Management of Chronic Wounds

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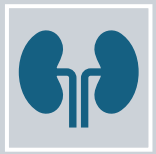
Objectives



Review data on care of chronic leg wounds (focusing on venous ulcers)

Using cases discuss management including dressings and edema management.

Learn practically how to choose dressings and manage edema

Epidemiology of Chronic Leg Wounds

- Venous Leg Ulcers:
  - Prevalence 2%, increases to 5% over 65 yrs old
  - Estimated in developed countries: 2% general population, 2.5% nursing homes, 0.05% hospitals (Team et al. Wound Rep Reg. 2019)
  - Incidence: 70-80% of all clinical ulcers
  - Recurrence: Within 6 months: 50-70% (Nicolaides, Adv Ther. 2020); Within 5 years: up to 70% (Raffeto et al. J. Clin. Med. 2021)
- Pressure Injuries:
  - Most common and costly medical error
  - Occur in almost 5% of patients over 65 & incidence increases with age
  - Prevalence in American hospitals is 12.3% (Noie, et al., Int. Wound J, 2024)
  - Incidence: 2.5 million people each year (AHRQ, www.ahrq.gov, downloaded 3/20/2025)
- Arterial Ulcers:
  - 5-20% of all nonhealing lower extremity ulcers
  - More prevalent in geriatric population (Mayrovitz et al., Cureus, 2023)

Delayed Healing = Chronic Ulcer

- Acute wounds heal within 4 weeks
- Chronic VLU average 6-12 months to heal—stuck in inflammatory phase
- Delayed wound closure: (Dini et. al. J Tissue Viability 2020; Raffetto et al. J. Clin. Med. 2021)

Advanced patient age

Pre-existing venous disease

BMI > 25 kg/m^2 & nutritional derangements

History of hip/knee replacements

Peri-wound contact dermatitis

Larger size, longer duration

Decreased ABIs

TIMERS (formerly known as TIME) Principles of Wound Bed Preparation

- **T** Tissue—tissue viability/need for debridement
- **I** Inflammation/Infection—treat bioburden/comorbidities
- **M** Moisture balance—maintain optimal moist environment
- **E** Edges—intervene for non-healing wound edges
- **R** Regeneration/Repair—consider use of advanced therapies
- **S** Social Factors—psychosocial and physical—a holistic approach

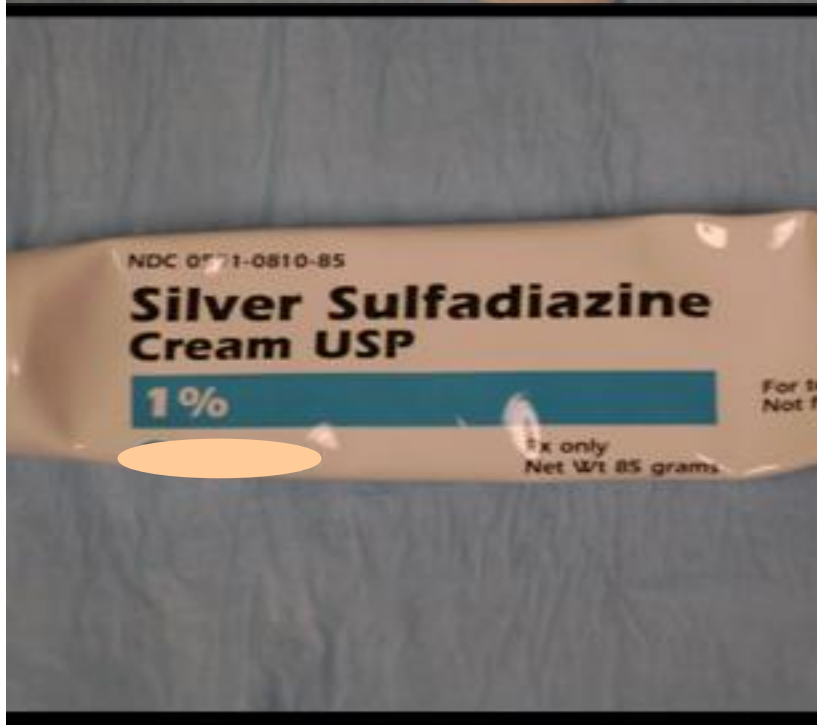
Debride Necrotic Material

- Surgical or sharps
  - Use of scalpels, scissors, forceps
- Mechanical
  - Wet-to-dry dressings, wound irrigation, whirlpool
- Enzymatic
  - Topical application of exogenous enzyme collagenase
- Autolytic
  - Achieved by natural wound fluid, endogenous enzymes with occlusive dressings

