

WOUND CARE CONSIDERATIONS IN THE PATIENT WITH DIABETES

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Medical Director

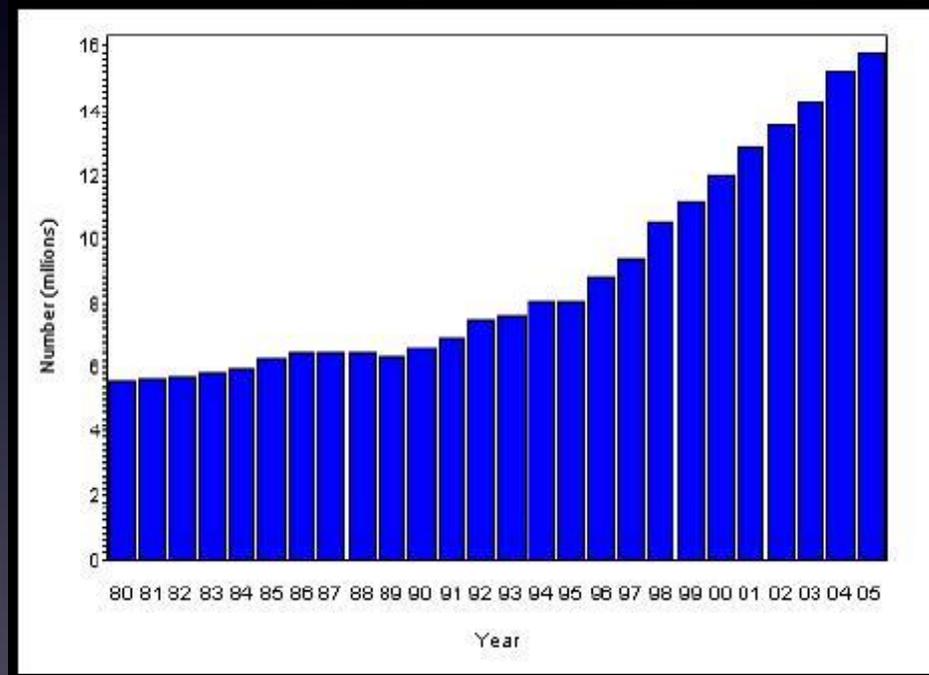
Hyperbaric Medicine & Wound
Treatment Center of Utah

OBJECTIVES

- Identify factors which contribute to non-healing in the DFU patient.
- Learn who to call for help and when to make that call.

DIABETES IS INCREASING

- 23.6 million people in the U.S. have diabetes
- 1/4 don't know it
- 15% will develop Diabetic Foot Ulcers (DFU)



85% of Amputations can be ***prevented*** with:

- Early detections
- Proper treatment



RECOMMENDATIONS FROM EVIDENCE

CONSENSUS RECOMMENDATIONS ON
ADVANCING THE STANDARD OF CARE
FOR TREATING NEUROPATHIC FOOT
ULCERS IN PATIENTS WITH DIABETES

APRIL 2010 OSTOMY AND WOUND MANAGEMENT

TREATMENT OF DFU's

- DEFINE
- DISCUSS
- DEBRIDE (VESSELS AND BED)
- DEBUG
- DE-LOAD
- DECIDE

DEFINE

- History
 - Diabetes duration and control
 - Associated co-morbidities, other illness
 - Previous wound healing history

DEFINE

- SKIN AND ULCER EXAM

- Skin

- Sensation

- Deformity

- Ulcer: Size, Location, Base, Wound edge, Tunnel, Necrosis



DEFINE DEFORMITY

■ Foot deformity

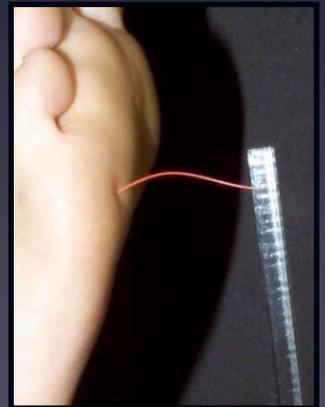


■ Calluses



DEFINE NEUROPATHY

- Neuropathy
 - 58% of patients with longstanding disease
 - 82% of patients with DFU have neuropathy



