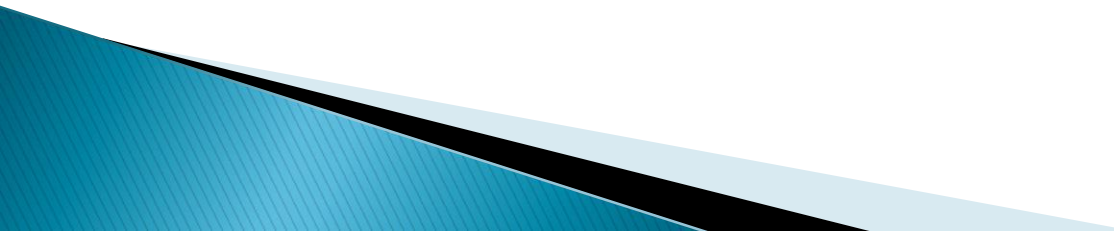


Diabetic Foot

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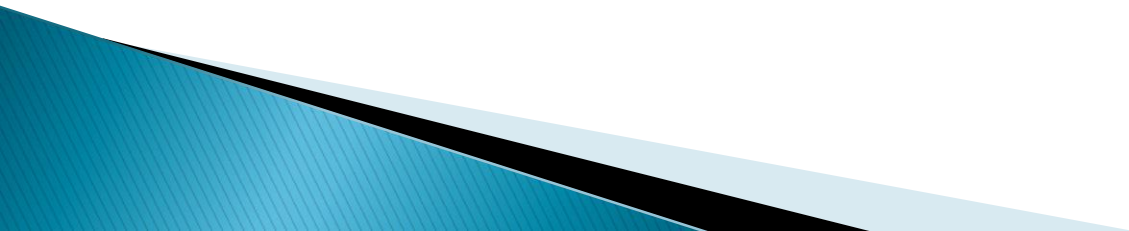
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Objective:

To understand the process of evaluating and treating the Diabetic foot and streamlining the treatment of the infected Diabetic foot.



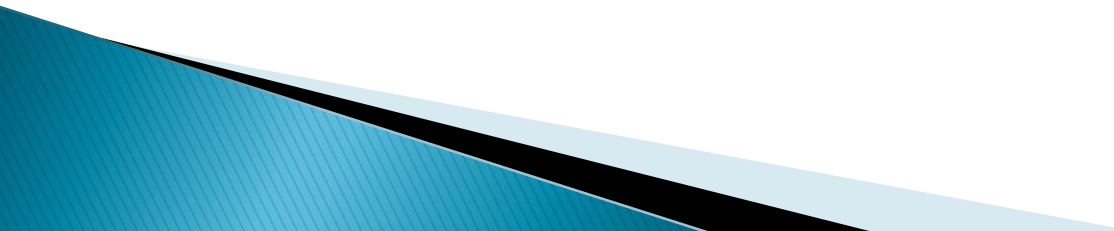
Statistic's of Diabetes & Prediabetes

- ▶ 2012: 29.1 M Americans with Diabetes, 1.25 M Am. Children & Adults have type 1 diabetes
- ▶ Undiagnosed: Of the 29.1M, 21.0 were Diagnosed, 8.1 were undiagnosed.
- ▶ Seniors: Age >65 (25.9% or 11.8M).
- ▶ New Cases: 2012, 1.7 M.
- ▶ Deaths: 7th leading cause of Death in America in 2010. 69K death cert., listed has underlining cause of death. 234K death cert., contributing cause of death.

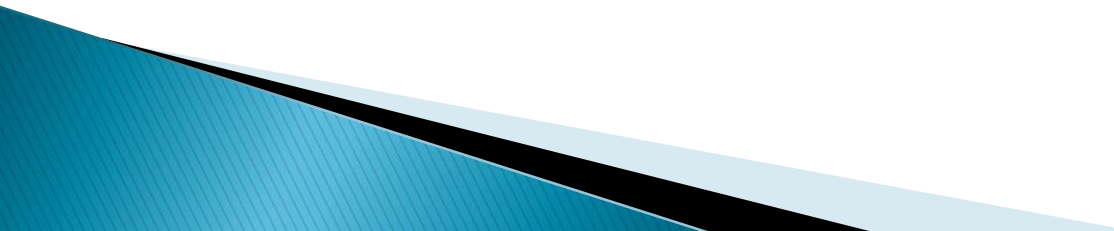
Continuation of Statistic's of Diabetes & Prediabetes

- ▶ Prediabetes: 2012, 86M Americans age 20 and older had prediabetes. Up from 79M in 2010.

Diabetes by Race/Ethnicity

- ▶ 7.6% Non Hispanic whites.
 - ▶ 9.0% Asian Americans.
 - ▶ 12.8% Hispanics.
 - ▶ 13.2% Non Hispanics blacks.
 - ▶ 15.9% American Indians/Alaskan Natives.
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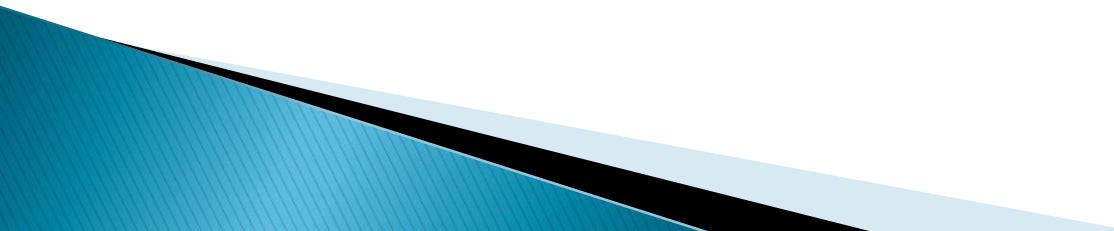
Complications/Co-Morbid Cond.

