

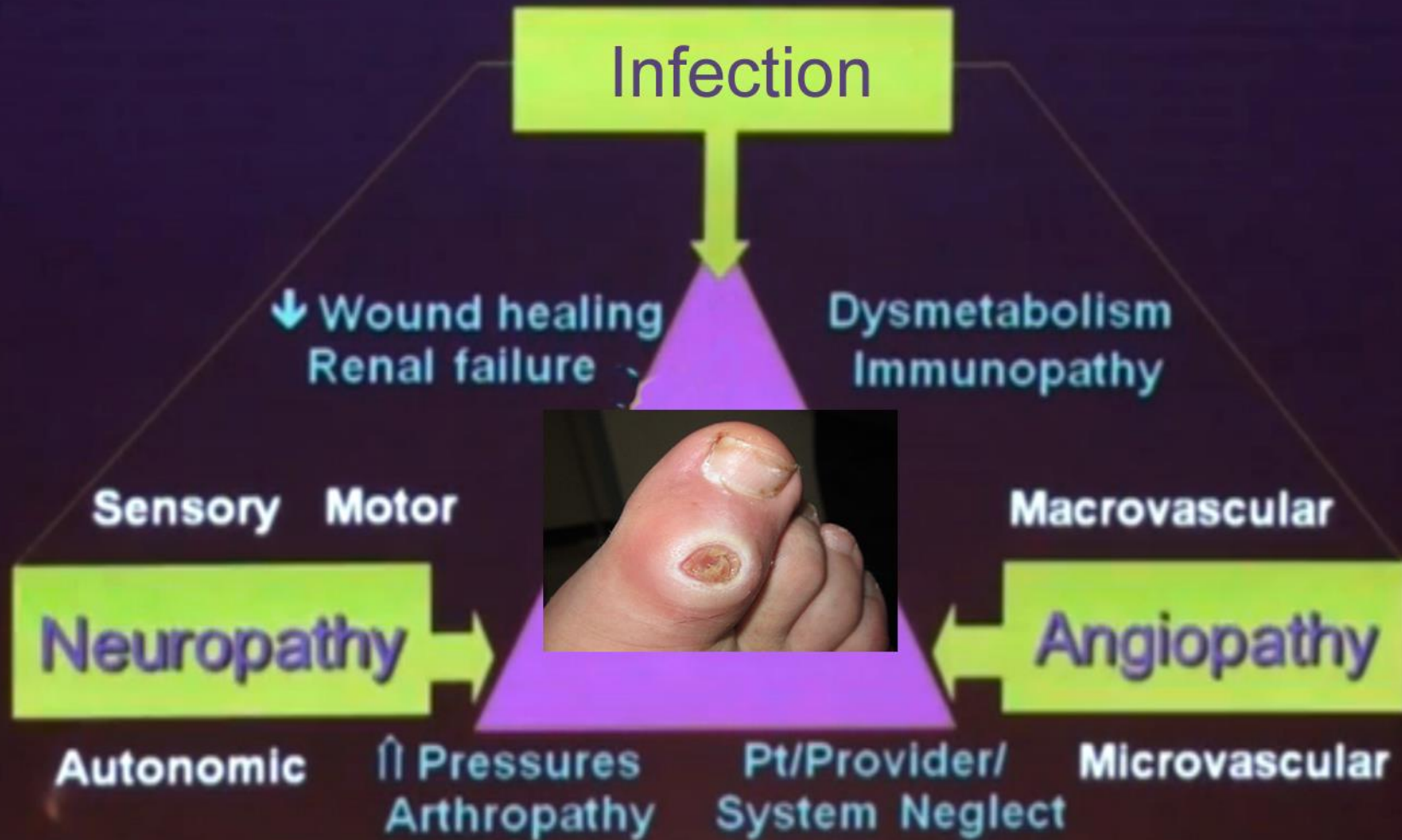


# Preventing Amputations

In the Lower Extremities  
Of Patients With Diabetes  
With Foot assessment



# Major Contributors to Diabetic Foot Disorders



# Several “steps” take place prior to the loss of a limb.

The six steps are:-

- ▶ Diabetes - chronic hyperglycemia
- ▶ Neuropathy - motor, sensory, autonomic
- ▶ Ulceration- biomechanics
- ▶ Vascular disease - Critical Limb Ischaemia
- ▶ Infection and amputation.



