surgical wounds
  - Blunt trauma wounds (no broken skin)

Types of “Burns” – Necrotizing fasciitis

Photos courtesy of Marie R. Adams, PTA, BA

Types of “Burns” – Snake bites

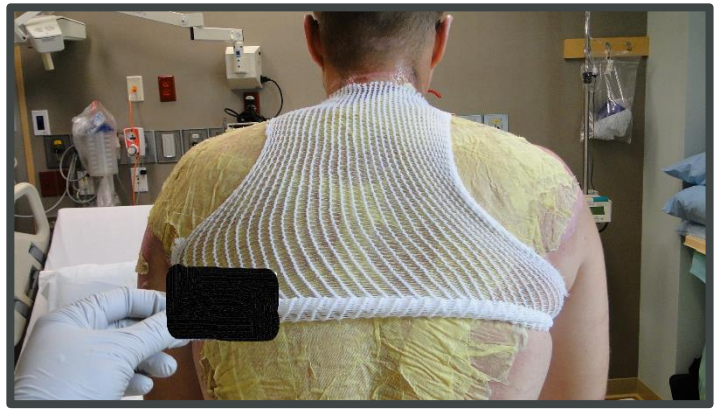
- **Snake bites**
  - CROFAB is a sheep-derived antivenin indicated for the management of adult and pediatric patients with North American crotalid (pit viper) envenomation

Photos courtesy of Danielle T. Jeffreys, PT, DPT

Burn Treatments

- **Superficial** (First degree burns)
  - Topical agent to keep burn/wound moist, pain control
- **Partial Thickness** (Second degree burns)
  - Suprathel ®, TransCyte ®, ReCell ®, DAO/Vasoline gauze, Collagenase, Mepilex ®, Mepitel ®
- **Full Thickness** (Third degree burns)
  - Skin grafting (FTSG, STSG), CEA
- **Full thickness** (Fourth degree burns)
  - Integra ®, BTM (+/- wound vac), flap, amputation

Burn Treatments – Suprathel ®



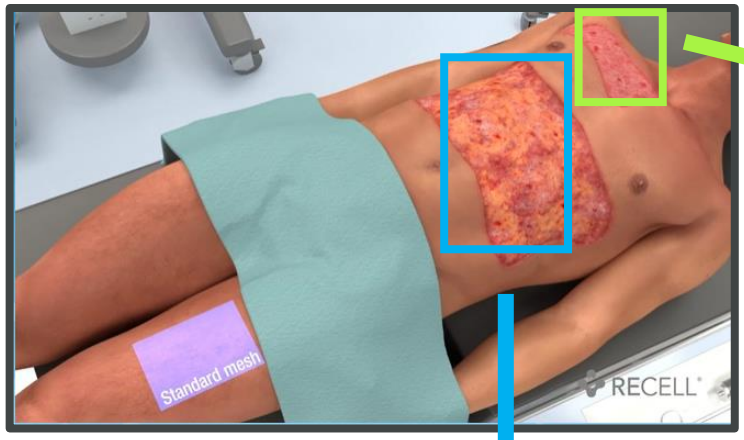
Photos courtesy of Danielle T. Jeffreys, PT, DPT

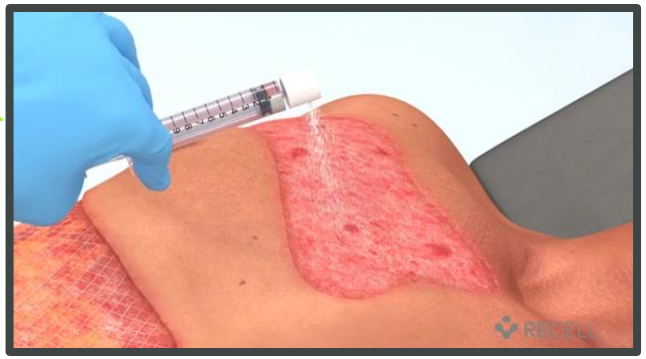
Photos courtesy of Marie R. Adams, PTA, BA