Gould, L. J., et al., Wound Rep Reg, 2024;32:6-33

Address Infection and Inflammation

- Cadexomer iodine (Iodosorb)—multiple studies show complete healing vs standard care or hydrocolloid dressing
- No difference between cadexomer iodine and silver sulfadiazine
- The use of silver sulfadiazine is to reduce bacterial infection, but it is not supported by the evidence for wound closure. (O'Meara et al., Cochrane Database Syst Rev 2012)
- Reducing bioburden will decrease inflammation

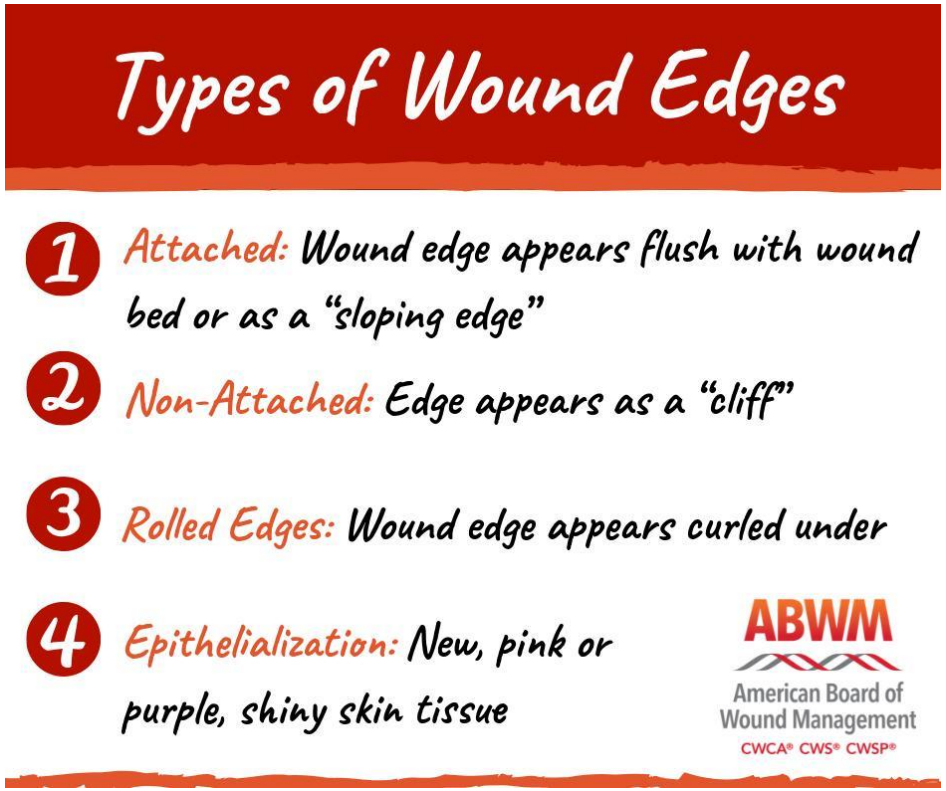


Maintain Moisture Balance

DRESSING SELECTION GRID	
Deep Wet Wounds	**Deep Dry Wounds**
Fillers: Calcium alginates, flat or rope; Gelling fibers/hydrofibers; Gauze and specialty gauze; antimicrobial foams (i.e. methylene blue/gentian violet foam dressings) Cover Dressings: ABD pads; Gauzes; Foam border; Superabsorbent pads; disposable diapers; feminine hygiene maxi pads	Fillers: Hydrogel and gauze; gauze impregnated hydrogel; saline gauze; antimicrobial foam (i.e. methylene blue/gentian violet foam) Cover Dressings: ABD pad and tape or transparent film; adhesive/non-adhesive foams (waterproof foams will stay on in shower)
Shallow Wet Wounds	**Shallow Dry Wounds**
Foam border dressings; Flat alginate under foam or wrap gauze; Gelling fiber or hydrofiber under foam or wrap gauze; Nonadherent contact layer and gauze cover (will need more frequent changes)	Hydrogel and gauze; solid hydrogel wafer; Hydrocolloids; Transparent film adhesive dressing; Non-adherent contact layer and gauze cover dressing

Assess Wound Edges

- Attached is a healthy wound edge
- Non-Attached edges include tunneling and undermining and slow wound healing—pack with dressing
- Rolled edges (Epibole) slow wound healing—open edges with silver nitrate
- Epithelialization is the goal!