Each of these steps is preventable and one can take action to prevent the patient from escalating to the next step.







# Close monitoring



Infectious process /underlying osteomyelitis  
diabetes- blood urea nitrogen (BUN) creatinine  
with extended antibiotic regime nephrologist rec  
consult new onset renal disease – prevent ARF

# Osteomyelitis



Clinical presentation of a patient presenting with a chronic hallux ulceration. This digit elicited a positive probe bone test.







# Treatment - Multifocal Approach

- ▶ Thorough history - CVD, CAD, Diabetes amputation nephropathy , retinopathy
- ▶ Optimising glycaemic control
- ▶ Vascular supply ~ ABI = 0.45 <0.9 abnormal - referral (TBI) (PVR) (TCOM)(SPP)
- ▶ Aggressive wound debridement
- ▶ Infection control
- ▶ Maintaining wound moisture control
- ▶ Appropriate offloading

# Diabetes Foot Screening and

## DIABETES FOOT SCREENING & RISK STRATIFICATION FORM

Please fill in blank spaces, tick or circle applicable highlighted areas.

Date: \_\_\_\_\_ Location: \_\_\_\_\_

**PATIENT DETAILS**

Name: \_\_\_\_\_

Address: \_\_\_\_\_

Phone: \_\_\_\_\_

GP: \_\_\_\_\_

Practice: \_\_\_\_\_

**DIABETES FOR**

10g Monofilament Testing Sites

RIGHT LEFT

✓ Detected ☒ Not detected ☒

**RIGHT FOOT**

Palpable Dorsalis Pedis ☐ yes ☒ no

Palpable Posterior Tibial ☐ yes ☒ no

Previous Vascular Surgery ☐ yes ☒ no

Ischaemic Claudication ☐ yes ☒ no

If yes (describe): \_\_\_\_\_

Previous diabetes amputation ☐ yes ☒ no

Significant structural foot deformity ☐ yes ☒ no

Significant callous / pre-ulcerative lesion ☐ yes ☒ no

Foot care: patient is capable or has help from others (specify): \_\_\_\_\_

**RISK FACTORS**

Active ulceration ☐ yes ☒ no

If yes, urgent referral to Multi-Disciplinary Hospital Admission for severe or life-threatening infection or ulceration

**RISK CATEGORY** ☒ **Active Foot Disease**

☐ Patient informed of risk category ☐ **GP**

Currently attending: ☐ MDT / Hospital Foot Clinic ☐ **GP**

Referral to: ☐ Hospital Foot Clinic ☐ **GP**

☐ Other Specify: \_\_\_\_\_

Additional comments: \_\_\_\_\_

Screened by: \_\_\_\_\_

## DIABETES FOOT SCREENING AND RISK STRATIFICATION

**REFERRAL PATHWAY FOR DIABETES FOOT SCREENING AND ASSESSMENT**

**LOW RISK**

- Protective sensation intact (10g pressure)