- ▶ Hypoglycemia: 2011 282K ER visits >18 yr.
 - ▶ Hypertension: 2009–12, 71% BP >140/90.
 - ▶ Dyslipidemia: 2009–12, 65% LDL cholesterol >100mg/dl.
 - ▶ CVD Death: 2003–06, 1.7x higher >18 yr and older with DM.
 - ▶ MI: 1.8x higher >20 yr. with DM.
 - ▶ Stroke: 1.5x higher >20 yr. with DM.
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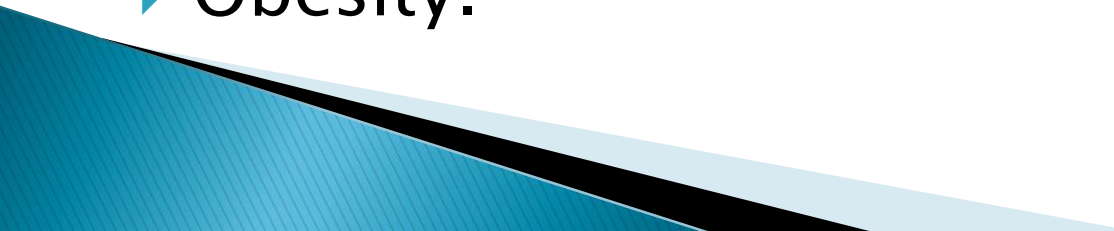
Complications/Co-Morbid Cond.

- ▶ Blindness and Eye Problems: 2005–08, 4.2 M with diabetic retinopathy.
- ▶ Kidney Disease: DM primary cause of Kidney failure.
2011, 49K began tx for Kidney failure.
2011, 228,924 chronic dialysis /transplant.
- ▶ Amputations: 2010, 73,000 non-traumatic lower limb amputations, >20 yr age with DM.

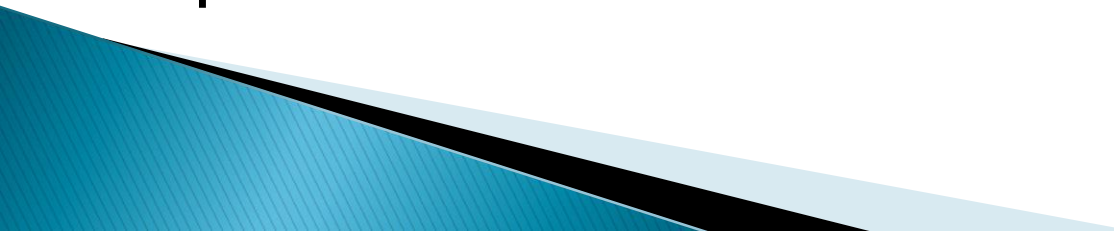
Prevention

- ▶ 40 to 50% of Diabetes related amputations are preventable.
 - ▶ Foot Care Programs in Diabetes have shown to reduce the rate of ulcers and amputations by 45% to 85%.
 - ▶ A complete foot program aims at identifying risk factors for the development of diabetic foot ulcers and ultimately, amputations.
- 

Prevention: Risk Factors for Development of Ulcers

- ▶ Peripheral neuropathy.
 - ▶ Absent pedal pulses.
 - ▶ Trophic skin changes, decreased hair growth, abnormal toenails, or discoloration of skin.
 - ▶ Calf or leg pain indicative of claudication.
 - ▶ History of previous foot ulcer or lower extremity amputation.
 - ▶ Previous hospitalization for any diabetic foot infection.
 - ▶ Obesity.
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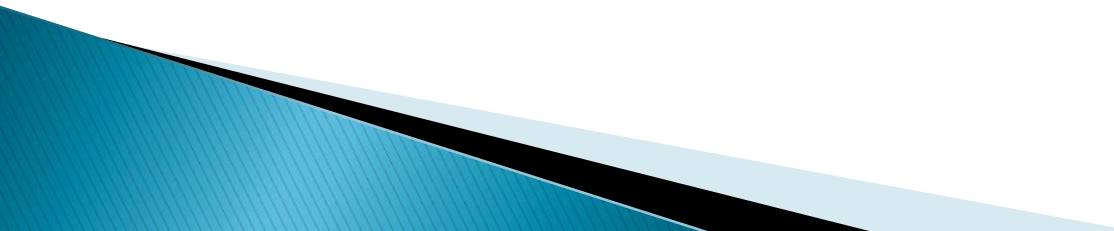
Prevention: Risk Factors for Development of Ulcers

- ▶ Foot deformity and callus formation resulting in focal areas of high pressure.
 - ▶ Autonomic neuropathy, causing decreased sweating and dry, fissured skin.
 - ▶ Impaired vision.
 - ▶ Poor glucose control–Impaired wound healing.
 - ▶ Poor footwear that causes skin breakdown, or inadequately protects the skin from high pressure and shear forces.
- 

Prevention: Foot Examination

- ▶ ADA recommends Diabetic's to have a thorough foot examination about once a year.
- ▶ foot examination would include:
 - 1) **DERMATOLOGY**: Pedal hair, skin integrity, The Temperature of skin, nails–normal, or mycotic.
 - 2) **VASCULAR**: Pedal Pulses DP and PT intact or absent, Cap refill +3 seconds, Edema.

