

Diabetic Foot

Introduction

- Epidemiology
- Pathophysiology
- Classification
- Treatment

Epidemiology

- DM largest cause of neuropathy in N.A.
- 1 million DM patients in Canada
- Half don't know
- Foot ulcerations is most common cause of hospital admissions for Diabetics
- Expensive to treat, may lead to amputation and need for chronic institutionalized care

Epidemiology

- \$34,700/year (home care and social services) in amputee
- After amputation 30% lose other limb in 3 years
- After amputation 2/3^{rds} die in five years
- Type II can be worse
- 15% of diabetic will develop a foot ulcer

Pathophysiology

- ?Vascular disease?
- Neuropathy
 - Sensory
 - Motor
 - autonomic

Vascular Disease

- 30 times more prevalent in diabetics
- Diabetics get atherosclerosis obliterans or “lead pipe arteries”
- Calcification of the media
- Often increased blood flow with lack of elastic properties of the arterioles
- Not considered to be a primary cause of foot ulcers

Neuropathy

- Changes in the vasoneurotrophin with resulting ischemia ? cause
 - Increased sorbitol in feeding vessels block flow and causes nerve ischemia
 - Intraneural accumulation of advanced products of glycosylation
- Abnormalities of all three neurologic systems contribute to ulceration

Autonomic Neuropathy

- Regulates sweating and perfusion to the limb
- Loss of autonomic control inhibits thermoregulatory function and sweating
- Result is dry, scaly and stiff skin that is prone to cracking and allows a portal of entry for bacteria

Autonomic Neuropathy



Motor Neuropathy

- Mostly affects forefoot ulceration
 - Intrinsic muscle wasting – claw toes
 - Equinous contracture

Sensory Neuropathy

- Loss of protective sensation
- Starts distally and migrates proximally in “stocking” distribution
- Large fibre loss – light touch and proprioception
- Small fibre loss – pain and temperature
- Usually a combination of the two

Sensory Neuropathy

- Two mechanisms of Ulceration
 - Unacceptable stress few times
 - rock in shoe, glass, burn
 - Acceptable or moderate stress repeatedly
 - Improper shoe ware
 - deformity

Patient Evaluation

- Medical
- Vascular
- Orthopedic
- Identification of “Foot at Risk”
 - ? Our job

Patient Evaluation

- Semmes-Weinstein Monofilament Aesthesiometer
- 5.07 (10g) seems to be threshold
- 90% of ulcer patients can't feel it
- Only helpful as a screening tool



Patient Evaluation

- Medical
 - Optimized glucose control
 - Decreases by 50% chance of foot problems

Patient Evaluation

- Vascular
 - Assessment of peripheral pulses of paramount importance
 - If any concern, vascular assessment
 - ABI ($n > 0.45$)
 - Sclerotic vessels
 - Toe pressures ($n > 40-50$ mmHg)
 - $TcO_2 > 30$ mmHg
 - Expensive but helpful in amp. level

Patient Evaluation

- Orthopedic
 - Ulceration
 - Deformity and prominences
 - Contractures

Patient Evaluation

- X-ray
 - Lead pipe arteries
 - Bony destruction (Charcot or osteomyelitis)
 - Gas, F.B.'s

Patient Evaluation



Patient Evaluation

- Nuclear medicine
 - Overused
 - Combination Bone scan and Indium scan can be helpful in questionable cases (i.e. Normal X-rays)
 - Gallium scan useless in these patients
 - Best screen – indium – and if Positive – bone scan to differentiate between bone and soft tissue infection

Patient Evaluation

- CT can be helpful in visualizing bony anatomy for abscess, extent of disease
- MRI has a role instead of nuclear medicine scans in uncertain cases of osteomyelitis

Ulcer Classification

- Wagner's Classification

0 – Intact skin (impending ulcer)

1 – superficial

2 – deep to tendon bone or ligament

3- osteomyelitis

4 – gangrene of toes or forefoot

5 – gangrene of entire foot

Classification

Type 2 or 3



Classification

Type 4



Treatment

- Patient education
 - Ambulation
 - Shoe ware
 - Skin and nail care
 - Avoiding injury
 - Hot water
 - F.B's

Treatment

- Wagner 0-2
 - Total contact cast
 - Distributes pressure and allows patients to continue ambulation
 - Principles of application
 - Changes, Padding, removal
 - Antibiotics if infected

Treatment



Treatment

- Wagner 0-2
 - Surgical if deformity present that will reulcerate
 - Correct deformity
 - exostectomy

Treatment

- Wagner 3
 - Excision of infected bone
 - Wound allowed to granulate
 - Grafting (skin or bone) not generally effective

Treatment

- Wagner 4-5
 - Amputation
 - ? level

Treatment

- After ulcer healed
 - Orthopedic shoes with accommodative (custom made insert)
 - Education to prevent recurrence

Charcot Foot

- More dramatic – less common 1%
- Severe non-infective bony collapse with secondary ulceration
- Two theories
 - Neurotraumatic
 - Neurovascular