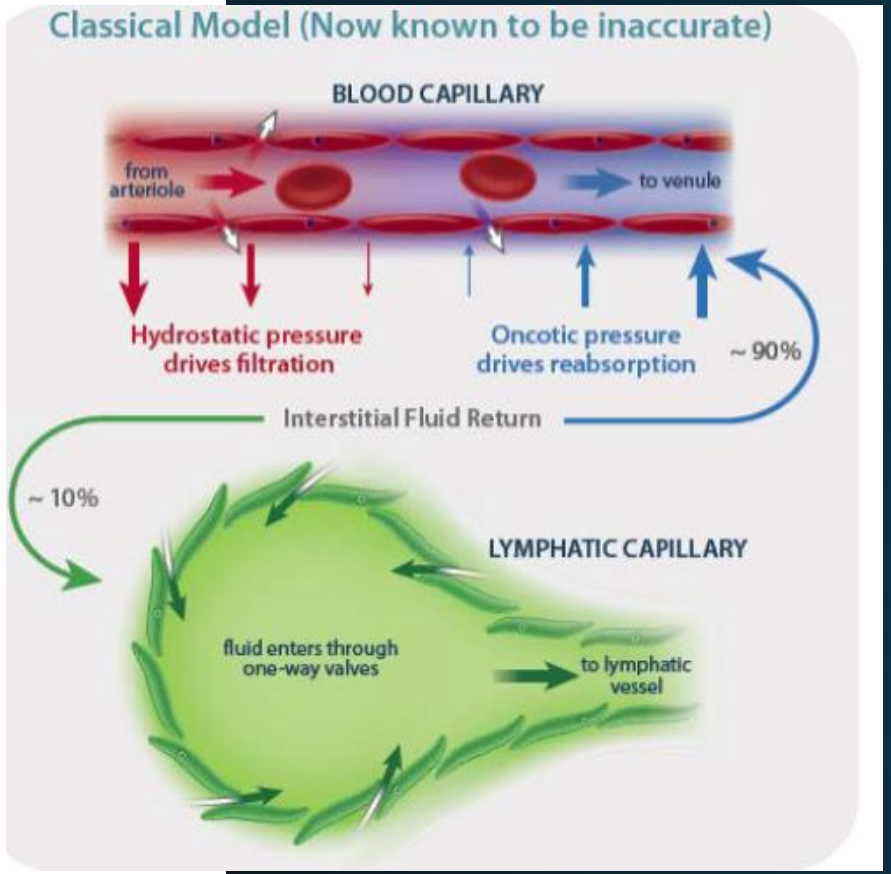


The Pathophysiology and Management of Venous Insufficiency

Compression is the gold standard!

Classic Starling Principle

This microvascular fluid exchange model discusses hydrostatic pressures which push fluid through artery and capillaries into the interstitium where majority is reabsorbed by the veins.



Revised StarlingPrinciple

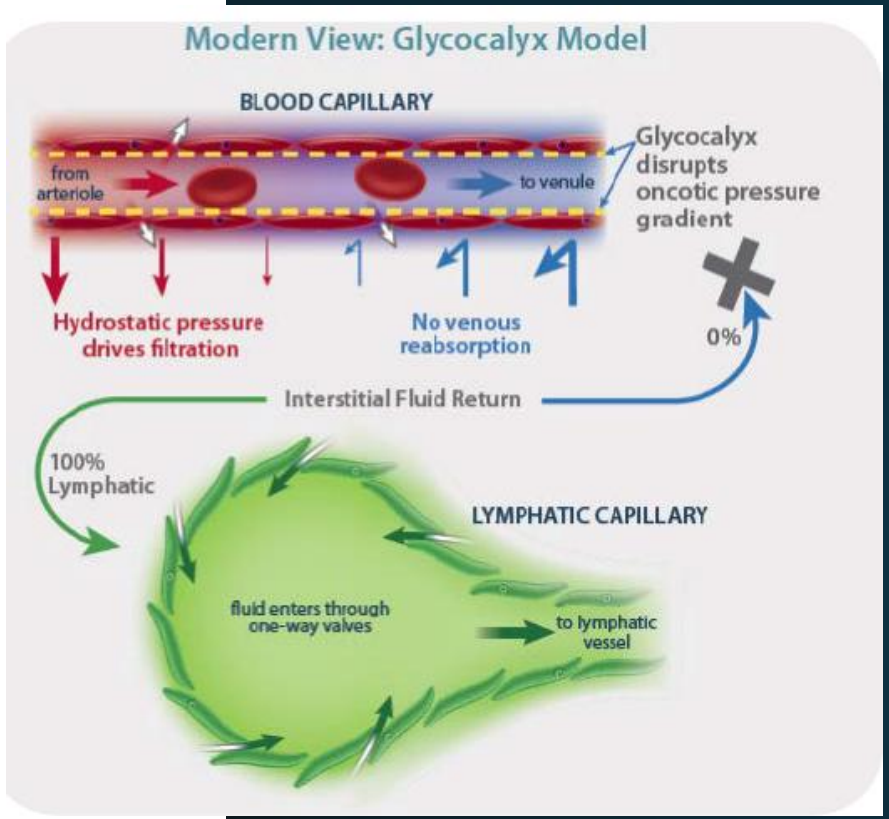
New imaging caused revised Starling Principle(2010).