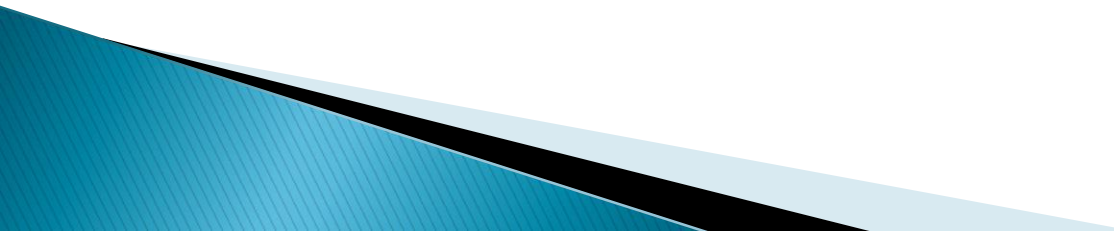
Prevention: Foot Examination

- ▶ foot examination would include:
 - 3) **NEUROLOGY**: Protective threshold intact with Semmes Weinstein 5.07 monofilament.
 - 4) **MUSCULOSKELETAL**: Strength, check all four quadrants, look for foot deformities, hammer toe's, bunions, rocker bottom foot, boney protuberance's, Pain with range of motion.
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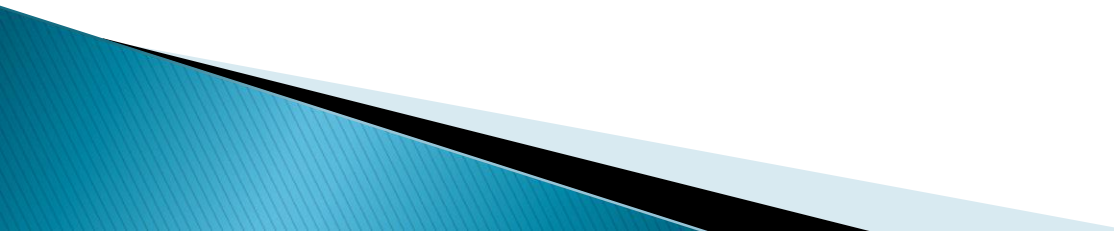
Prevention: Glycemic Control

- ▶ Poor glucose control increases risk of developing peripheral neuropathy in the lower extremities.
 - ▶ Leads to insensitive foot and ulcer formation.
 - ▶ Diabetic Complications and Control Trial (DCCT):
 - 1) Type 1, achieved near normal glucose, experience reduction in clinical neuropathy by 57% to 69%.
 - 2) Type 2, reduces micro vascular and neuropathic complications.
- 

Prevention: Smoking Cessation

- ▶ Cigarette smoking is a major risk factor for PVD and amputation in people without diabetes.
 - ▶ Relationship between tobacco and diabetic foot ulcers has not been clearly established.
 - ▶ Evidence of an association between smoking and micro vascular disease as seen in retinopathy and nephropathy.
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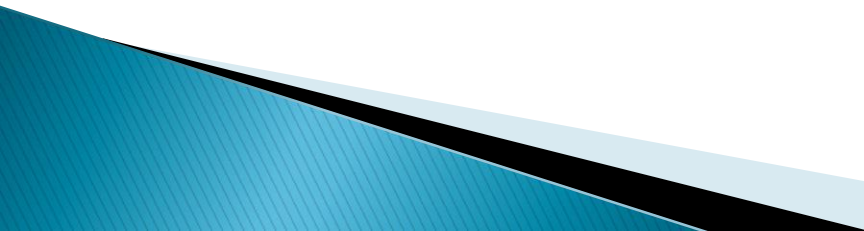
Prevention: Patient Education

- ▶ Studies have shown that patient education about foot care results in a significant reduction of diabetic foot ulcerations.
 - ▶ Diabetic patients need to be taught that their feet need daily surveillance and that the primary care physician needs to be notified of any abnormality.
 - ▶ Diabetic patients need to be educated on the importance of diet and nutrient.
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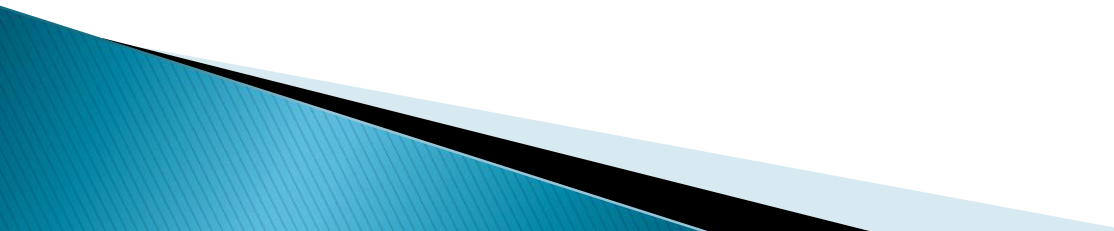
Prevention: Patient Education



