CLINICAL ASSESSMENT AND CLASSIFICATION OF THE DIABETIC FOOT

DR PC CHYE
Consultant Orthopaedic Surgeon
Dept Of Orthopaedic Surgery & Traumatology
Hospital Kuala Lumpur
Every patient with diabetes has increased risk of developing foot ulceration which often leads to grave consequences

Needs to take all precautions to prevent this from happening
1 in 6 people with diabetes will have an foot ulcer during their lifetime

At any one time, 3-4% of diabetic patients have a foot problem (2010: 10 million)
DIABETIC FOOT ULCER

Responsible for 50% of admissions of diabetic patients
FOR THE CLINICIANS & HEALTHCARE SYSTEM

-- Huge workload
-- High initial and recurring healthcare cost
-- Management challenge
International Diabetes Federation:

_In USA_: Average cost to heal a simple diabetic foot ulcer is

**US$7,000 - US$10,000**

Total cost of treatment that end with an amputation for diabetic foot is

**US$30,000 – US$60,000**

Adding in the cost to the individual patient and loss of productivity & quality of life, the estimated cost of diabetic foot in the USA is ~ **US$4 BILLION A YEAR**!

--- 12-15% of the healthcare resources
Diabetics spend more time in the hospital for foot complications than for all other aspects of their disease combined.

- Immediate & long term morbidity
  - limb loss
  - psychological trauma
  - social impact
  - financial burden
Many a times, we concentrate only on treating the foot ulcer, tried all means, get frustrated in the process, but forget to assess and tackle the many factors that contribute to its happening and stubbornness to heal and poor response to treatment.
The overall risk of an individual developing a diabetic foot ulcer is determined by a combination of factors which can be easily assessed and monitored:

- Neuropathy
- Peripheral Vascular Diseases
- Poor diabetes control
- Past history of foot ulceration / amputation due to diabetes
DIABETIC FOOT ASSESSMENT

- Identify the patients at risk so that they can receive appropriate treatment, treatment monitoring, education and footcare and even prophylactic treatment measures including surgery to prevent ulcer development.

- Helps to direct valuable health care resources to people who need it. Eg. Patients at low risk only need general advice and monitoring while patients at high risk need specific footcare instruction as well as close monitoring.
COMPLETE HISTORY

PROVIDE IMPORTANT INFORMATION FOR RISK ASSESSMENT

• Duration of diabetes, type of treatment received
• Quality of glycaemic control
• Other diabetes complications: renal insufficiency, visual impairment, hypertension, ischaemic heart disease, myocardial infarction, transient ischaemic attack, strokes
• Initial wound formation and treatment received. Problems of wound healing & response to treatment
• Functional impact of the wound on the patient
• Previous foot ulceration/amputation, vascular surgery / angioplasty
  - any patient who has a previous ulcer will always remain “At Risk”
  - a current ulcer indicates the patient is at “High Risk” of amputation
• Smoking & exercise
• Neuropathic symptoms: burning or shooting pain, electrical or sharp sensations, numbness
• Vascular symptoms: claudication, rest pain, nonhealing ulcer
• Social history & support,
Peripheral neuropathy is the most important cause of diabetic foot ulceration.

Detect the loss of protective sensation.

Simple and do not require expensive instruments.
NEUROLOGICAL ASSESSMENT

Look for abnormalities in:

• **LIGHT TOUCH**  --  cotton wool
• **PAIN**  --  pin prick
• **PRESSURE**  – 10g monofilaments
• **VIBRATION**  - 128Hz Tuning Fork, Biothesiometer
• **DEEP TENDON REFLEXES**
• **TEMPERATURE**  –  palpation, Dermal Thermometer
• **PROPRIOCEPTION**
• **TWO-POINT DISCRIMINATION**  (measure nerve fibre density)
NEUROLOGICAL ASSESSMENT – Pain – Pin Prick Sensation