Glycocalyx is gel like layer that lines all blood vessels down to 5 microns. They prevent reabsorption to veins.

Role of healthy Glycocalyx: Improves endothelial function like little hands moving fluid along. It results in sheer force that can release nitric oxide which decreases the permeability and does not allow fluid to be reabsorbed.

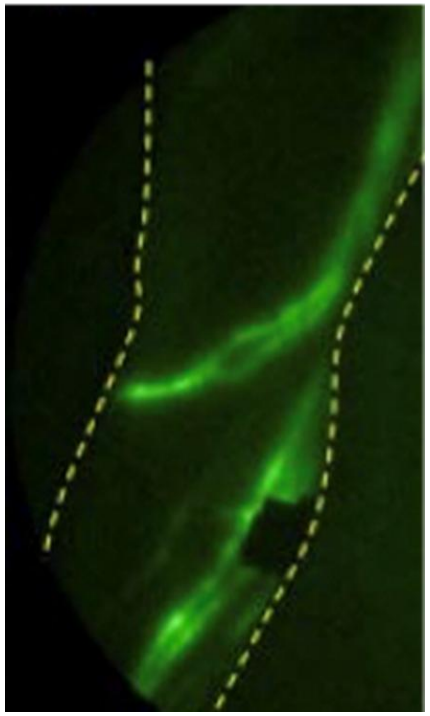
It inhibits platelet adherences and impacts coagulation and regulatory factors. 100% of fluid goes back into circulatory system through the lymphatics(Rockson et al.). All chronic lymphedema is failure of lymph drainage.

Lymphatic dysfunction exists with venous disease.