Prevention: Footwear

- ▶ Medicare coverage of therapeutic shoes for diabetics became available in 1993.
 - ▶ Diabetic shoes are seamless and come with a molded insert.
 - ▶ Properly fitted footwear can reduce the formation of calluses and ulcers.
 - ▶ Purchase new shoes in the afternoon when feet are the largest.
 - ▶ Select shoes that have rounded toes, high toe box and soft leather uppers.
- 

Prevention: Footwear

- ▶ The ball of the foot should rest in the widest part of the shoe.
 - ▶ Wear shoes that are of adequate length, width and depth. Shoes should not compress the toes or foot. The uppers should be soft leather.
 - ▶ Wear new shoes around the house on carpeting for one hour and check for any hot spots or problem areas.
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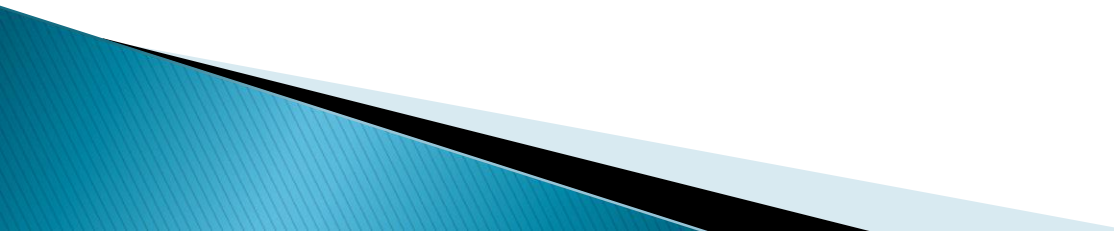
Prevention: Footwear



Prevention: Footwear



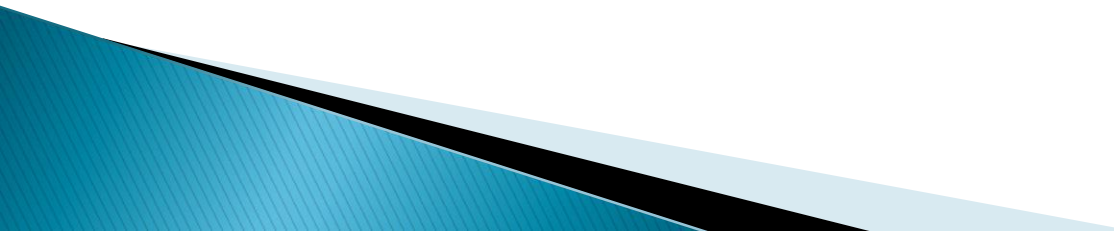
Prevention: Footwear

- ▶ Replace your shoes regularly. Have at least two pairs of well-fitting shoes to alternate so that shoes can dry between wearing.
 - ▶ Have your feet measured every time you purchase a pair of shoes.
 - ▶ People prone to diabetes-related foot problems should not wear a new shoe more than 2 hours without checking their feet for pressure areas. Five hours should be the maximum daily length of wear.
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Prevention: Footwear



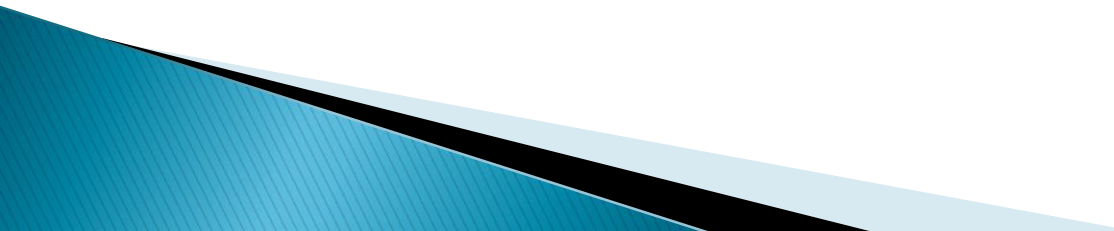
Prevention: Footwear

- ▶ Steel toe footwear should be avoided or implement more foot inspection for pressure points.
 - ▶ Do not buy sandals with thongs between the toes.
 - ▶ Avoid wearing high heels and shoes with pointed or open toes.
 - ▶ Replace the inserts in a timely manner.
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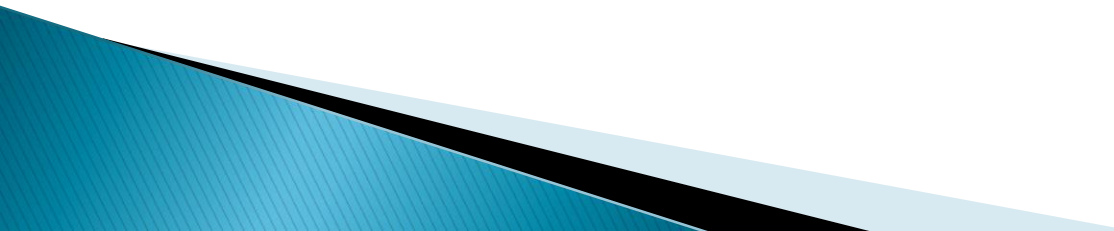
Prevention: Footwear