• A disposable pin is applied just proximal to the toenail on the dorsum of the big toe with just enough pressure to deform the skin
• Inability to perceive pinprick over either big toes would be regarded as abnormal test
NEUROLOGICAL ASSESSMENT – Pressure - 10g Monofilaments

- Also known as Semmes-Weinstein monofilaments
- Originally used to assess loss of sensation in leprosy patients
- A nylon monofilament constructed to buckle with 10g force is applied
- 4 sites (1st, 3rd, 5th metatarsal heads + plantar surface of the big toe) be tested on each foot with patient eyes closed
- Loss of the ability to detect this pressure at one or more anatomic sites on the plantar surface of the foot has been associated with the loss of large-fibre nerve function & is highly predictive of subsequent foot ulceration
NEUROLOGICAL ASSESSMENT – Vibration -- 128Hz Tuning Fork

• Tested over the tip of both big toes
• An abnormal test is when the patient loses vibration sensation and the examiner still perceives it while holding the fork at the tip of the big toe
The biothesiometer is a simple portable device that gives semiquantitative assessment of vibration perception threshold.

The stylus of the instrument is placed over the big toe and the vibration amplitude is increased until the patient can detect the vibration (the reading is the VPT).

The mean of 3 readings is taken over both big toes.

A VPT of > 25V is regarded as abnormal and is strongly predictive of subsequent foot ulceration.
NEUROLOGICAL ASSESSMENT – Ankle Reflexes

- Tested with patient resting on the examination couch
- The Achilles tendon should be stretched before striking it with the tendon hammer
- If a jerk is initially absent, patient will be asked to hook fingers together and pull, the ankle reflex is then tested again
- Total absence of ankle reflex is associated with increased risk of foot ulceration
SKIN TEMPERATURE MEASUREMENT IN DIABETIC FOOT - INFRARED DERMAL THERMOMETRY

- A non-invasive, portable hand-held infrared skin temperature probe that can be used at home by the patient on a daily basis
- Studies have found that inflammation, seen as a rise in temperature on the surface of the skin, is the earliest warning of a potential foot ulceration
- Patient can easily detect early inflammation and allow them and their doctor to prevent diabetic foot ulcers
FOOT ASSESSMENT

• Remove the shoes and socks
• Check BOTH feet
• Check the appropriateness of the shoes
• Check the shoes for correct size & depth & width, abnormal wear patterns, seams, ridges or other areas of friction or pressure
• Foot care hygiene practices
FOOT ASSESSMENT

- Look for oedema, cyanosis, hyperaemia, dependent rubor, ingrowing toenails, paronychia, cracks, ulceration, callus, deformity, healed scars, loss of toes & signs of infection.
FOOT ASSESSMENT

• **Assess the foot for deformity**: Claw toes, hammertoe, pes cavus, rocker bottom foot, hallux rigidus, bunions and Charcot changes

• **Look for callus**: Ulcer may be embedded under thickened callus over areas like big toe, heel, metatarsal heads
FOOT ASSESSMENT

**Look for signs of foot ischaemia:**

-- mottling, dusky colour, cold foot, shiny thin dry skin, atrophic nails, loss of hair on lower limbs
EXAMINE THE ULCER

- Very important for treatment
- Check the location & dimensions of ulcer
- Look for sinus track, evidence of osteomyelitis and abscess
- Assess the ulcer base:
  - Black: necrotic / eschar
  - Yellow: slough
  - Pink: granulation tissue
- Take note of slough, necrotic/gangrene tissue, dry exposed tendons/ligaments/fascia/joint capsule
EXAMINE THE ULCER

Check for evidence of infection:
- redness
- swelling
- discharge/pus
- abscess
- sequestrum

Sometimes, deep infection may have deceptively few superficial signs.
Pedography is a dynamic measurement tool for the early recognition of the altered pressure patterns in the foot of diabetic patient.

Patient walks barefoot across a platform with thousands of calibrated pressure sensors, each sensor will scan up to 400 times/sec and data is transmitted to the computer for analysis.