**MODERATE RISK**

- One risk factor present
- Loss of protective sensation

**HIGH RISK**

- Previous amputation
- Previous ulceration

**ACTIVE**

- Active foot ulcer
- Spreading infection

**REFERRAL PATHWAY FOR ACTIVE DIABETIC FOOT DISEASE**

RISK STATUS	REFERRAL PATHWAY	MANAGEMENT
<b>Active Foot Disease</b> <ul style="list-style-type: none"> <li>Active foot ulcer</li> <li>Hot swollen foot with/without pain-suspected Charcot foot</li> <li>Severe or spreading infection</li> <li>Critical limb ischaemia</li> <li>If in doubt, refer or contact to discuss</li> </ul>	<b>MULTIDISCIPLINARY HOSPITAL FOOT CLINIC</b>	<b>MULTI-DISCIPLINARY HOSPITAL FOOT CLINIC</b> <p>Postal Address: _____</p> <p>Physical Address: _____</p> <p>Tel: _____</p> <p>Fax: _____</p>
	<b>MEDICAL ADMISSION</b> <p>Severe infection</p> <ul style="list-style-type: none"> <li>Rapid deterioration of ulcer</li> <li>Deep abscess</li> <li>Spreading cellulitis</li> <li>Systemically unwell</li> </ul> <p>Access to surgical team if required</p> <p>If in doubt, seek advice from the Multi-disciplinary or Hospital Foot Clinic</p>	<b>ALL PATIENTS WITH ACTIVE FOOT DISEASE</b> <ul style="list-style-type: none"> <li>Ongoing review by appropriately skilled and experienced podiatrist</li> <li>Information given about future foot care and how to access services in an emergency</li> <li>Refer to Orthotist for footwear if clinically required</li> <li>Antibiotics as required</li> <li>Referral to vascular, orthopaedics, surgical or medical if clinically required</li> </ul>
	<b>URGENT VASCULAR REVIEW</b> <p>Acute / critical limb ischaemia</p> <ul style="list-style-type: none"> <li>Discolouration of toes/foot: pale, dusky, black</li> <li>Signs of necrosis</li> <li>Pain at rest, often at night</li> </ul> <p>If in doubt, seek advice from the Multi-disciplinary or Hospital Foot Clinic</p>	
<b>High Risk</b> <ul style="list-style-type: none"> <li>Foot intact and stable</li> <li>Previous amputation</li> <li>Previous ulceration</li> <li>Referral to community podiatry service for ongoing management</li> </ul>	<b>COMMUNITY PODIATRY SERVICE</b>	<b>COMMUNITY PODIATRY</b> <p>Postal Address: _____</p> <p>Physical Address: _____</p> <p>Tel: _____</p> <p>Fax: _____</p>

Adapted from the Foot Action Group (Scottish Diabetes Group) by PodSIC (N2350) 680/14

**LOW RISK**

No risk factors present - no loss of sensation or absent or diminished pulses.

Annual screening by a trained Nurse or Health Professional. Agree self-management plan. Provide written and verbal education with emergency contact numbers. Appropriate access to podiatrist if required.



# IDF Clinical Practice Recommendations on the Diabetic Foot – 2017

A guide for healthcare professionals

Contents

Foreword

Introduction

Diabetic Peripheral  
Neuropathy

Peripheral  
Arterial Disease

Ulcers

Diabetic Foot  
Infection

Charcot Neuro-  
osteoarthropathy



# Glycemic Control & vascular stasis

- ▶ Control blood glucose -imperative healing chronic wounds.
- ▶ Hyperglycemia results - leukocyte dysfunction, suppression lymphocytes.
- ▶ Requires adequate tissue oxygenation
  - = well vascularized wound bed
  - = new granulation tissue

# Smoking

- ▶ Smoking greatest impact on PAD
- ▶ Cessation is the cornerstone of PAD treatment
- ▶ Education - smoking effect healing as carbon monoxide binds red blood cells so oxygen cannot bind and reach tissues to heal.
- ▶ Quit smoking before surgery- 10 weeks
- ▶ Postoperative complications wound dehiscence, Infection , amputation







# Caution Debridement

- ▶ Surgical debridement - inappropriate for ulcers with vascular insufficiency -extreme Caution  
On patients on anticoagulants.



# Emphasizing The Value Of Risk Stratification and Preventative measures.

- ▶ Frequency visits depends on the severity of the abnormality and the degree of intervention necessary to control ulcer risk.
- ▶ Some hemorrhagic keratosis require weekly, biweekly - monthly.
- ▶ Debridement is extremely effective preventing ulceration.
- ▶ infection, hospitalization and amputation.





# Compromised sensory perception

- ▶ L.O.P.S - localized pressure, leading to tissue ischaemia and ulceration.
- ▶ PN- high risk impaired balance and gait.
- ▶ Loss somatosensory afferents from peripheral neuropathy =increased risk ulceration balance and gait control.



# Initial Care for referred patient

- ▶ Vascular - if pedal pulses are not palpable , we order non - invasive arterial studies and obtain vascular consult based results.(ABI) (TBI)
- ▶ Neurological exam. Knee/ankle joint reflexes, 5.07 monofilament, vibration 128mHz/ graduated tuning fork or biothesiometer, joint proprioception.
- ▶ X-ray rule out osteomyelitis and assess deformity that might be contributing to the wound.
- ▶ Infection antibiotic management.



