Diabetic Foot

Objectives

- Define diabetic foot
- Explain etiopathogenesis of diabetic foot ulcer
- Wagner grades
- Understand Charcot’s foot
- Explain prevention strategies to patient

Definition

A foot with a constellation of pathologic changes affecting the lower extremity in diabetics, often leading to amputation and/or death due to complications; the common initial lesion leading to amputation is a nonhealing skin ulcer, induced by regional pressure, pathogenically linked to sensory neuropathy, ischemia, infection

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Extent

- 20 million DM patients in India (2 Crore)
- DM largest cause of neuropathy
- 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

- 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

Neuropathy

- Changes in the vasonervosum 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

Vascular Disease

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

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
  - Equinus 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 s
    - deformity

Patient Evaluation

- Medical
- Vascular
- Orthopedic
- Identification of “Foot at Risk”

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>40-50mmHg)
    - 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)

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

Six intervention demonstrate efficacy in diabetic foot management

1- off loading

2- Debridement and drainage

3- wound dressing

4- appropriate use of antibiotic

5- revascularization

6- limited amputation

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

- **5 P’s**

- **3D’s**

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

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

Prevention

- Diabetic control
- Foot care

Diabetic foot successfully treated !!