The information provided through analysis of peak pressures, force and gait lines, provides an essential tool for design of orthotic and therapeutic footwear.
PEDOGRAPHY

STATIC

DYNAMIC
Patients with Diabetic Foot Syndrome

- Often claw toes => less/no loading in toe area
- => increased peak pressure underneath MTH
- Charcot deformities => extremely increasing peak pressure
- Lower peak pressure in heel area
- Severe foot deformities => increasing peak pressure

Charcot foot
GAIT ANALYSIS – SEE HOW THE PATIENT WALKS

- **NORMAL FOOT**: Complex kinematics
- **DIABETIC FOOT**: Altered biomechanics. Every foot is different & the spectrum and degree of abnormalities changes over time

- Two dimensional gait analysis: older model, more rigid
- Three dimensional analysis: comprehensive, multisegment models

- Detect imbalances which may be contributing towards the foot problems
Vertical plantar pressure dispersion across the plantar surface of the foot is recorded by an insole sensor, processed, and graphically displayed in terms of sequential gait changes. It allows recognition of biomechanical abnormalities, monitoring preorthotic and postorthotic use, evaluation of the diabetic foot, and pre- and postsurgery functional examinations.
VASCULAR ASSESSMENT

• Important in defining the overall lower limb risk status
• Compare both feet and legs
• Patients with diabetes and co-existing foot pathology should have pressure studies done for a baseline assessment
VASCULAR ASSESSMENT

- Taking temperature of the foot
- Palpate for pulses
- Check the ABSI
  - Normal: 0.9 - 1.2  
    Risk of foot ulcer is small
  - Definite vascular disease: 0.6 - 0.9  
    Risk of ulcer is moderate and depends on other risk factors
  - Severe vascular disease: < 0.6  
    High risk of developing foot ulcer
- Check the Toe-Brachial Index < 0.5  
  - Peripheral V Dis
- Transcutaneous O2 tension
- Duplex Scan
VASCULAR ASSESSMENT – ABSI

• Measures the patency of lower limb arterial system
  [ Normal : 0.91-1.3; Mild obstruction : 0.7-0.9
    Moderate Obstruction : 0.4-0.69    Severe Obstruction : < 0.4 ]
• 30% of patients with diabetes have incompressible (calcified) vessels at the level of the ankle with a very small group having incompressible (calcified) vessels in the toe
• Therefore a ‘normal’ ABSI does not exclude peripheral vascular disease
• Suspect incompressible (calcified) vessels when :
  - Ankle pressure >300 mmHg
  - Ankle pressure >75mmHg higher than brachial pressure
  - ABSI >1.3
VASCULAR ASSESSMENT – TOE-BRACHIAL INDEX

- Toe-Brachial Index is more accurate than ABSI for patients with neuropathy
- A normal TBI can exclude the presence of arterial disease

<table>
<thead>
<tr>
<th>Range</th>
<th>Interpretation</th>
</tr>
</thead>
<tbody>
<tr>
<td>&gt;0.7</td>
<td>Normal</td>
</tr>
<tr>
<td>0.5-0.7</td>
<td>Mild</td>
</tr>
<tr>
<td>0.35-0.5</td>
<td>Moderate</td>
</tr>
<tr>
<td>&lt;0.35 and toe pressure 40 mmHg</td>
<td>Moderate-Severe</td>
</tr>
<tr>
<td>&lt;0.35 and toe pressure &lt; 30 mmHg</td>
<td>Severe</td>
</tr>
</tbody>
</table>
TRANSCUTANEOUS O2 TENSION

• Important factors in the healing process include not only macrocirculation, but more specifically, the local skin microcirculation and oxygenation of the tissue surrounding the ulcer.