# Ongoing Care - further foot problem

- ▶ Active Charcot joint - PVD
- ▶ A complication of osteomyelitis in people diabetes
- ▶ Vascular - ( ABI ) vs toe - brachial index ( TBI ) - 40% PVD studies charcots neuroarthopathy
- ▶ Gold standard defining normal macrovascular anatomy and identifying vascular pathology  
**Contrast Angiography**
- ▶ ABI tests are often falsely negative in dx PAD in diabetes and/or ESRD



# The Effects Of ESRD On Patients With Diabetes

- ▶ Dialysis is an independent risk factor for ulceration. Extensive arterial calcifications due higher calcium phosphorus product and impaired microcirculatory perfusion
- ▶ A 2x increase in the prevalence of other lower extremity complications such as peripheral arterial disease (PAD) and amputations in dialysis-treated patients.
- ▶ Found an increase in foot ulcerations in patients with ESRD.
- ▶ A 4X increase in diabetic foot complications, defined as infection, gangrene and amputation.





# *End-stage renal disease (ESRD)*







- ▶ Kidney disease increases the risk of peripheral arterial disease (PAD) 3X in comparison to patients without renal disease but the severity of PAD worsens as kidney disease progresses.
- ▶ Dialysis - independent risk factor for foot ulceration

# The Effects Of ESRD On Patients With PAD

- ▶ Calciphylaxis is a thrombolytic event that provokes ischaemia and tissue infarction.
- ▶ Common lower extremities.
- ▶ Begin painful red areas that develop into indurated plaques followed by eschar, ulceration and gangrene.
- ▶ One year mortality rate > 50% often 2<sup>nd</sup> to sepsis deriving ulcers.



# Clinical Classification Diabetic Foot Infection

Clinical Manifestations*	IDSA Severity	IWGDF PEDIS	
No purulence or inflammation (erythema, pain, warmth, tenderness, or induration)	Uninfected	1	
Infected( $\geq$ signs/sx inflammation) But erythema $\leq$ 2cm around ulcer, infection limited to skin or superficial subcutaneous tissues	Mild	2	
$\geq$ 1 of following: cellulitis $>$ 2cm Lymphangitis; subQ spread Deep abscess; gangrene; Muscle, tendon, joint or bone involved	Moderate	3	
Systematic toxicity or metabolic instability	Severe	4	