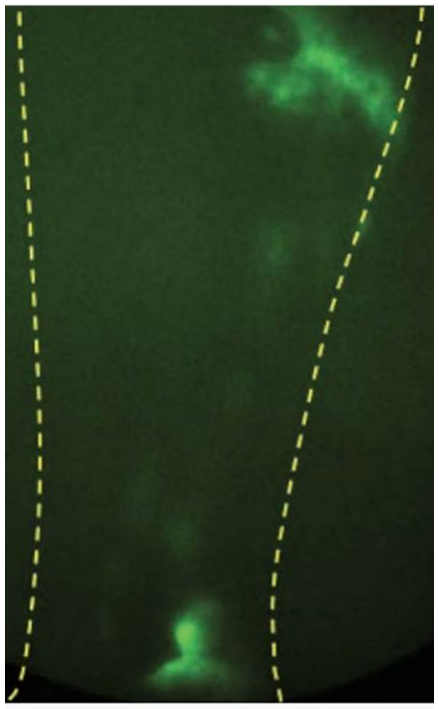


Near-infrared Fluorescence Image

Clear Lymphatic Uptake

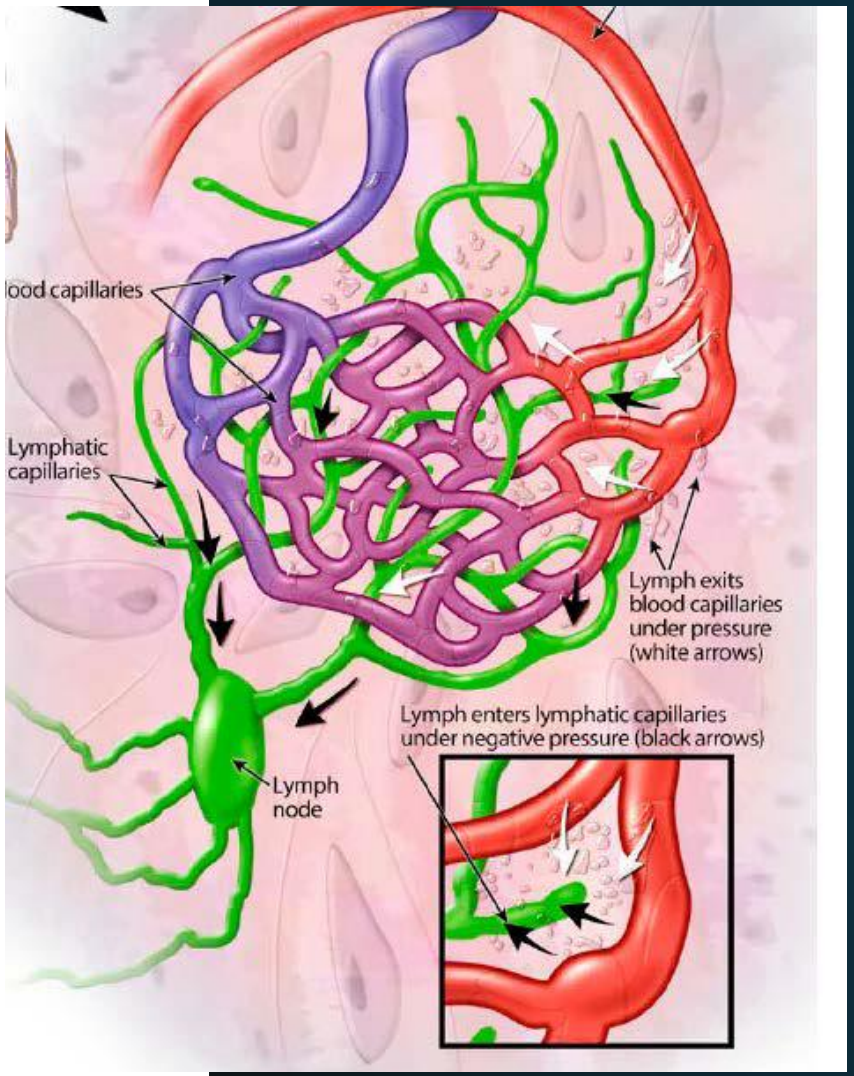


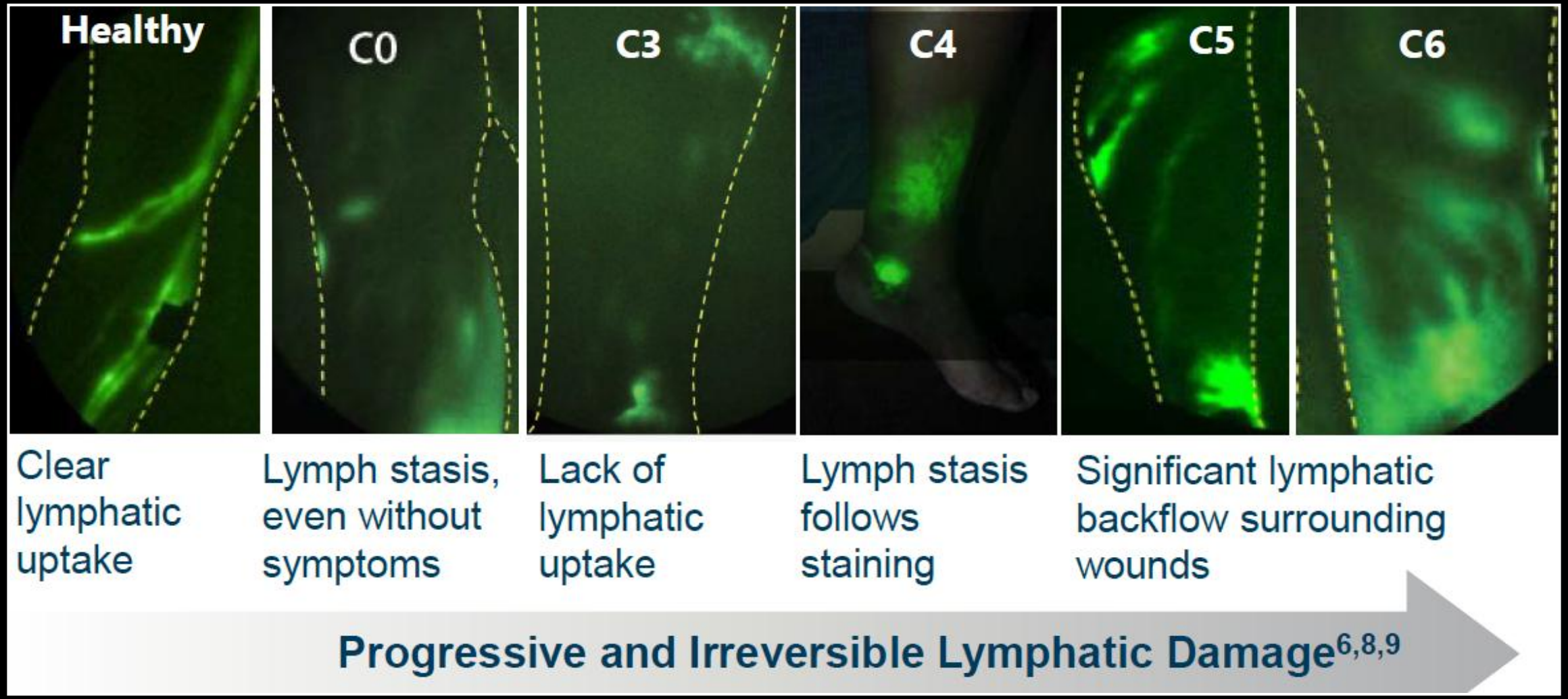
Lack of Lymphatic Uptake



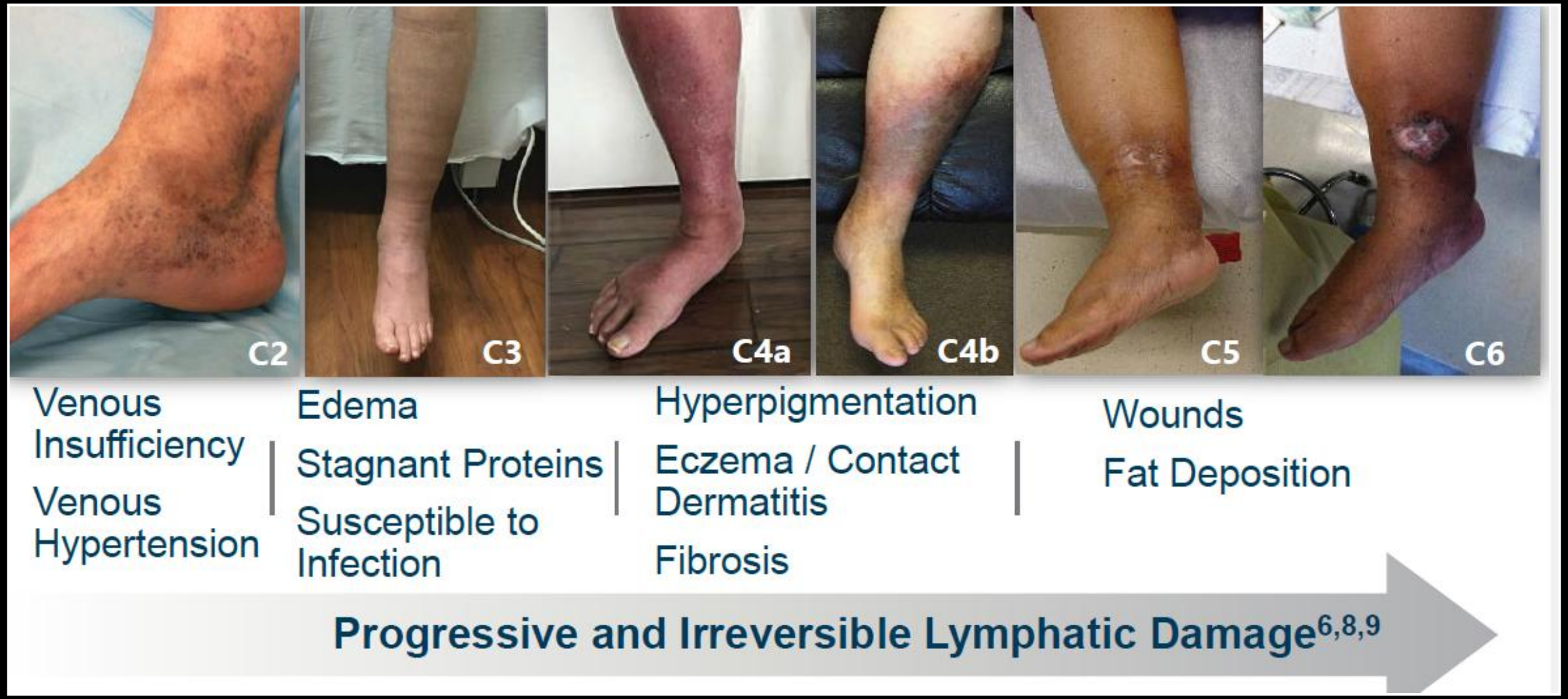
Revised Starling Principle

- The endothelial glycocalyx is a 500-2000 Nanometer layer formed by membrane-bound proteoglycans and glycoproteins creating a thick, hydrogel-like, layer that lines all the veins just inside the endothelial cells.
- This structure is relatively protein-free which means it is not exerting oncotic pressure and it disrupts the oncotic pressure that could have been exerted by proteins in the vein on interstitial fluid.
- The oncotic pressure only helps disrupt filtrate but does not help draw fluid back into the veins. There is steady dwindling filtration out of the entire length of the arterial side including capillaries and into the interstitial space, but **there is no reabsorption into the veins**.
- The lymphatics are responsible for maintaining tissue fluid balance by absorbing interstitial fluid and proteins out of the interstitial space and returning fluid to circulation.