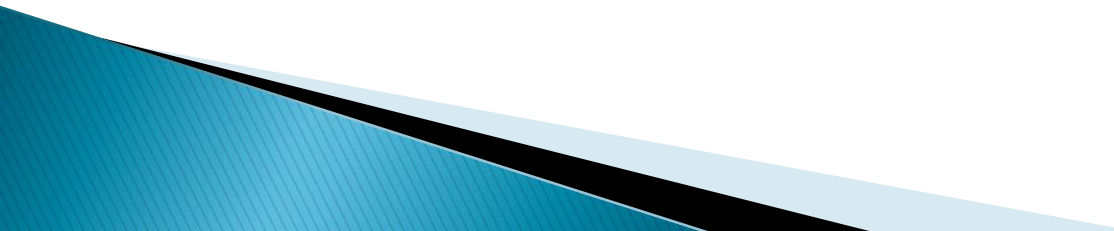
Prevention: Exercise

- ▶ Exercise is very important in the management of diabetes.
 - ▶ Exercise must be modified in patients with high-risk factors, such as peripheral neuropathy or PVD.
 - ▶ Subjecting insensitive feet to repetitive weight bearing exercises such as jogging, prolong walking, treadmill, and step exercises may lead to ulceration and fractures.
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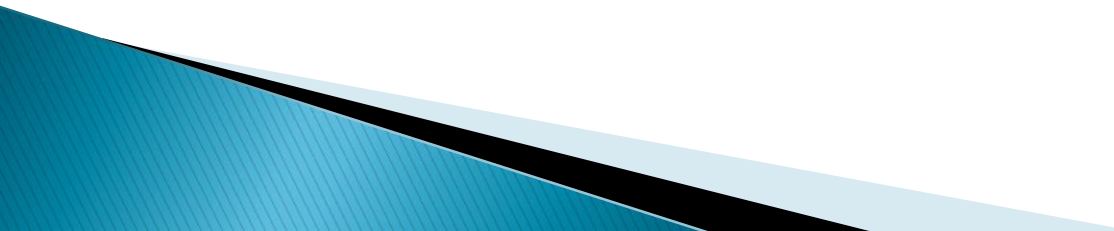
Prevention: Exercises for Diabetic Patients with neuropathy

- ▶ Swimming.
 - ▶ Bicycling.
 - ▶ Rowing.
 - ▶ Chair exercises.
 - ▶ Arm exercises.
 - ▶ Other non-weight bearing exercises.
- 

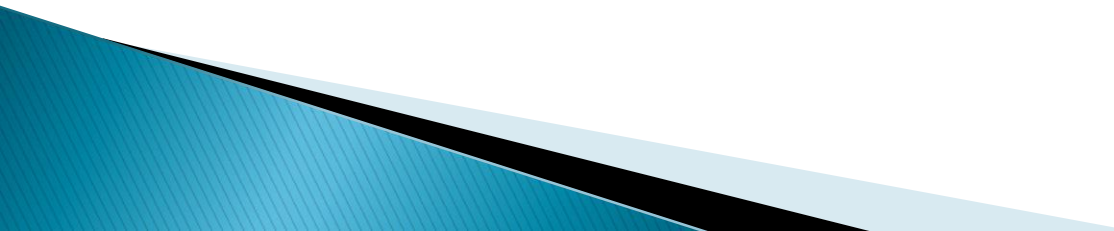
Prevention: Exercises Contraindicated for Diabetic Patients with neuropathy

- ▶ Treadmill.
 - ▶ Prolong walking.
 - ▶ Jogging.
 - ▶ Step exercises.
- 

Microbiology

- ▶ Diabetic foot infection is usually polymicrobial.
 - ▶ Organisms isolated from an infected diabetic foot ranges from one and five organisms.
 - ▶ Average number of bacterial isolates per culture-positive specimen was 2.8 (Lipsky et al).
 - ▶ The most common isolated pathogen was *S aureus*(44%). 80% methicillin sensitive.
- 

Microbiology

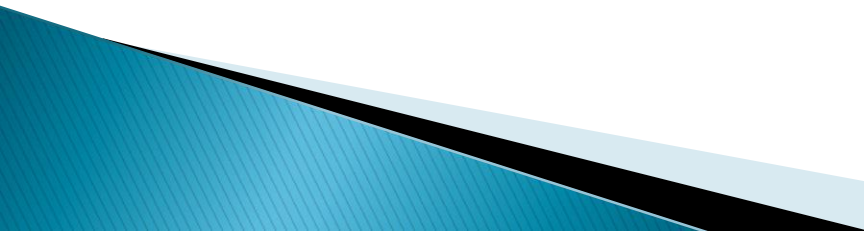
- ▶ Other common isolates were:
 - Peptostreptococcus spp**
 - Prevotella–Porphyromonas group**
 - Enterobacteriaceae**
 - Enterococcus spp**
 - Streptococcus agalactiae**
 - Bacteroides fragilis**
 - Pseudomonas**
- 

Imaging of the Diabetic foot

- ▶ There are more hospital admissions for Diabetics with related foot pathology.
 - ▶ Neuropathy, peripheral vascular disease, neuro-osteoarthropathy (Charcot's joint) contribute to foot ulcers, cellulitis, soft tissue abscesses, gangrene, and osteomyelitis.
 - ▶ Differentiating these conditions and the infection often require imaging studies.
 - ▶ Plain radiography, radionuclide studies, CT, and MRI help with these assessment.
- 

Imaging of the Diabetic foot

Soft Tissue and Bone

- ▶ Imaging of the symptomatic soft tissues and underlying bones is indicated in selected Wagner Classes II to IV and Class V patients.
 - ▶ Patients requiring imaging should receive plain radiographs first.
 - ▶ Changes in the soft tissues in active infections include swelling, gas in tissue with abscesses/cellulitis related to gas forming organisms.
 - ▶ Next would be increased sensitivity to include radionuclide bone scanning (RBS) and MRI.
- 

Imaging of the Diabetic foot

Wagner Classification

- ▶ Need for imaging is dictated by clinical circumstances.