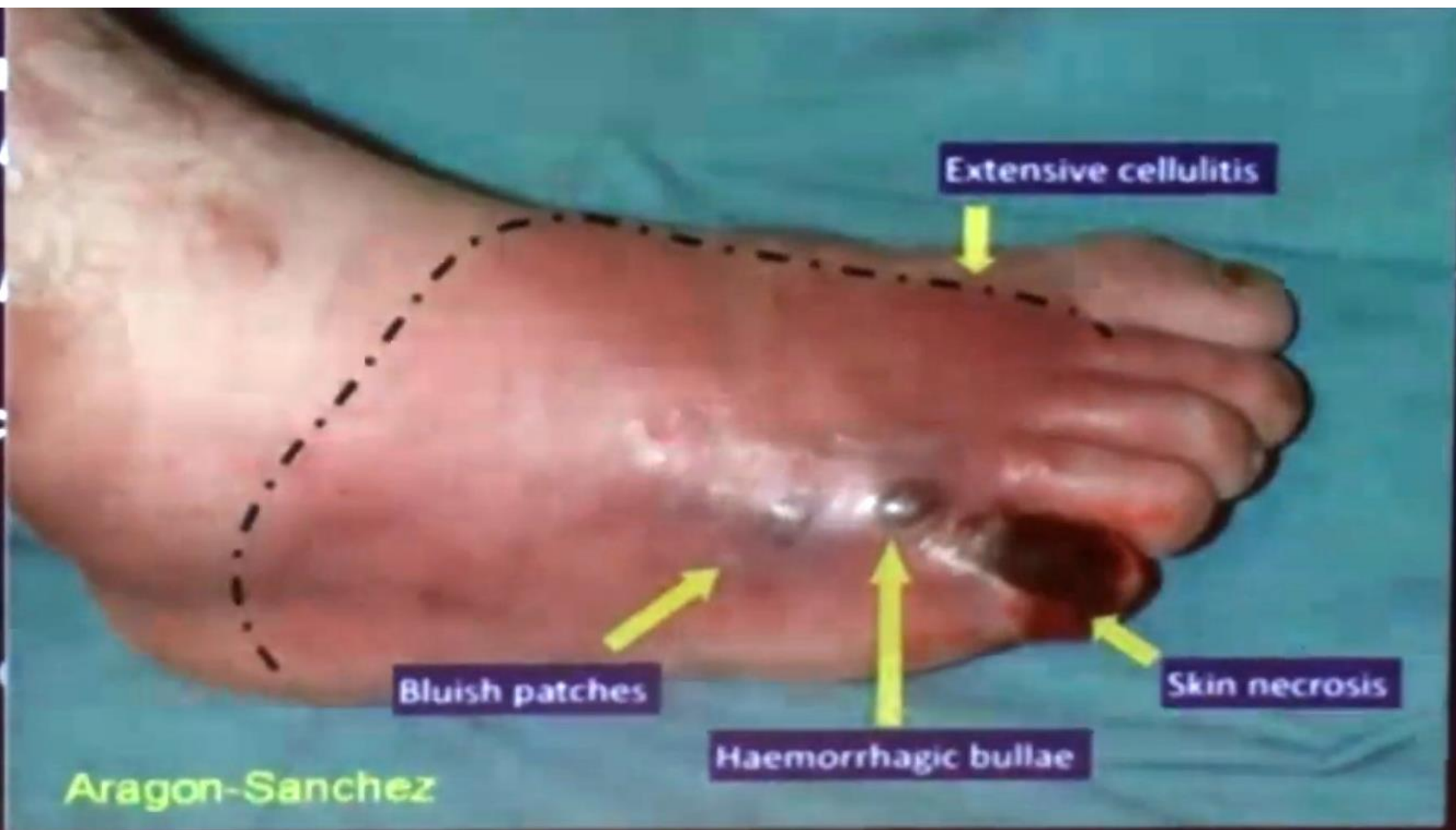
# Diagnosing DFO: Current Methods

## **Clinical (for osteomyelitis)**

- History: long wound duration, recurrent infection
- Exam deep large(>2cm<sup>2</sup>) ulcer, bony prominence, visible bone/joint, “sausage” toe
- Probe-to bone: useful if done and interpreted correctly
- Blood tests: WBC, ESR, C-RP, ? Biomarkers









# Motor neuropathy

- Atrophy of the short extensor muscle and intrinsic muscles arch.
- Functional shortening Achilles tendon ( advanced glycosylation of soft tissues) potential equinus deformity -forefoot ulcers
- Hammer toe deformities
- Hallux valgus deformity
- Gait instability
- Falls

elicitation reflexes /muscle testing

Physical therapy for strengthening

Braces/orthotics/decompression nerves



# Diabetic Motor Neuropathy



Charcot feet - heel walk - cannot raise toes  
Tibialis anterior weakness- Foot slap

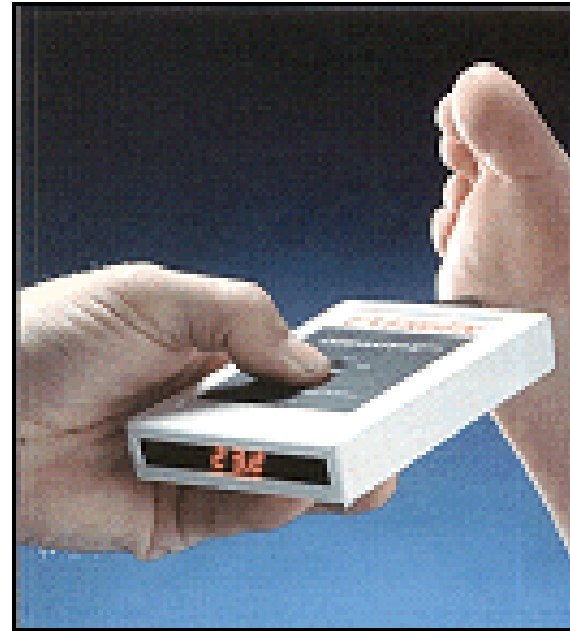
# Inactive Charcot Foot



When there is no inflammation it is inactive

# Thermography

- ▶ Diagnosis of Charcot's foot is supported, where available, by the use of thermography, which will show a skin temperature of 2-8°C higher than the contralateral foot.
- ▶ More than a fourfold decrease in risk ulceration



# Early Active Charcot

- ▶ Misdiagnosis
  - ▶ Cellulitis, Gout, Deep venous





# Developing A Charcot Patient Profile

- ▶ Longstanding diabetes ( greater than 10 years in duration)
- ▶ Profound neuropathy. Peripheral sensory loss may be more evident than associated motor dysfunction.
- ▶ Autonomic dysfunction - may be mediated through peripheral vasodilation and washing out mineral content bones
- ▶ Arterial calcifications
- ▶ Uncontrolled hyperglycemia
- ▶ Trauma - often minor
- ▶ Local inflammation, including previous ulceration, recent foot surgery
- ▶ Occasionally may follow successful revascularization.

# Evaluating Equinus



Silfverskiöld Test

# Equinus

- ▶ Equinus - the most profound casual agent in foot pathomechanics
- ▶ Life threatening
- ▶ significantly increases risk of diabetic foot ulcer
- ▶ Treatment conservative - stretching, orthotics

Surgical intervention in symptomatic patients with Isolated equinus or equinus as a component of A complex foot deformity.



# Equinus Treatment

- ▶ Debridement wound
- ▶ Offloading - moonboot
- ▶ Tendo-achilles lengthening to heal a diabetic fore-foot ulcer
- ▶ Refer orthopaedic surgeon for surgery options
- ▶ Conservative prior ulceration - manual stretching - night splints



# Equinus Treatment





# Neuropathic Diabetic Wound

- ▶ One should initially consider the “VIPs” (vascular, infection and pressure).
- ▶ Increased plantar pressure is a common reason for non-healing of ulcerations. Equinus deformity



# Diabetic neuropathic wound



- ▶ Damaged nerve impulses control muscles ie motor nerves.
- ▶ Pain , touch or positional sense ie sensory nerves.
- ▶ As a result of peripheral neuropathy they may develop other sequelae, including an increased risk of falling.



# Ulceration

This is due to loss of plantarflexory function of the gastrocnemius muscle and subsequent overload at the plantar heel in gait.

- ▶ An ankle foot (AFO) or orthotics with extra - depth shoe can be appropriate in some cases
- ▶ Meticulous wound management, including debridement. Vascular surgeon consult - revascularization.
- ▶ The knee walker scooter moonboot.
- ▶ AFO - orthotics modification remains healed.



# Ulceration - treatment





# Digital amputation significant indicator of future leg loss



- ▶ Loss digits alteration of osseous architecture of foot, resulting in changes pressure location new areas osseous prominence >PRESSURE - ulceration -infection AMPUTATION.
- ▶ Multiple hospitalizations and re -operations

# Preventing Diabetic foot Recurrence

After achieving healing

- ▶ Appropriate shoe gear
- ▶ Orthotics or bracing to help prevent recurrence
- ▶ Therapeutic footwear in those with severe
- ▶ Refer surgeon
- ▶ Distal toes tenotomy
- ▶ Charcot reconstruction
- ▶ Achilles lengthening



I frequently get orthotics to get rocker soled shoes, metatarsal pads and accommodation under the affected areas.

# Emphasizing appropriate Shoe gear And Patient Education



- ▶ Evaluation and management of minor trauma triggers like foot deformity, pressure callus and undetected injury may prevent amputation
- ▶ Encourage compliance with diabetes control
- ▶ Emphasize the importance of visual foot exams at home.

# Emphasizing appropriate Shoe gear And Patient Education

- ▶ Pressure relieving shoes and orthotics help lower risk amputation
- ▶ Educate patients every visit
- ▶ Explain the potential impact of neuropathy



# Current interventions to address gait and balance diabetic peripheral neuropathy

improve the motor control of gait and balance for patients to walk safely.

- ▶ Physiotherapy - guided training
- ▶ Postural control training
- ▶ Custom insoles - enhance balance control in individuals with neuropathy.

There is a need to improve, restore or replace inputs regarding plantar pressure proprioception to





# SurroGait Rx

- ▶ Wearable technology has a potential benefit high - risk population.