• Measurement of transcutaneous oxygen tension (Tc PO2) is a noninvasive method reflecting local arterial blood flow and skin oxygenation that can be used to determine severity and clinical progression of peripheral arterial disease.
VASCULAR ASSESSMENT - DUPLEX ULTRASOUND & ANGIOGRAPHY

Should be done if:

- An ankle brachial pressure index of <0.5
- A transcutaneous oxygen tension (reflecting local arterial perfusion pressure) of <30 mm Hg
- A toe pressure of <30 mm Hg.
- An ischaemic ulcer has not shown progress in healing despite optimum treatment
Duplex ultrasound and angiography can show areas of vascular stenoses or occlusions & measure blood flow velocity & turbulence.
LASER DOPPLER FLOWMETRY

- Non-invasive & highly accurate
- Enables the user to image changes in blood flow over the entire wound surface, with a full colour 2-dimensional map of microvascular flow.
MEASUREMENT OF SKIN PERFUSION PRESSURE

• Skin Perfusion Pressure (SPP) is the pressure required for restoring microcirculatory blood flow following release of carefully controlled occlusion.

• It is useful in the assessment of peripheral arterial disease for both critical ischaemia (Castronuovo, 1997, Castronuovo et al, 1997), and also for the determination of optimal levels for amputation (Tsuji et al, 2008).

• There are also indications in the literature that SPP measurements are useful indicators for wound healing potential (Yamada et al, 2008).
<table>
<thead>
<tr>
<th>RISK CATEGORY</th>
<th>DEFINITION</th>
<th>TREATMENT RECOMMENDATIONS</th>
<th>SUGGESTED FOLLOW-UP</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>No LOPS, no PAD</td>
<td>Patient education, appropriate footwear</td>
<td>Annually (by generalist / specialist)</td>
</tr>
<tr>
<td></td>
<td>No deformity</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>LOPS ± deformity</td>
<td>Special footwear</td>
<td>Every 3-6 months (specialist)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Consider prophylactic surgery if deformity is not able to be safely accommodated in shoes</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Continue patient education</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>PAD ± LOPS</td>
<td>Special footwear</td>
<td>Every 2-3 months (specialist)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Consider vascular consultation / combined follow-up</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>History of ulcer or amputation</td>
<td>Same as category 1</td>
<td>Every 1-2 months (specialist)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Consider vascular consultation / combined follow-up if PAD present</td>
<td></td>
</tr>
</tbody>
</table>

LOPS: Loss Of Protective Sensations; PAD: Peripheral Arterial Disease
NUTRITION & ENERGY REQUIREMENT ASSESSMENT -- Importance

- Detect patients who are malnourished or at risk, so treatment can be started as soon as possible
- Determine the quantity of malnutrition, so that the individual nutritional need can be quantified
- Monitoring of changes in nutritional state during nutritional intervention
- Achieve excellent blood glucose control and a healthy diet
- Prompt treatment with optimum amounts of calories, protein, fluids, and vitamins/minerals
- Frequent reassessment to adjust the nutrition care plan to promote optimal wound healing.
NUTRITIONAL PROBLEMS IN DIABETICS

- Poor diet and glycaemic control leads to hyperglycaemia
- Impaired utilization of carbohydrate due to hyperglycemia leads to more proteolysis, glycogenolysis, and lipolysis and subsequent decreased wound healing
- Hyperglycemia also leads to osmotic diuresis and the loss of water and electrolytes
- Both extracellular and intracellular dehydration occurs
NUTRITIONAL ASSESSMENT

• Complete nutrition history
  - 24-hr recall, usual food intake, meal frequency
  - intake of protein, fat and carbohydrates, its type and amount
• Estimate daily calorie intake, expenditure and actual needs
• Assess current nutrition therapy
• Evaluate who does food prep/shopping
• Determine frequency/choices when eating out
• Assess alcohol intake
NUTRITIONAL ASSESSMENT

Measure height, weight, BMI & ideal body weight

Determine activity types and frequency

Determine limitations that hinder exercise

Assess willingness and ability to be more physically active

Determine use of vitamin/minerals/nutrition supplements

Assess for eating disorders
LABORATORY SCREENING - Blood

- HbA1c > 10% : ↑ risk of infection and poor wound healing
- Random / Fasting sugar
- Renal Function
- Liver Function, Serum Albumin
- Full blood count : Hb, Total White
- ESR, CRP
LABORATORY SCREENING - Microbiology