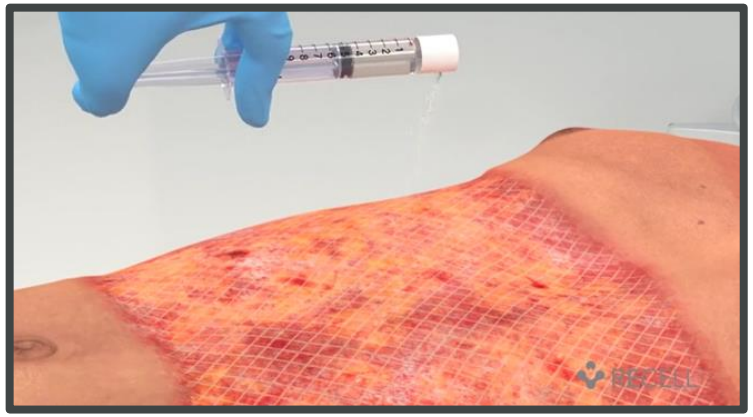
Burn Treatments – TransCyte ®

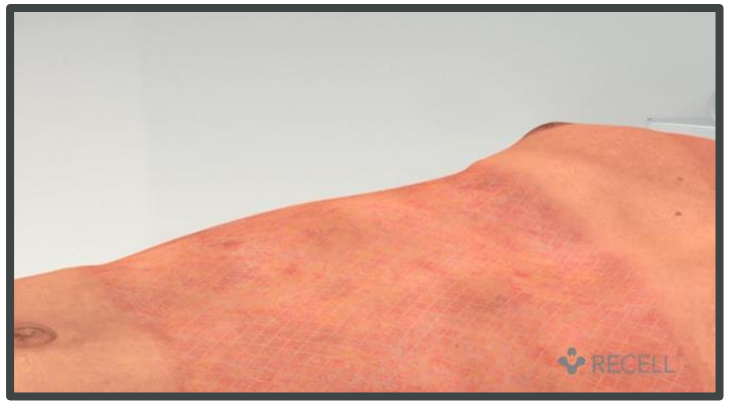
Photo courtesy of Marie R. Adams, PTA, BA

Burn Treatments – ReCell ®









Wood FM, Giles N, Stevenson A, Rea S, Fear M.

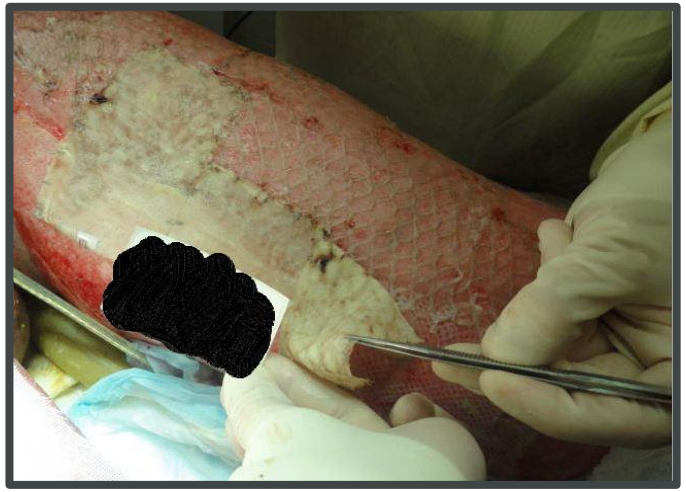
Burn Treatments – Split Thickness Skin Graft (STSG)

Photos courtesy of Marie R. Adams, PTA, BA

Burn Treatments – Full Thickness Skin Graft (FTSG)

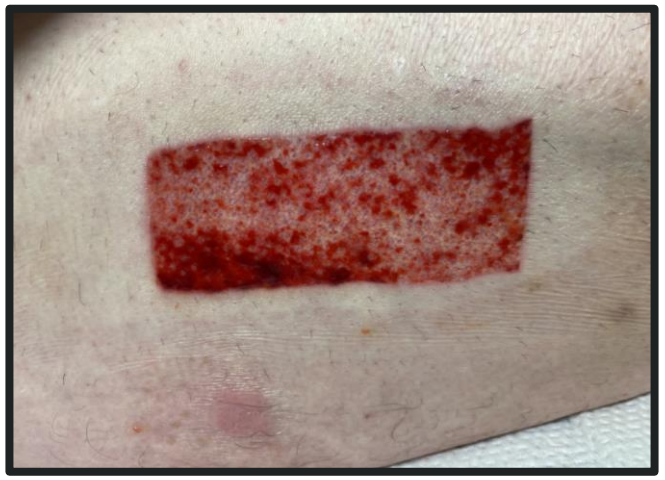
Photos courtesy of Danielle T. Jeffreys, PT, DPT

Burn Treatments – Cultured Epithelial Autograft (CEA)



Photos courtesy of Danielle T. Jeffreys, PT, DPT

Burn Treatments – Donor sites



Photos courtesy of Danielle T. Jeffreys, PT, DPT

Burn Treatments – Integra ®

- Outer layer of silicone with an inner matrix of collagen from bovine tendon/cartilage and glycosaminoglycans derived from shark cartilage
- Enhances wound healing
- Makes a more formidable wound bed to prepare for skin grafting

Burn Treatments – Biodegradable Temporizing Matrix (BTM)

- Type of wound dressing
- Intended for treatment of full-thickness wounds and burns
- The dermal structure has been lost to trauma or damaged
- Requires surgical removal and requires a split-thickness skin graft for final closure

Photos courtesy of Danielle T. Jeffreys, PT, DPT

Therapy Considerations

- **Graft Shearing**
  - Bed mobility
  - Transfers
- **Grafts directly crossing joints**
  - Splinting
  - ROM
  - Strengthening
- **Mobility**
  - Lower extremity compression with tubigrip or ace wraps for graft support
- **Comfort = Contracture**

Early Ambulation Initiative Following LE Grafts in Comparison to Our Center's Traditional Standard of Care: A Retrospective Data Review

Danielle T Jeffreys, DPT; Lisa LePage OTR/L, BT-C
Lehigh Valley Health Network, Allentown, Pa.

Introduction

Our traditional practice guideline following lower extremity grafting is loosely defined as post-operative bedrest vs. lateral transfers only until POD#5. Patient's mobility status is increased POD#5 with WB established per physician discretion. A proposal was created to initiate mobility earlier than POD#5 for patients with LE grafts. Two of our three surgeons were in agreement with the early ambulation protocol. The third surgeon wished to follow the traditional ambulation practice guideline. This request was respected and made known to all staff for carryover. This afforded us the opportunity of a comparison group with our center's traditional standard of care functioning as the control group.

96%

of patients demonstrated
no graft loss with first dressing change
following early ambulation guideline

Methods/Design

The proposed early ambulation protocol was influenced by previously researched guidelines found in Practice Guidelines for Early Ambulation. by Nedelec et.al in combination with the input of our burn surgeons. Criteria was based upon the location of grafting, graft crossing a joint, size of wound being grafted (< or = 400 cm), and general medical status of the patient. Our early ambulation protocol was established as follows:

POD#1	Lateral transfers with involved LE elevated
POD#2	WBAT, Dependent LE at edge of bed, WBAT short distance ambulation to chair or bathroom with AD.
POD#3-4	Increase ambulation as tolerated, assess need for continued splinting, assess appropriateness of progressive ambulation, assess need for assistive device, AROM exercises
POD#4-5	Progress ambulation with AD as needed, stairs as needed for discharge, home exercise program

Inclusion Criteria: LE burns with STSG not involving joints, STSG involving joints with appropriate immobilization

Exclusion Criteria: fractures of involved LE, patients who were non-ambulatory at baseline, wounds >400 cm2, STSG to plantar aspect of foot, medically unstable patients, and surgeon discretion.

Results/Findings

Data reviewed over an eight month period of time yielded 27 patients who met our established criteria; 26 had no graft loss on the first dressing change. The graft loss was attributed to placement directly over bone of the distal phalnx. Comparatively, no loss was noted in the control group with 10/10 patients ambulating on POD#5. Of note, early ambulation was granted for several patients with larger surface areas with no graft loss demonstrated, but were not included in this study.

Conclusions/Implications

In conclusion, 96% of 27 patients demonstrated no graft loss with first dressing change following our early ambulation guideline. All 10 patients who followed the traditional ambulation guideline demonstrated no graft loss on the first dressing change. Based on our findings, early mobility is not detrimental to graft integrity following specific established guidelines.

Our data supports early mobility of LE grafting up to 400 cm2 with 96% success rate. This may be supportive of further research with early mobility involving a larger surface area of LE STSG.

Photo courtesy of Danielle T. Jeffreys, PT, DPT

Early Ambulation & Mobility Protocol

- All patients to have double compression
  - Ace wrapping and Coban ®
- Elevate extremities when at rest

Early Ambulation & Mobility Protocol

- **POD 0**
  - OOB to chair
  - NWB to affected extremity
  - Dangle (if pt tolerates)
- **POD 1**
  - WBAT to affected extremity
  - Dangle (if pt tolerates)
  - Short distance ambulation to chair or bathroom with assistive device (if pt tolerates)
- **POD 2 – 3**
  - Progress ambulation distance as able
  - At dressing change:
    - Assess need for continued splinting
    - Assess if appropriate for progressive ambulation & ROM
- **POD 3 – 5**
  - Progress ambulation in hall with assistive device as needed
  - Stairs as needed for discharge home

Early Ambulation & Mobility Protocol

- **Inclusion criteria**
  - Patients of any age
  - Burns with STSG over joints with appropriate immobilization of joint
    - Knee immobilizer
    - Scotch cast or thermoplastic orthosis for ankle
- **Exclusion criteria**
  - Fractures
  - Patients with pre-burn inability to ambulate
  - Wounds >300 cm^2
  - Medical status prohibiting mobility
  - STSG to plantar aspect of foot

Early Ambulation & Mobility Protocol

Goals

- Increase mobility
- Increase independence
- Increase ROM to improve function post grafting
- Decrease length of stay
- Decrease need for inpatient or subacute rehabilitation
- Decrease need for assistive device use at discharge
- Decrease risk of DVT

Positioning & Splinting

- Post-operative scotch-cast splint
- Think outside the box dependent upon location and type of graft
- Consider every joint beyond traditional OT/PT boundaries
- Avoid flexion postures

Typical positioning of lower extremity entails applying a demi-boot with a wearing schedule.

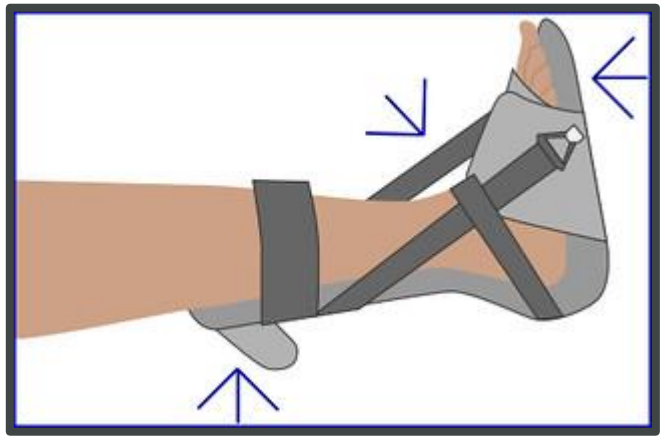
Photos courtesy of Marie R. Adams, PTA, BA

Positioning & Splinting

- When burn scars cross a joint, important to evaluate ROM daily to initiate splint or alter current wear schedule

Photo courtesy of Danielle T. Jeffreys, PT, DPT

- If seeing early signs of contracture, consider night splinting or positioning to balance functional use and ROM during the day



Positioning & Splinting

Photo courtesy of Danielle T. Jeffreys, PT, DPT

Photos courtesy of Lisa Lepage, OTR/L, BT-C

Custom Fabricated Open Anterior Ankle Foot Orthosis to Promote Early Mobility with Lower Extremity Grafts

Lisa LePage, OTR/L, BT-C
Lehigh Valley Health Network, Allentown, Pa.

Learning Objectives

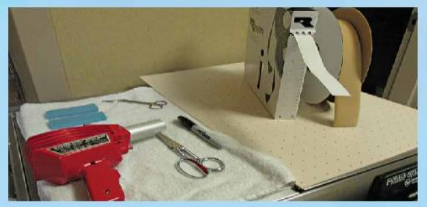
- Understand the process of fabrication of an anterior ankle foot orthosis
- Immobilizing ankle with open anterior approach to promote graft integrity and early mobility following lower extremity STSG

Introduction

Distal lower extremity STSG's present a challenge with the balance of early mobility and immobilization of the ankle. Traditional commercially available ambulation boots or pre-fabricated orthotics may impose circumferential compression endangering graft integrity. Custom fabricated posterior AFO's comprised of thermoplastic, scotch cast or fiberglass materials are not recommended for weight-bearing of the lower extremity during mobility/ambulation. What may also hinder promotion of early mobility is having a multitude of injuries or advanced age with decreased ability to adhere to a LE NWB status. An anterior approach to immobilization of the ankle was thought of to free the plantar surface of the foot for weight-bearing. The open concept of the orthosis itself minimizes direct contact with the involved LE graft. This promotes graft integrity during mobility with ankle immobilization.

Materials Needed

Thermoplastic material, scissors, strapping, dense blue adhesive foam, adhesive Velcro and a heat gun.



Fabrication

1. Measure the distance of where the desired proximal end of the splint would be to the patient's metatarsal heads on the dorsal aspect of the foot, then double it to calculate the amount of material needed.

2. The width of the material should be approximately 3 to 4 inches. The material should be warmed and folded together so the width of the material is reduced to approx. 1½ to 2 inches. This will increase the stability of the material. Shape the folded material into a continuous oval and place on the patient's distal LE.

3. As the material cools, shape the oval away from the medial and lateral aspects of the distal LE restricting the points of contact to the anterior most proximal and distal aspect of the desired splint parameters.

4. Remove once cooled and add dense blue adhesive foam to the 2 points of contact that will rest against the patient. This will allow for a slight area of allowance or "give" of the splint to allow support during weight-bearing of the LE/foot.

5. Velcro and straps are added to the proximal and distal ends of the oval; heating the adhesive side will imbed the Velcro allowing increased durability with repeated donning/doffing.

Results/Findings

Different degrees of weight-bearing are allowable with the open construction of this anterior ankle-foot orthosis eliminating contact with the distal LE STSG. The forefoot and heel are available to weight bear safely within the confines of the open anterior ankle foot orthosis.

Patients have been trialed with and without an assistive device with success in the achievement of ankle immobilization with mobility. Weight-bearing instructions that accompany this splint wear is foot placement rather than a normal heel strike cadence to avoid undue pressure at the proximal aspect of the splint on the lower extremity

Conclusions/Implications

This splint has been successfully utilized for immobilization without compromise to STSG integrity due to the anterior open support it offers the ankle. Perhaps this concept could be applied to other joints to avoid direct contact of the splint with STSG during the initial stages of healing.

Photo courtesy of Danielle T. Jeffreys, PT, DPT

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Questions?

Marie’s Questions

- 1. **True or False?** ALL mobility is appropriate when a patient has an arterial line (A line) inserted.
- 2. **True or False?** A gait belt should NOT be used on a patient with a new colostomy or ileostomy bag.
- 3. **True or False?** Mobility is allowed when a patient has a chest tube connected to wall suction.
- 4. **True or False?** A patient with an axillary-femoral bypass does not have any ROM restrictions.
- 5. **True or False?** The rehabilitation team is solely responsible for the dangle protocol.

Marie’s Answers

- 1. **FALSE** – Only bed mobility is appropriate when a patient has an A line
- 2. **TRUE**
- 3. **TRUE** – only short distances in room is allowed
- 4. **FALSE** – There should be NO SHOULDER flexion/abduction above 90 degrees (typically forever)
- 5. **FALSE** – The dangle protocol is a multi-disciplinary collaboration between plastic surgery, nursing and rehabilitation

Danielle's Questions

- **True or False?** A third-degree burn does NOT require surgery.
- **True or False?** A second-degree burn is very painful because the nerve endings are still intact.
- **True or False?** The Lund-Browder is a method to estimate the extent of burns for children.
- **True or False?** Full thickness skin grafts are meshed in order to cover a larger area.
- **True or False?** A therapist should encourage early mobility when working with patients from the burn population.

Danielle's Answers

- **FALSE** – A third-degree burn will most likely require surgery to be excised
- **TRUE** – A second-degree burn usually has the nerve endings intact; therefore, it is very painful
- **TRUE** – Lund-Browder is used for children where Rules of Nines is used for adults
- **FALSE** – Split thickness skin grafts are meshed, and full thickness skin grafts are NOT meshed
- **TRUE** – Early mobility is key for burn patients.