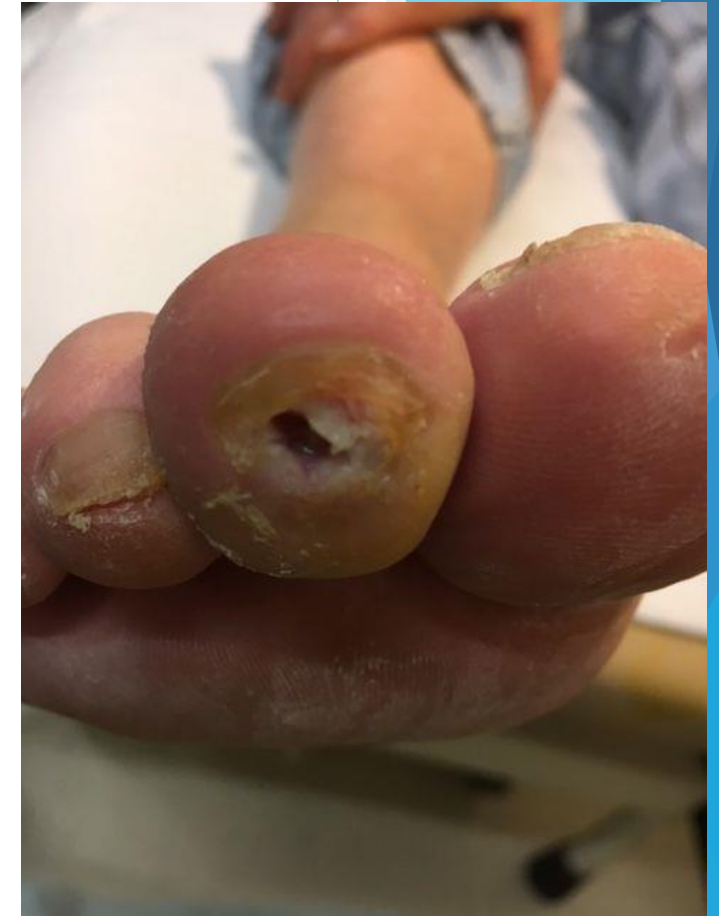


# Treatment

- ▶ Offloading the wound.
- ▶ Surgical shoes
- ▶ Casts TCC
- ▶ Crutches
- ▶ Walkers
- ▶ Wheelchairs

# Flexor tenotomy - distal tip toes diabetic neuropathy

- ▶ A full thickness ulcer 4x6mm, a slight hyperkeratotic rim with red granular base positive probing bone
- ▶ Radiographic findings cortical disruption -concern osteomyelitis
- ▶ Oral antibiotics started.
- ▶ The triad of diabetic neuropathy
- ▶ Hammertoe deformity and repetitive trauma resulted ulceration in this patient
- ▶ Digital amputation most common foot amputation - eradicate infection



# Subungual squamous cell carcinoma

- ▶ Dedridement/incisional biopsy
- ▶ Risk of metastatic spread
- ▶ Management plan to deal tumor
- ▶ Referral Plastic Surgical colleagues
- ▶ Dermatologist



# Why You should Rethink The Management Nail Unit Dystrophy

- ▶ Level pain, presence infection - grade infection.
- ▶ Risk of sinus nail sulcus which may go undetected -soft tissue infection and osteomyelitis of distal phalanx may occur.
- ▶ Biomechanical adjustments and adjusting shoe gear, eliminating microtrauma acute - chronic trauma, dermatological diseases, neoplastic processes, mycotic and non-mycotic infections.
- ▶ If conservative treatment fails review patient history, diabetes, pvd, (CLI) meds, X-ray.





# Why You should Rethink The Management Nail Unit Dystrophy



# Conclusion

- ▶ Research has shown that multidisciplinary teamwork, the addition of a podiatry service, prescription footwear and home temperature monitoring can prevent diabetic foot ulcers and amputation.
- ▶ Prevention of foot complications in diabetes is key in improving the patient's quality of life, reducing mortality and lowering healthcare costs.
- ▶ **APPROPRIATE SCREENING AND TREATMENT CAN SAVE LIMBS AND LIVES.**





The end