- Culture and Sensitivity:
  - Ulcer swab
  - Tissue
  - Bone
  - Pus
LABORATORY SCREENING - Histopathology

- Useful for diagnosis of osteomyelitis
- Biopsy of chronic non-healing ulcer: Marjolin’s Ulcer
  Squamous Cell Ca, Malignant Melanoma
The most widely recognized classification is the Wagner system, which grades ulcers from 0 to 5 based largely on ulcer depth and severity.

Although easy to remember, this system fails to address critical parameters like foot ischaemia, peripheral neuropathy, ulcer dimensions.

<table>
<thead>
<tr>
<th>GRADE 0 :</th>
<th>GRADE III :</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intact skin ( preulcerative state )</td>
<td>Infected deep ulcer</td>
</tr>
<tr>
<td></td>
<td>With abscess, osteomyelitis</td>
</tr>
<tr>
<td></td>
<td>or septic arthritis</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>GRADE I :</th>
<th>GRADE IV :</th>
</tr>
</thead>
<tbody>
<tr>
<td>Superficial ulcer</td>
<td>Local ischaemia</td>
</tr>
<tr>
<td>Skin or subcutaneous tissue only</td>
<td>Gangrene of toes or distal</td>
</tr>
<tr>
<td></td>
<td>forefoot</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>GRADE II :</th>
<th>GRADE V :</th>
</tr>
</thead>
<tbody>
<tr>
<td>Deep full-thickness ulcer</td>
<td>Extensive ischaemia</td>
</tr>
<tr>
<td>Involving tendon, bone or joint</td>
<td>Gangrene of midfoot or hindfoot</td>
</tr>
<tr>
<td>capsule</td>
<td></td>
</tr>
</tbody>
</table>

The UT system is easy to use and addresses not only the wound depth, but also the presence or absence of infection and ischaemia.

Does not address neuropathy.
## UNIVERSITY OF TEXAS CLASSIFICATION

**Classification of diabetic foot wounds.**

Lavery LA, Armstrong DG, Harkless LB. Dept Orthopaedics, U of Texas, San Antonio, USA.

<table>
<thead>
<tr>
<th>STAGE</th>
<th>GRADE 0</th>
<th>GRADE I</th>
<th>GRADE II</th>
<th>GRADE III</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>Pre- or postulcerative state – Completely epithelized</td>
<td>Superficial Ulcer – not involving tendon, capsule or bone</td>
<td>Ulcer penetrating to tendon or capsule</td>
<td>Ulcer penetrating to bone or joint</td>
</tr>
<tr>
<td>B</td>
<td>Infected</td>
<td>Infected</td>
<td>Infected</td>
<td>Infected</td>
</tr>
<tr>
<td>C</td>
<td>Ischaemic</td>
<td>Ischaemic</td>
<td>Ischaemic</td>
<td>Ischaemic</td>
</tr>
<tr>
<td>D</td>
<td>Infected &amp; Ischaemic</td>
<td>Infected &amp; Ischaemic</td>
<td>Infected &amp; Ischaemic</td>
<td>Infected &amp; Ischaemic</td>
</tr>
</tbody>
</table>

*J Foot Ankle Surg (1996)35:528-31*
The PEDIS system is even more detailed and was developed by the International Working Group on the Diabetic Foot (IWGDF) in 2003 for research purposes.