Charcot Foot

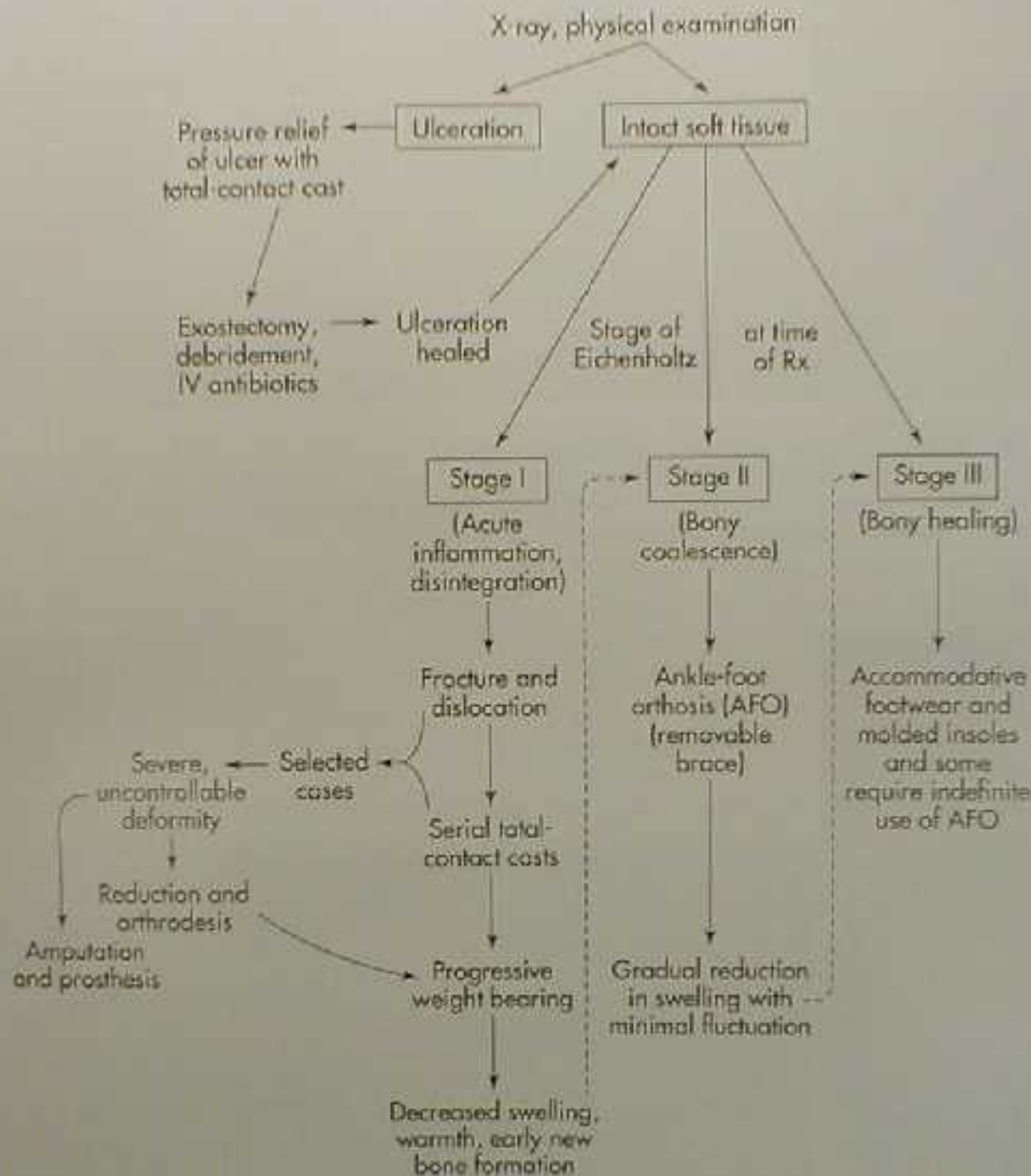
- Neurotraumatic
 - Decreased sensation + repetitive trauma = joint and bone collapse
- Neurovascular
 - Increased blood flow → increased osteoclast activity → osteopenia → Bony collapse
 - Glycolization of ligaments → brittle and fail → Joint collapse

Classification

- Eichenholtz
 - 1 – acute inflammatory process
 - Often mistaken for infection
 - 2 – coalescing phase
 - 3 - consolidation

Classification

- Location
 - Forefoot, midfoot (most common) , hindfoot
- Atrophic or hypertrophic
 - Radiographic finding
 - Little treatment implication



Case 1



Case 1



Case 1



Case 2





Case 3



Case 3



Case 4



Case 4



Indications for Amputation

- Uncontrollable infection or sepsis
- Inability to obtain a plantar grade, dry foot that can tolerate weight bearing
- Non-ambulatory patient
- Decision not always straightforward

Conclusion

- Multi-disciplinary approach needed
- Going to be an increasing problem
- High morbidity and cost
- Solution is probably in prevention
- Most feet can be spared...at least for a while