Imaging Reveals Concurrent Veno-lymphatic Dysfunction



Concurrent Venous and Lymphatic Disease Progression

CVI Contributes to Edema Via Altered Lymphatic Function
CVI is the Leading Cause of Lymphedema in the U.S.

Venous insufficiency/venous hypertension

Edema with stagnant proteins and susceptible to infection/lymphatic overload

Hyperpigmentation-eczema/contact dermatitis/fibrosis

Wounds/fat deposits-permanent damage to lymphatic system

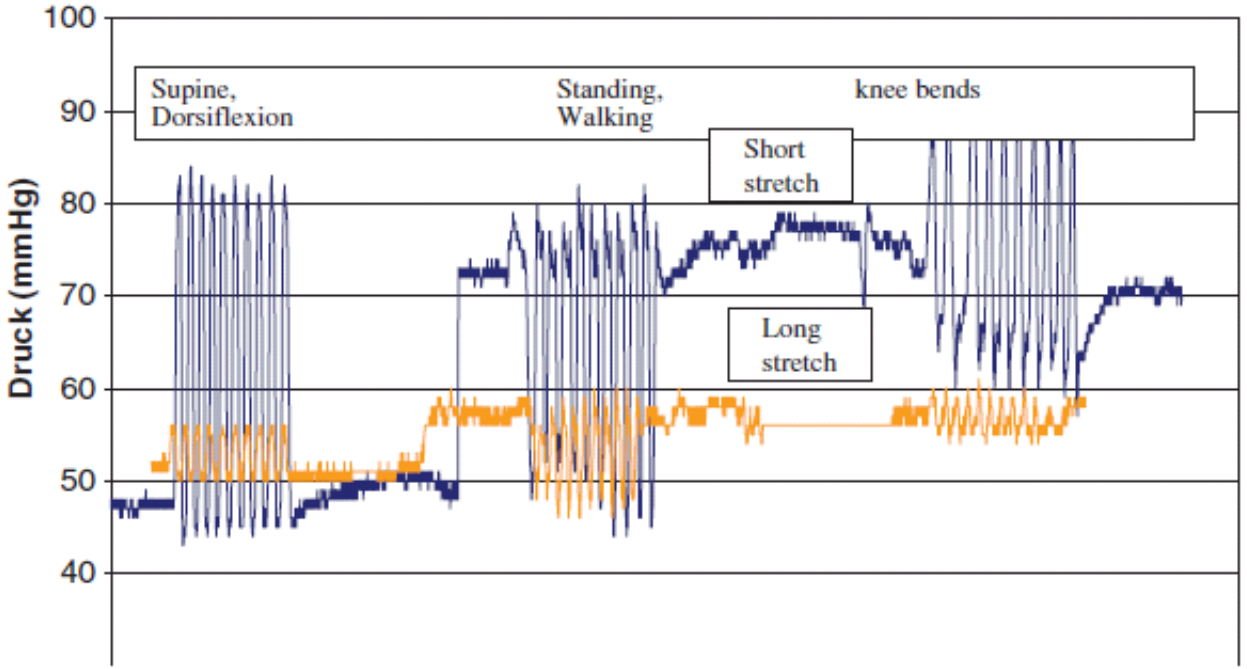
Compression Bandages

Long Stretch Bandages

- >140% extensibility
- High resting pressure, low working pressure
- Ace wraps, Profore, Coban
- Can use for acute edema and sometimes venous insufficiency with or without ulcers

Short or Low Stretch Bandages

- <50% extensibility
- **Low resting, pressure, high working pressure**
- Prevents refill of area caused by the inelasticity of skin from being over-stretched(creates a second skin)
- Does not create enough force to collapse initial lymphatics
- Comprilan, Coban 2(must have at least 20-30 mmHg and often 30-40mmHg)
- For venous insufficiency, lymphedema, dependent lymphedema, post op and post trauma lymphedema and post DVT.



- Partsch et al, Dermatol Surg 2006;32:224–233. Measurement of Lower Leg Compression In Vivo

Benefits of Compression Therapy

- Enhances calf muscle pump effectiveness
- Enhances lymph return
- Helps restore valve competency
- Improves tissue oxygenation and decreases wound drainage
- Softens induration
- Protection for trauma and pathogens
- Reduces pain
- Must be done day one of therapy

Contraindications/Precautions to Compression Therapy

Arterial insufficiency with an ABI<0.8

- Can treat under 0.8 but with caution. Do not use Tubigrip due to potential for bunching up and restricting blood flow if below 0.6.