It describes each of the following ulceration characteristics on a scale of 1 to 4, depending on severity:
- Perfusion
- Extent (or size)
- Depth/tissue loss
- Infection
- Sensation
The aims of this system is to categorize different populations of diabetic patients with a foot ulcer for the purpose of research using terms which are unambiguous and applied worldwide. This should facilitate communication and enable comparison of the results of different research projects. This system is also used by the Infectious Disease Society of America for the development of a classification for diabetic foot infection.
**“PEDIS” GRADING OF DIABETIC FOOT INFECTION**

**INTERNATIONAL CONSENSUS ON THE DIABETIC FOOT 2003**

<table>
<thead>
<tr>
<th>Clinical manifestations of infection</th>
<th>Infection severity</th>
<th>PEDIS grade</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wound lacking purulence or any manifestations of inflammation</td>
<td>Uninfected</td>
<td>1</td>
</tr>
<tr>
<td>Presence of ≥2 manifestations of inflammation (purulence, or erythema, pain, tenderness, warmth, or induration), but any cellulitis/erythema extends ≤2 cm around the ulcer, and infection is limited to the skin or superficial subcutaneous tissues; no other local complications or systemic illness.</td>
<td>Mild</td>
<td>2</td>
</tr>
<tr>
<td>Infection (as above) in a patient who is systemically well and metabolically stable but which has ≥1 of the following characteristics: cellulitis extending &gt;2 cm, lymphangitic streaking, spread beneath the superficial fascia, deep-tissue abscess, gangrene, and involvement of muscle, tendon, joint or bone</td>
<td>Moderate</td>
<td>3</td>
</tr>
<tr>
<td>Infection in a patient with systemic toxicity or metabolic instability (e.g., fever, chills, tachycardia, hypotension, confusion, vomiting, leukocytosis, acidosis, severe hyperglycemia, or azotemia)</td>
<td>Severe</td>
<td>4</td>
</tr>
</tbody>
</table>

PEDIS : Perfusion, Extent / size, Depth / tissue loss, Infection, Sensation
Infections are described based on the composite of the clinical appearance of the foot and the systemic condition of the patient.

Delineates diabetic foot infections into four straightforward categories:

**UNINFECTED** - lacking purulence or inflammation

**MILD**
- infection limited to skin/subcutaneous tissue
- peri-wound erythema of less than 2 cm
- less than two signs of inflammation

**MODERATE**
- involvement of muscle, joint, bone, or presence of lymphangiitis
- peri-wound cellulitis beyond 2 cm or gangrene

**SEVERE**
- infection in a patient with systemic toxicity or metabolic instability
INTERNATIONAL CONSENSUS ON THE DIABETIC FOOT INFECTION CLASSIFICATION SYSTEM 2004

• **GRADE 1**: No symptoms or signs of infection

• **GRADE 2**: Infection involving skin and subcutaneous tissue only. No systemic signs and symptoms. No other cause of inflammatory response (gout, trauma, acute Charcot neuro-osteoarthropathy, fracture, thrombosis, venostasis) At least 2 of the following: localised swelling or induration, erythema > 0.5-2cm around the ulcer. Localised tenderness or pain, local warmth, purulent discharge
• **GRADE 3**: Infection involving deeper than skin and subcutaneous tissues (abscess, osteomyelitis, septic arthritis, necrotising fasciitis), erythema extending > 2cm around an ulcer in addition to one of the following: oedema, tenderness, heat, purulent discharge. No sign of systemic inflammatory response.
• **GRADE 4**: Any foot infection with signs of a systemic inflammatory response syndrome, manifested by 2 or more of the following: Temperature < 36°C or > 38°C, Heart rate > 90 beats per min, respiratory rate > 20 breaths /min, PaCO2 < 32mmHg, WBC > 12,000 or < 4000/mm³
CHARCOT FOOT CLASSIFICATIONS

Attempt to define the natural course of Charcot arthropathy have produced a number of classification processes over the years:

- Eichenholtz Classification
- Sanders-Frykberg Classification
- Brodsky Classification
- Rogers and Bevilacqua Classification
EICHENHOLTZ CLASSIFICATION OF CHARCOT FOOT 1966

- Eichenholtz was the first to develop a system for staging Charcot's arthropathy.
- The system, originally consisting of 3 stages, is based on the changes seen on radiographs.
- The purpose of this classification system is to determine the patient's prognosis and to gauge the optimal timing for arthrodesis.
- Surgical intervention is most effective when performed during early stage 1 or late stage 3 disease.
EICHENHOLTZ CLASSIFICATION OF CHARCOT FOOT 1966