DEFINE

- WOUND CLASSIFICATION
 - Wagner Grade: exposed structure, infection or necrosis
 - University of Texas : depth, infection and/or ischemia

Wagner Classification System

Grade	Lesion
0	No open lesions: may have deformity or cellulitis
1	Superficial ulcer
2	Deep ulcer to tendon or joint capsule
3	Deep ulcer with abscess, osteomyelitis or joint sepsis
4	Local gangrene - forefoot or heel
5	Gangrene of entire foot

University of Texas Diabetic Wound Classification System

		Wound Depth			
		0	1	2	3
Presence of infection or ischemia	A	Pre- or postulcerative lesion with complete epithelialization	Superficial wound. No involvement of tendon, bone or capsule.	Wound penetrates to tendon or capsule.	Wound penetrates to bone or joint.
	B	Pre- or postulcerative lesion with complete epithelialization and infection.	Superficial wound. No involvement of tendon, bone or capsule. Presence of infection.	Wound penetrates to tendon or capsule with infection.	Wound penetrates to bone or joint with infection.
	C	Pre- or postulcerative lesion with complete epithelialization and ischemia.	Superficial wound. No involvement of tendon, bone or capsule. Presence of ischemia.	Wound penetrates to tendon or capsule and ischemia.	Wound penetrates to bone or joint with ischemia.
	D	Pre- or postulcerative lesion with complete epithelialization, infection and ischemia.	Superficial wound. No involvement of tendon, bone or capsule. Presence of infection and ischemia.	Wound penetrates to tendon or capsule with infection and ischemia.	Wound penetrates to bone or joint with infection and ischemia.

DEFINE

- INFECTION
 - Drainage
 - Odor
 - Redness
 - Swelling
 - Probe Bone
 - If suspicious:
 - ESR, CRP (If both are normal, Osteomyelitis is unlikely)
 - Culture

IMAGING

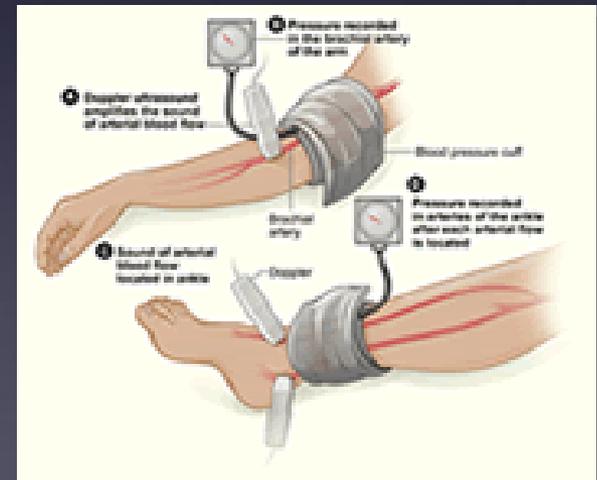
- Plain films
- MRI or CT



VASCULAR EVALUATION

A tiered approach is recommended :

1. Pulses, ABI, and/or TBI
2. Segmental pressure volume, SPP and TcPO₂
3. Vascular consultation



TISSUE HYPOXIA

- TcPO₂ < 40mmHg suggests impaired healing
- Risk of amputation is 161 times greater if TcPO₂ <20 rather than TcPO₂ >40
- Risk amputation is 55 time greater if ABI is <0.45 rather than >0.7

DEFINE

- LABS
 - CBC
 - HgA1c
 - Cholesterol, HDL, LDL
 - Homocysteine (Hcy)