Acute infection

- No studies that indicate contraindicated
- Can apply compression once patient tolerates

Uncontrolled or severe CHF

Pulmonary hypertension

Acute deep vein thrombosis-can treat once anticoagulated

Compression Therapy in Acute Deep Venous Thrombosis of the Lower Limb and for the Prevention of Post-Thrombotic Syndrome

Review Based on a Structured Literature Search

Summary

Background: After an acute deep venous thrombosis (DVT) of the lower limb, 20% to 63% of patients develop post-thrombotic syndrome (PTS). In this review, we address the efficacy of compression therapy in the treatment of acute DVT of the lower limb, and for the prevention of PTS.

Methods: 12 randomized controlled trials (RCTs) and one meta-analysis, with a total of 3751 patients, were identified in a structured literature search.

Results: Two RCTs showed that adding compression therapy to drug treatment in the first 9 days of the acute phase of lower limb DVT led to more rapid pain relief ($p<0.050$) and less swelling (remaining difference in circumference, 1 cm versus 3 cm, $p<0.050$). As for the prevention of PTS, four RCTs showed a short-term benefit or no benefit of compression therapy. In three further RCTs, medical compression stockings (MCS) brought about a 16% to 27% absolute reduction of the frequency and severity of PTS (47% vs. 20 %, $p<0.001$; 40% vs. 21% (95% confidence intervals [29.9; 50.1] and [12.7; 29.5], respectively; and 58% vs. 42%, relative risk [RR] 0.73 [0,55; 0.96]). The benefit of MCS was also confirmed in a recent meta-analysis (RR 0.66 [0.44; 0.99], I2 = 88%). Thigh-length MCS were not superior to knee-length MCS for the prevention of PTS (33% vs. 36%, hazard ratio [HR] 0.93 [0.62; 1.41]). Individual, symptom-oriented tailoring of the duration of treatment was not inferior to a fixed treatment duration of 24 months (29% vs. 28%; odds ratio [OR] 1.06 [0.78;1.44]).

Conclusion: Compression therapy relieves symptoms in acute DVT and lessens the frequency and severity of PTS. It is therefore recommended as standard treatment.

Cite this as
Thieme D, Linnemann B, Mühlberg K, Noppeney T, Kreutz M, Thieme M: Compression therapy in acute deep venous thrombosis of the lower limb and for the prevention of post-thrombotic syndrome—a review based on a structured literature search. Dtsch Arztebl Int 2024; 121: 188–94.
DOI: 10.3238/arztebl.m2024.0001

Application of Short Stretch Bandages

Apply firmly, not tight

To wear 24 hours a day. Remove for shower, dressing changes. Can be left on for up to week(Coban 2)

Pressure determined by number of layers not how tightly it is applied-each about 8-10 mmHg each layer of Comprilan

Bandages are washable and last for up to 6-8 weeks(Comprilan)

Can use tubigrip under or over to help keep from sliding

Warn patient of possibility of fluid moving to knee and thigh and for men, scrotum

- **Teach to have knee and thigh supported so lymphatic fluid cannot pool in thigh and knee.**

Compression Garments or Stockings

- Used when wound is healed and once edema maximally reduced
- Garment will not reduce edema
- Patient to use daily when get out of bed and remove at night but can keep Velcro closure garments on at night or use night garment
- Issues with putting on and taking off but new donners help
- Can slide down
- Costs and lack of insurance coverage(improved with Medicare now covering these stockings or garments)
- Patients should buy online if need to self pay. Much cheaper than through a DME
  - Easy to fit a patient by using fitting chart

Lymph Ulcer Management

- **Key-Manage Edema**
  - **Muscle activation as well as increased heart rate and breathing increases activation of the lymphatic drainage**
    - **Ankle pump, stretch /strengthening exercises, gait training, balance training**
  - **Compression Therapy(Short Stretch bandages(Coban 2, Comprilan).**
  - **Leg Elevation**
    - Above level of the heart is best with groin area open(since lymph fluid must pass through groin lymph nodes)
    - Challenging with ambulatory, working pts
    - Compression Pump-basic or advanced

Lymph Ulcer Management

- **Pain Management**
  - Usually, ↓ edema…↓ pain
  - Analgesics prn
- **Manual Lymphatic Drainage by Lymphedema PT or OT as needed**
- **Wound and Skin Management**
  - Topical steroids(Triamcinolone) or UNNA boot for treating weeping, crusted or scaling peri-wound skin
  - Manage wound based on assessment characteristics(exudate management)-Aquacel, Alginate, ABD pads