Shows stage of disease progression over time based on radiograph changes:

**Stage “0”** - hot foot, normal Xrays. MR shows bone oedema and fractures (ADDED by Shibata, Tada & Hashizume 1990)

**Stage 1** – foot warm & swollen, bone debris at articular margins, fragmentation of subchondral bone, bone resorption, subluxation, dislocations, fractures

**Stage 2** - decreased warmth & swelling, coalescence, bone ends become sclerotic, fracture healing, debris resorption,

**Stage 3** – consolidation & remodelling
Classified Charcot arthropathy anatomically into pattern of joint involvement

5 PATTERNS OF DESTRUCTION:

**Pattern I**: Forefoot joints. Osteopenia, osteolysis, juxtacortical bone defects, subluxation

**Pattern II**: Tarsometatarsal joints & bases, cuneiforms & cuboids. Subluxation, fracture, dislocation, rocker bottom [most common]

**Pattern III**: Chopart’s joint (naviculocuneiform). Osteolysis, fragmentation

**Pattern IV**: Ankle with or without subtalar joint. Joint destruction and collapse or dislocation. Severe instability

**Pattern V**: Calcaneum only. Avulsion of Tendo Achilles from posterior tubercle
SANDERS-FRYKBERG SYSTEM

- Ankle joint: 10%
- Calcaneus: 5%
- Naviculocuneiform joints: 30%
- Talonavicular & Calcaneocuboid joints
- LisFranc - Tarsometatarsal joints: 40%
- IPJs & phalanges: 15%
- MPJs & metatarsals
BRODSKY CLASSIFICATION OF CHARCOT FOOT, 1999

• Most widely used
• Shows disease distribution of the Charcot foot
• Described 4 distinct anatomical areas of the foot and ankle that are most commonly affected

Brodsky Classification of Charcot Foot

TYPE 1: Tarsometatarsal and lesser tarsal
70% of cases. Leads to rocker bottom foot & plantar skin breakdown

TYPE 2: Peritalar
20% results in instability
Brodsky Classification of Charcot Foot

Type 3a (ankle) and 3b (posterior calcaneum)
10% results in instability

Trepman added type 4 (multiple sites) and type 5 (forefoot) as shown here
COULD A NEW CLASSIFICATION OF THE CHARCOT FOOT HELP PREDICT AMPUTATION RISK?

ROGERS and BEVILACQUA Classification 2008

• Considers deformity, ulceration and osteomyelitis
• Focusing on degrees of complications of Charcot Foot
• Helpful in predicting amputation
• 2-axis system (XY) combining features of clinical exam, radiography and anatomy
## Rogers and Bevilacqua Charcot Foot Classification 2008

<table>
<thead>
<tr>
<th></th>
<th>1: Forefoot</th>
<th>2: Midfoot</th>
<th>3: Rearfoot/Ankle</th>
</tr>
</thead>
<tbody>
<tr>
<td>A: Acute Charcot with No Deformity</td>
<td>1A</td>
<td>2A</td>
<td>3A</td>
</tr>
<tr>
<td>B: Charcot with Deformity</td>
<td>1B</td>
<td>2B</td>
<td>3B</td>
</tr>
<tr>
<td>C: Charcot with Deformity and Ulceration</td>
<td>1C</td>
<td>2C</td>
<td>3C</td>
</tr>
<tr>
<td>D: Charcot with Deformity, Ulceration and Osteomyelitis</td>
<td>1D</td>
<td>2D</td>
<td>3D</td>
</tr>
</tbody>
</table>

- **A**: Acute Charcot with no deformity
- **B**: Charcot with deformity
- **C**: Charcot with deformity and ulceration
- **D**: Charcot with deformity, ulceration and osteomyelitis

**More serious, higher risk of amputation**
THANK YOU