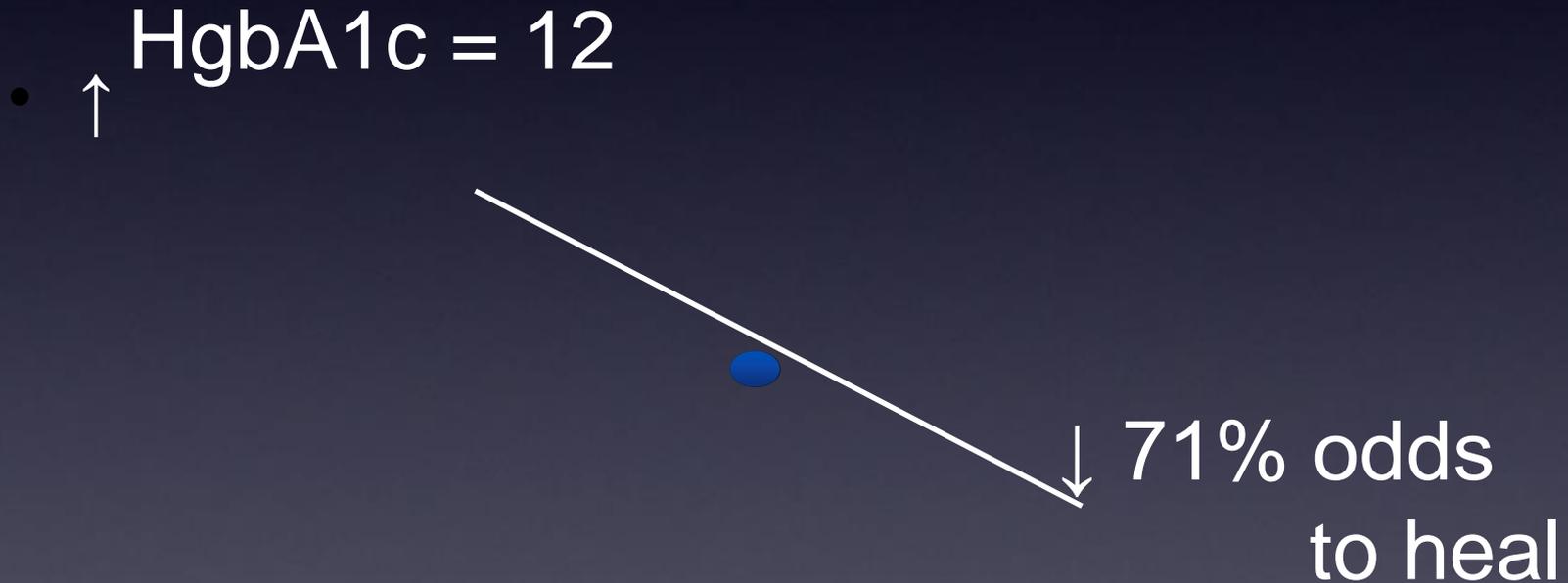
HEMOGLOBIN A1C & WOUND HEALING

- **Methods:** A **retrospective analysis** of data gathered from multi-center, controlled, prospective, randomized FDA approved clinical trials is being conducted.
 - Analyzed several variables
 - Multilevel linear regression looking at HgbA1C on the % of wound healing at 12 weeks
 - The initial sample size was 458 subjects.
- **Results:** The final linear regression model ($P < 0.0001$) found that higher HgbA1C levels were associated with lower percentages of wound healing ($P = 0.05$), after adjusting for gender, body mass index, initial wound size, and method used to off-weight foot ulcers.

**For every 1% increase in HgbA1c there is
a
decrease of 3% in expected healing area**

HEMOGLOBIN A1C & WOUND HEALING

The odds of healing a diabetic foot ulcer decreased 14.3% for every 1% increase in hemoglobin A1c.



DEFINE

- LABS
 - CBC
 - HgA1c
 - Cholesterol, HDL, LDL
 - Homocysteine (Hcy)