Grade 0 Callus w/o ulcer

Grade 1 Superficial ulcer w/o infection

Grade 2 Deep ulcer w/cellulitis

Grade 3 Deep ulcer w/abscess, cellulitis,
osteomyelitis

Grade 4 Partial gangrene

Grade 5 Gangrene of entire foot

Wagner Grade 1:



Wagner Grade 1: Debride and Measure



Wagner Grade 2: Deep ulcer/Cellulitis



Wagner Grade 3: Full thickness/exposed bone.



Charcot Foot Deformity: Rocker bottom foot



CROW Boot:



Imaging of the Diabetic foot

Plain x-ray's & MRI study

- ▶ Osteomyelitis is one of the most feared complications of the diabetic foot. It is almost always related to the spread of infection from a diabetic ulcer to the bone (secondary osteomyelitis) rather than from hematogenous spread.
- ▶ Plain film radiography is specific but not particularly sensitive in osteomyelitis diagnosis.
- ▶ MRI superior to other methods for suspected soft tissue and or osteomyelitis.

Charcot foot: Plain imaging study



Charcot foot: Plain imaging study



Charcot foot: Post Study Plain imaging study



Osteomyelitis: Plain x-ray study



Osteomyelitis: Plain x-ray study



Osteomyelitis: Plain x-ray study

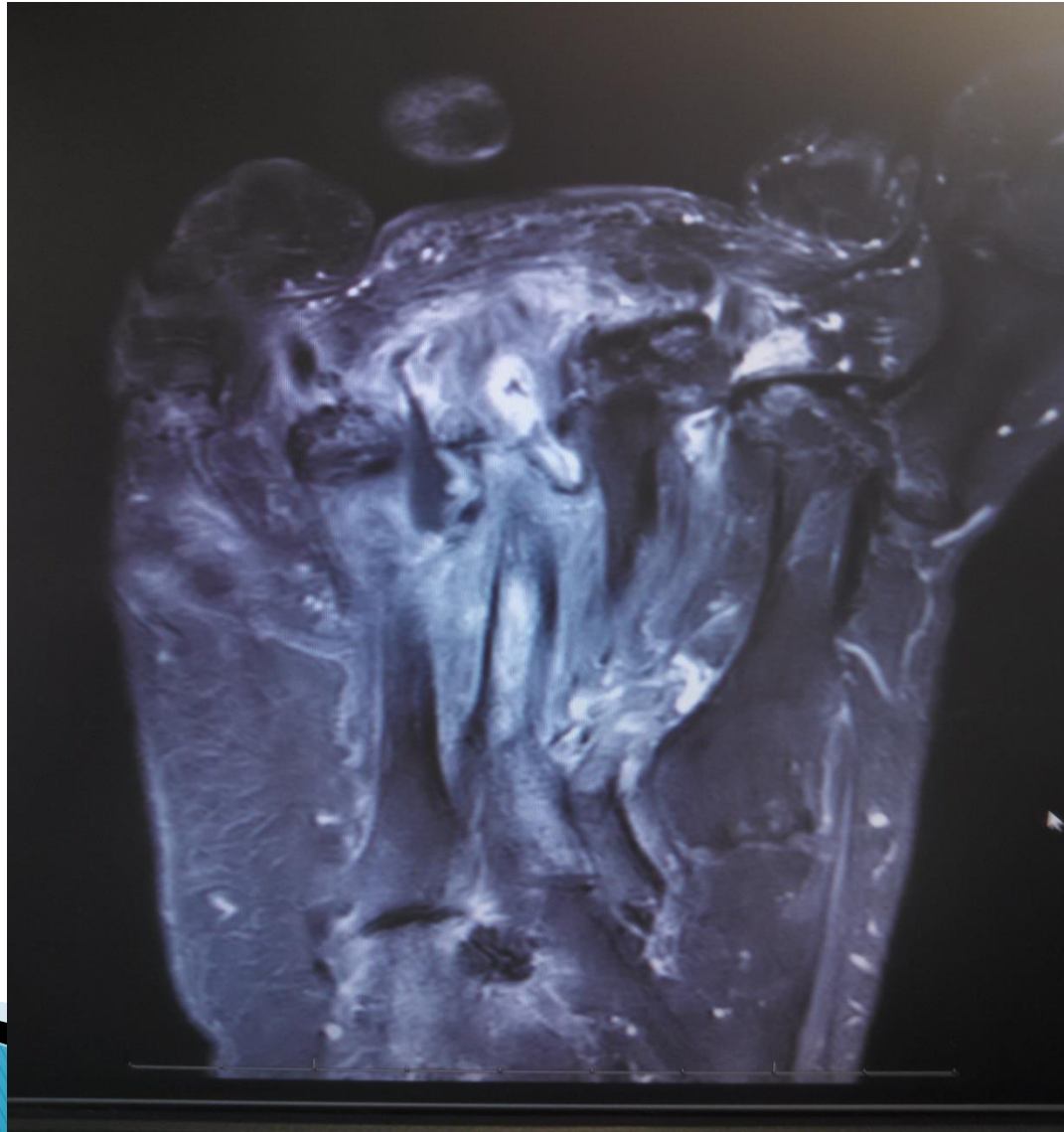