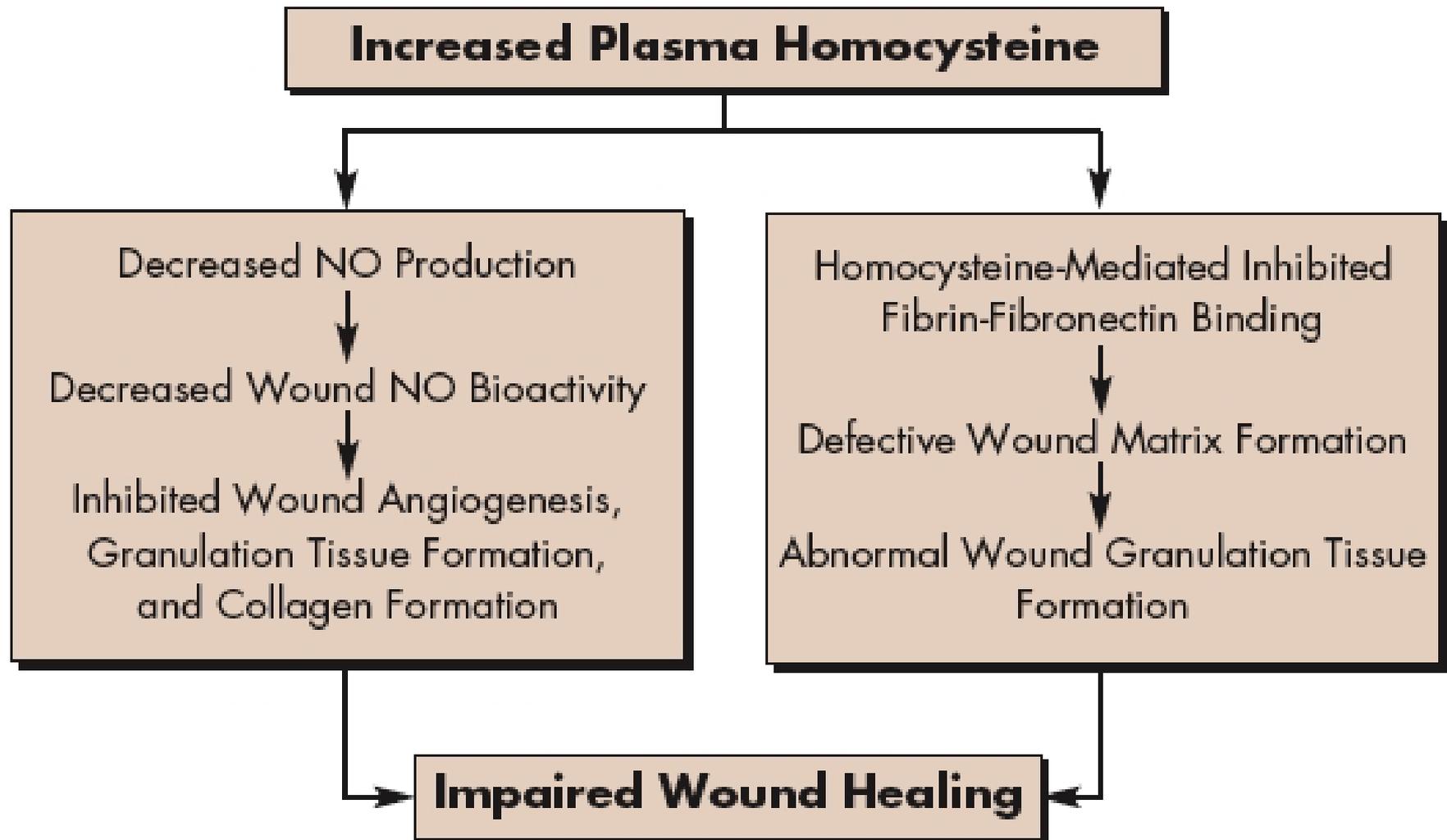


Homocysteine (Hcy)

- Known risk factor for atherosclerotic vascular disease and is an inhibitor of nitric oxide (NO) bioactivity
- \uparrow serum Hcy = \downarrow wound NO bioactivity and impaired wound healing
- \uparrow Hcy was observed in
 - 50% of patients with chronic wounds
 - 63% of patients with diabetic, neuropathic ulcers

FACTORS ELEVATING Hcy

- Environmental factors:
 - Nutrition: Deficiencies of folate, B12, and B6
 - Lifestyle factors: cigarette smoking, high alcohol and coffee
- Physiological conditions: genetic anomaly
 - Aging and menopause
 - Drugs: methotrexate, cyclosporine, metformin, anticonvulsant or hypolipidemic drugs may inhibition of vitamin B6 function.
- Disease states: Chronic renal failure, hypothyroidism, SLE, several cancers, and spinal cord injury



TREATMENT OF HYPER- Hcy

- Combination therapy of L-methylfolate, pyridoxal 5'-phosphate, and methylcobalamin is recommended as an effective treatment for lowering elevated Hcy.
- L-methylfolate administration has proven superior to folic acid therapy.
 - 7 times more bioavailable than folic acid
 - Results in 3X's lower serum Hcy

DEFINE

- NUTRITION
 - Nutrition Screen
 - Albumin, Pre-Albumin, Transferrin

- SMOKING



Nutrition Screen

Height, Weight, BMI

Unintentional change in weight

>5# in 1 month or >10# in 6 months

>10 pounds in past 6 months

Persistent or recurrent diarrhea

Alcohol > 3 drinks per day

Mouth, tooth or swallowing problems

Tube feedings or TPN

Limited access to food

Missing 2 meals/day > 2 days/week

Morning fasting blood sugar

NUTRITION

- Albumin has a half-life of approximately 20 days, meaning a patient may be malnourished before an actual drop in albumin occurs

Laboratory Data

	Normal	Moderately Depleted	Severely Depleted
Albumin	>3.5 g/dl	2.8-3.5 g/dl	<2.8 g/dl
Transferrin	>200 mg/dl	160-200 mg/dl	<160 mg/dl
Prealbumin	>14 mg/dl	11-14 mg/dl	<11 mg/dl

DEFINED DISEASE PROCESSES

- ULCER
- DEFORMITY
- INFECTION
- VASCULAR STATUS
- NUTRITIONAL STATE
- DIABETIC CONTROL

DEFINE & DISCUSS

- Initial definition to determine what issues contribute to the problem
- Discuss with appropriate specialists



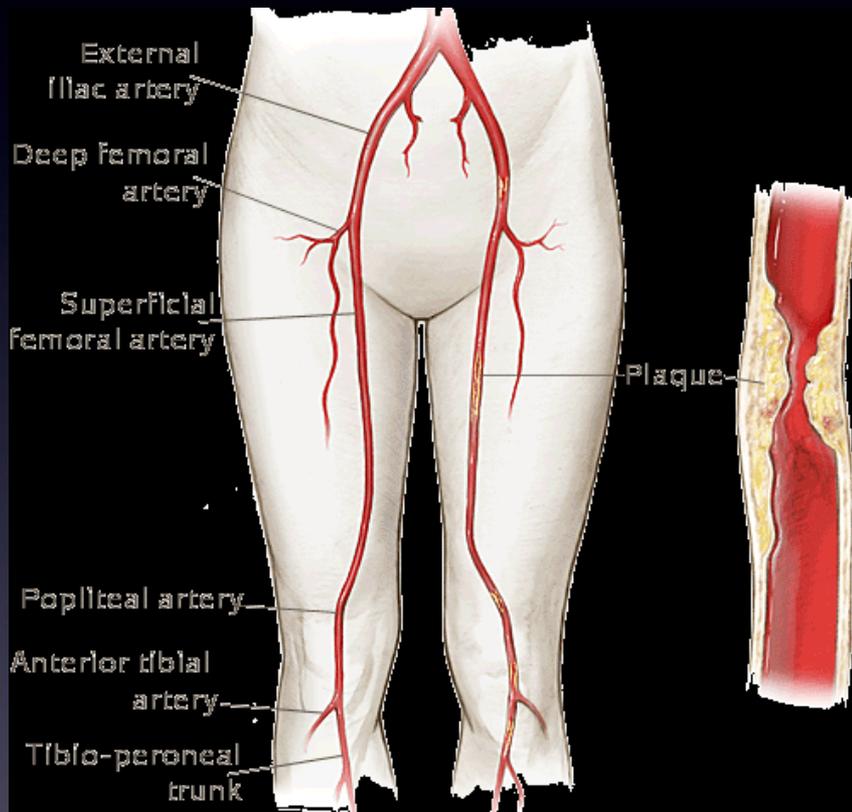
DEFINE AND DISCUSS

- Tissue Hypoxia Vascular surgeon
- Deformity Ortho/ Podiatry/ Pedorthotist
- Infection Infectious Disease
- Nutrition Endocrinologist/ Dietician

PROTEIN INTAKE

HEALTHY PATIENTS	RDA for protein is 0.8g/kg each day (.36 g/pound)
PTS. WITH WOUNDS	1.2 to 1.5 g/kg of protein (.5 to .7 g/pound)
CRITICALLY ILL, STRESSED OR BURNED	2.0 g/kg of protein (.9 g/pound)

ARTERIAL DISEASE



■ Treatment

- Bypass
- Endarterectomy
- Stent
- Hyperbaric Oxygen

WOUND BED PREPARATION AND DRESSING

- Debridement
 - Sharp
 - Mechanical
 - Chemical
 - Autolytic



WOUND BED PREPARATION AND DRESSING

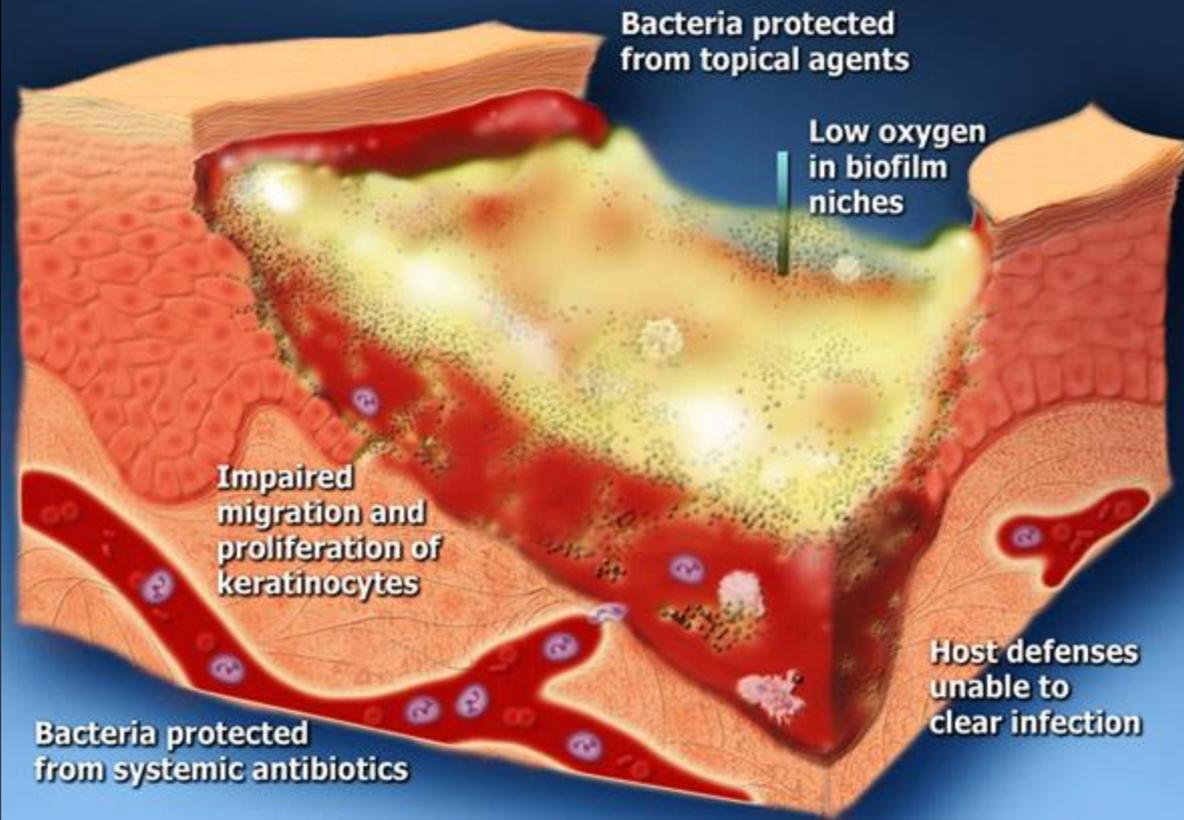
Wound bed preparation = Management

- to accelerate endogenous healing
- facilitate the effectiveness of other measures

Convert the molecular and cellular environment of a chronic wound to an acute healing wound.

BIOFILMS

Bacterial biofilm is a major barrier to wound healing



TREATMENT OF WOUND INFECTION

Contamination	→	Wound cleansing
Colonization	→	Debridement
Critical Colonization	→	Topical Agents*
Cellulitis	→	Antibiotics
Sepsis	→	Aggressive Abx

* Systemic Antibiotics do not penetrate granulation tissue

COMMONLY USED DRESSINGS

- Wound care dressing orders for 202 patients receiving home health or HMO care

42% Wet-to-Dry

7.5% Enzymatic

7% Dry Gauze

Cowan L, Stechmiller J,

Advances in Skin and Wound Care

Dec, 2009

WOUND DRESSINGS

WET TO DRY DRESSINGS ARE ONLY APPROPRIATE FOR:

- Debridement when >50% of wound bed is non-viable
- For short periods of time

WOUND DRESSINGS

WET TO DRY DRESSINGS ARE
INAPPROPRIATE BECAUSE:

- Increased Pain
- Lack of Compliance
- Increased Risk of Infection
- Re-injury to Healthy Granulation
- Increased Costs

GENERAL WOUND DRESSINGS

Moist Wound Dressing

- Healing times decreased by 2-3 times compared to Wet to Dry dressings
- Promote granulation
- Increase epithelial cell migration

DRESSING CHOICES

TO DRY:

- Alginates
- Foams
- ABD' s
- Polymers

TO MOISTEN:

- Hydrogel
- Medihoney
- Ointments

DRESSING CHOICES

- ANTIMICROBIAL
 - Silver
 - Iodosorb
 - Medihoney
- ACTIVE DRESSING
 - Collagens
 - Regranex
 - Skin Substitutes

DE-LOAD

(Off- Load)



OFF LOADING DEVICES

DECIDE @ 4 WEEKS

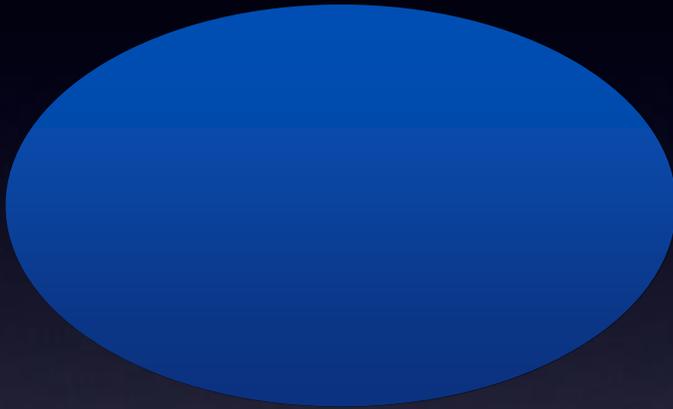
Percentage of Area Reduction @ 4 weeks	Complete Healing @ 12 weeks
>53%	58%
<53%	9%

Percentage of Area Reduction =

$$(A_1 - A_2) \div A_1 \times 100$$

$$A = \text{Length} \times \text{Width}$$

DECIDE



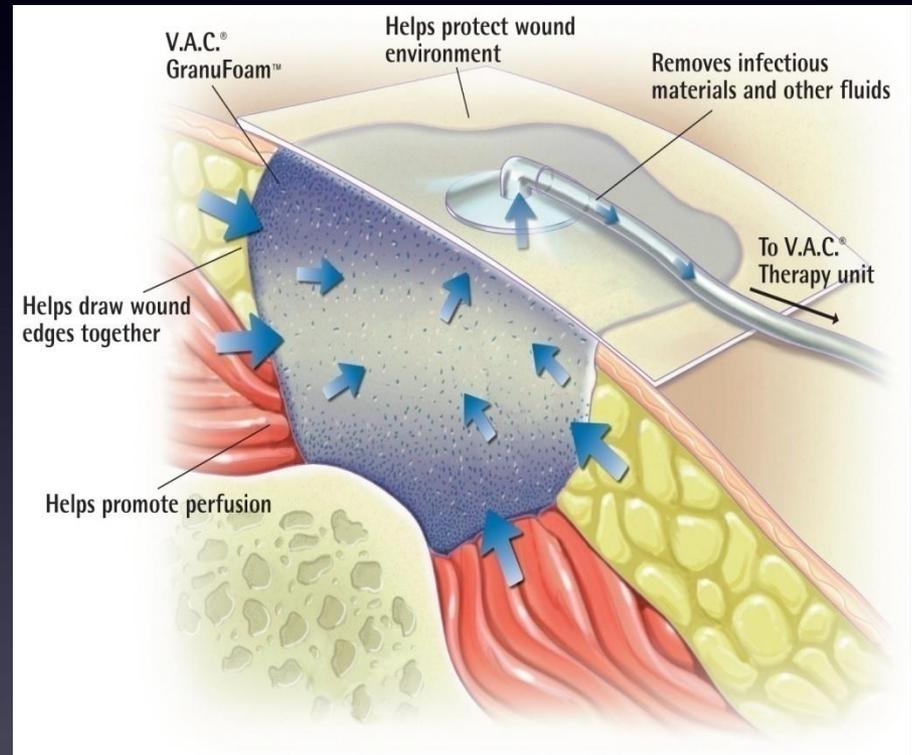
- **50% REDUCTION IN 4 WEEKS**

Width: 2.5 cm
Length: 1.5 cm
Area: 2.95 cm²

Width: 1.8 cm
Length: 1.1 cm
Area: 1.47 cm²

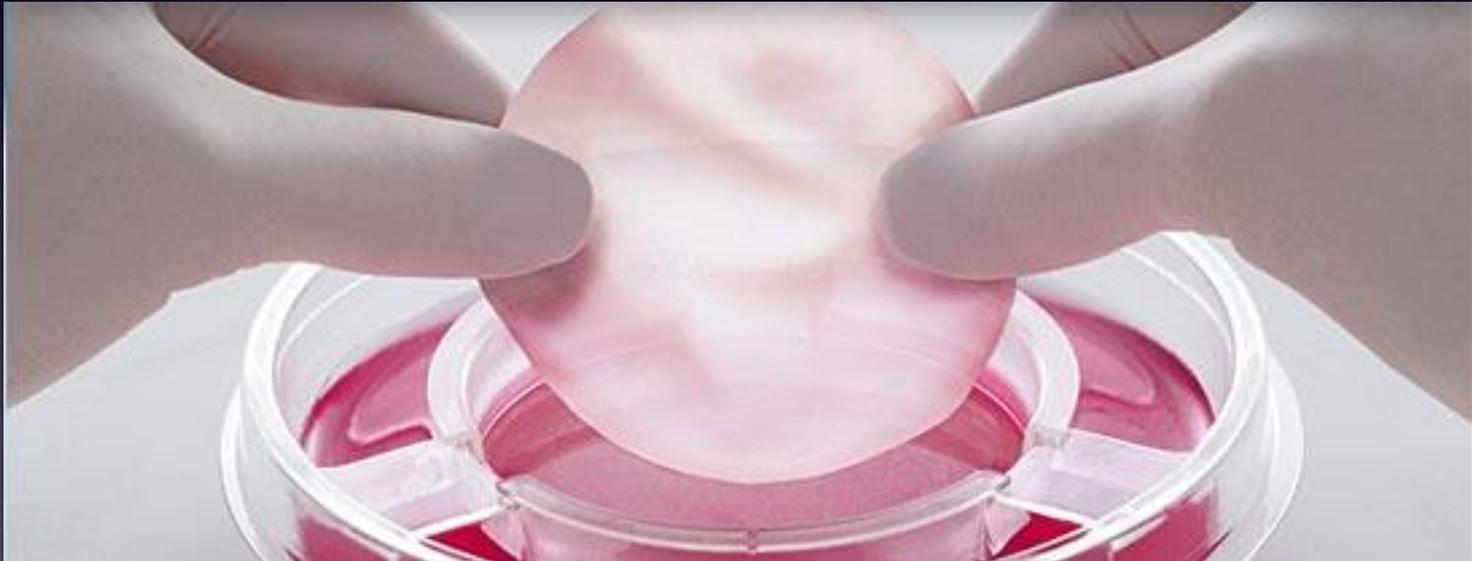
FAILURE → ADVANCED TX

- Negative Pressure Wound Therapy



FAILURE → ADVANCED TX

Living Skin Substitutes



FAILURE → ADVANCED TX

Hyperbaric Oxygen
Therapy



FAILURE → ADVANCED TX



- Deformity can be mitigated with appropriate footwear.
- Severe deformity may be corrected with surgery

DFU'S ARE HARD TO HEAL

Even with adequate blood flow

- 24% of patients closed at 12 weeks
- 31% at 20 weeks

Using standardize protocols in a multi-center wound care network

- 68% healing rate at 20 weeks

LIMB SALVAGE TEAM

- Multiple problems contribute to critical wounds and potential amputation.
- Multiple doctors with expertise in their area working together to save a leg.