Osteomyelitis: Plain x-ray study



MRI study: T-1 stir

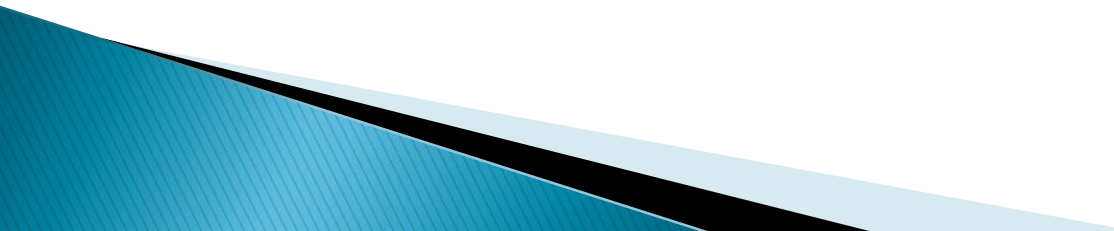
Osteomyelitis



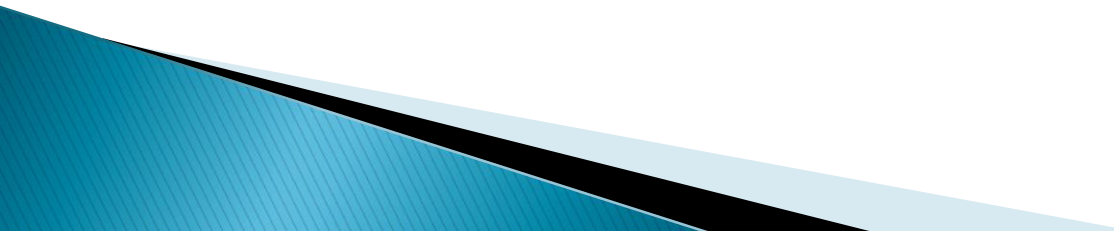
MRI study: T-1 stir Osteomyelitis



Medical treatment Assessment

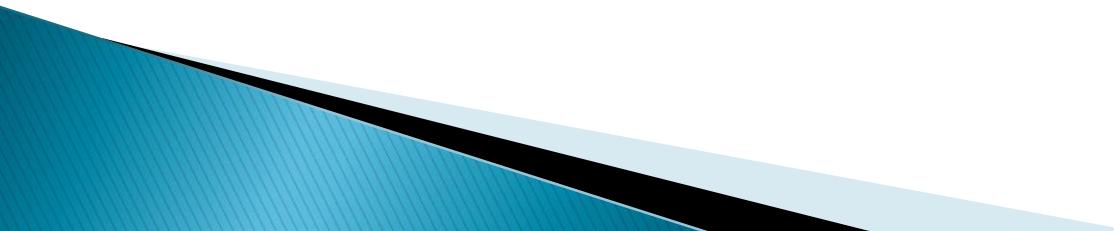
- ▶ Evaluate the Diabetic Patient with the foot wound infection.
 - ▶ Diagnose infection on symptoms and signs of inflammation (erythema, warmth, tenderness, pain, induration, or purulent secretions).
 - ▶ Identify factors that increase the risk for DFI, such as: Probe to bone, Tobacco usage, PVD, loss of Protective sensation, History of foot ulcers, Trauma, Presence of renal insufficiency, ABI, TCPO2.
- 

Medical treatment Consultation:

- ▶ Podiatrist: Outline's treatment plan, reads MRI, x-rays, C&S test, resects infected bone.
 - ▶ Vascular Surgeon: TCPO2, Angiogram, Angioplasty, Stent, resects infected bone.
 - ▶ Infectious Disease: Appropriate antibiotic regimen, IV or oral treatment.
 - ▶ Wound specialist: Periodic debridement of wound and application of biologics or other.
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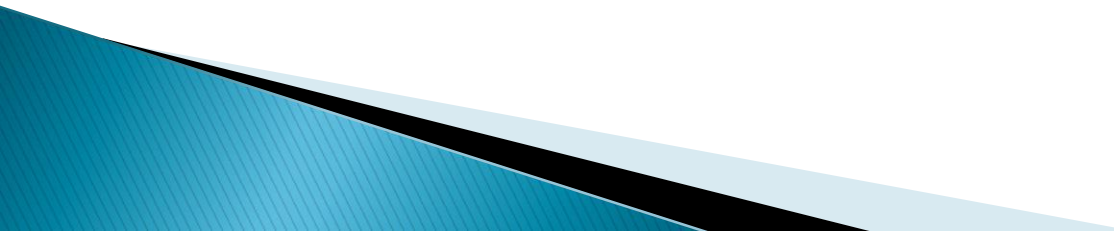
Medical treatment

Hospitalization:

- ▶ All patients with severe infection, selected patients with complicating features (eg. Diabetics, Severe peripheral arterial disease, lack of home support).
 - ▶ Any patient unable to comply with required outpatient treatment regimen (psychological or social).
 - ▶ Infectious Disease monitoring of IV antibiotic.
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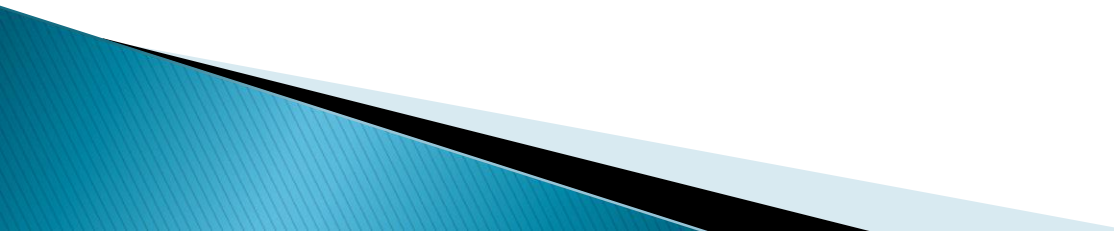
Medical treatment

Microbiology:

- ▶ Do not collect a specimen for clinically uninfected wounds.
 - ▶ Infected wounds, send appropriately obtained specimens for culture prior to starting empirical antibiotic therapy.
 - ▶ Specimens for culture should be from deep tissue, biopsy or curettage after the wound has been debrided.
 - ▶ Infectious Disease application of appropriate antibiotics based on C&S, gram stain etc.
- 

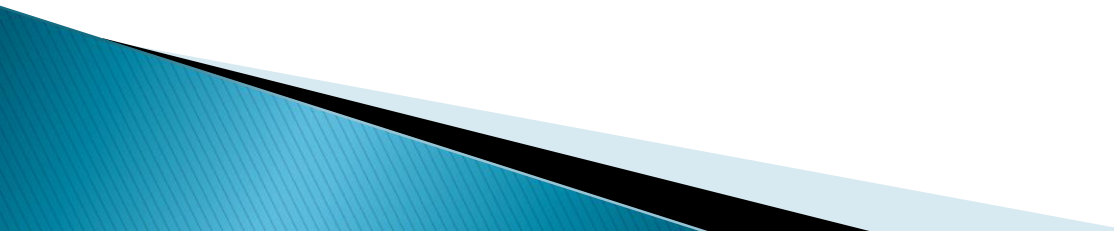
Medical treatment

Imaging Studies:

- ▶ Patients presenting with new DFI should have plain radiographs of the affected foot, look for bone abnormalities, soft tissue gas, and foreign objects. Space study by two weeks.
 - ▶ MRI is study of choice for more specific imaging, soft tissue abscess, osteomyelitis.
 - ▶ MRI unavailable or contraindicated, consider radionuclide bone scan and labeled white blood cell scan.
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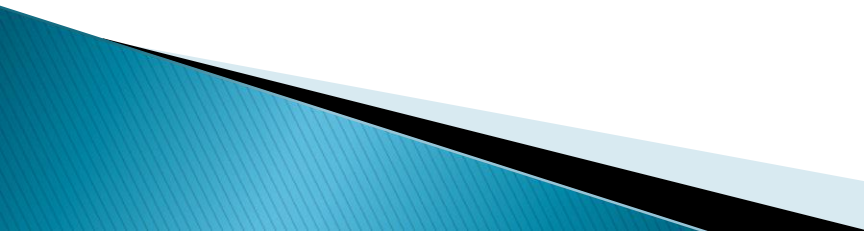
Medical treatment

Antibiotic Regimen:

- ▶ Prescribe antibiotics for all infected wounds.
 - ▶ Select an empirical antibiotic regimen based on the severity of the infection.
 - ▶ Base definitive therapy on both the results of obtained culture and sensitivity and patient's clinical response to the regimen.
 - ▶ Base therapy on infection severity, parenteral for severe, oral when patient improves.
 - ▶ Continue therapy until resolution of infection.
- 

Medical treatment

Surgical Intervention:

- ▶ Nonsurgical clinicians consider assessment by a surgeon for moderate or severe DFI.
 - ▶ Urgent surgical intervention required for most foot infections with gas in tissue, abscess or necrotizing fasciitis, or extensive bone or joint involvement.
 - ▶ Involve vascular surgeon early for revascularization when ischemia complicates a DFI.
- 

Medical treatment

Wound Care:

- ▶ Diabetic patients with foot wounds should receive the following:

Debridement of wound.

Off-loading wound.

Bioengineered skin equivalents

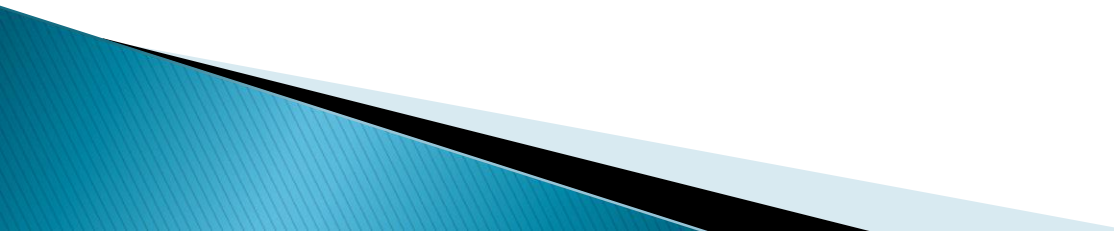
Growth factors

Granulocyte colony stimulating factors

Hyperbaric oxygen therapy

Negative pressure wound therapy

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Questions:

