

Clinical Presentation of Acute Charcot Arthropathy (Neurovascular Joint Disease)

Scott Mitchell, DPT

ACL Physical Therapy Department

Discovery of Charcot Joint Disease

- Jean-Martin Charcot, French neurologist – in 1868 discovered a link between neurosyphilis and a particular kind of deformed joint.
- Initially he thought it was a deformity due to a “spontaneous fracture,” but later realized it might be a chronic process related to neuropathy.



Etiology of Charcot joint disease

Two main theories, both probably play a significant role:

Neurovascular theory (French):

- Dysregulated autonomic nervous system → hyperemia - desensitized joints receive increased blood flow → increased osteoclastic resorption of bone

Neurotraumatic theory (German):

- loss of peripheral sensation and proprioception → repetitive microtrauma → inflammatory resorption of traumatized bone

Together these lead to an increased susceptibility to fractures and joint damage

Prevalence in diabetic patients

Charcot joint disease most prevalent in neurosyphilis (tabes dorsalis) when originally discovered.

Other neurologic conditions associated c Charcot neuroarthropathy:

alcoholism, leprosy, syringomyelia, pernicious anemia, Charcot-Marie-Tooth disease, poliomyelitis, trauma to peripheral nerves or spinal cord

In 1936, physicians discovered the link between Charcot joint disease and diabetic neuropathy. DM is now the most frequent condition associated c this condition.

7% of DM patients, 29% of those c diabetic neuropathy are affected.

Related to long-term poor glucose control.

Clinical signs and symptoms of Charcot foot

- History of fall, sprain, or direct trauma
- May be painless because of diabetic neuropathy or painful if sensory neuropathy is not complete
- Unilateral lower extremity warmth, redness, and/or edema
- Depressed medial arch, “rocker- bottom” foot or other visible deformity
- “Bounding” pedal pulses; no systemic signs of infection
- MHx: Pt has longstanding uncontrolled DM and sensory neuropathy

Clinical signs and symptoms of Charcot foot

Differential diagnosis:

- Cellulitis
- Deep vein thrombosis (DVT)
- Osteomyelitis

Misdiagnosis can lead to:

- Unnecessary incision and drainage
- Inappropriate treatment c antimicrobial therapy
- Continued WB on affected extremity, additional bony destruction and foot deformity

Joints affected

- 1) Tarsometatarsal joint (TMT or Lis-Franc's joint) – about 60%
- 2) Metatarsophalangeal joint (MTP) – about 30%
- 3) Talocrural joint (ankle mortise) – about 10%

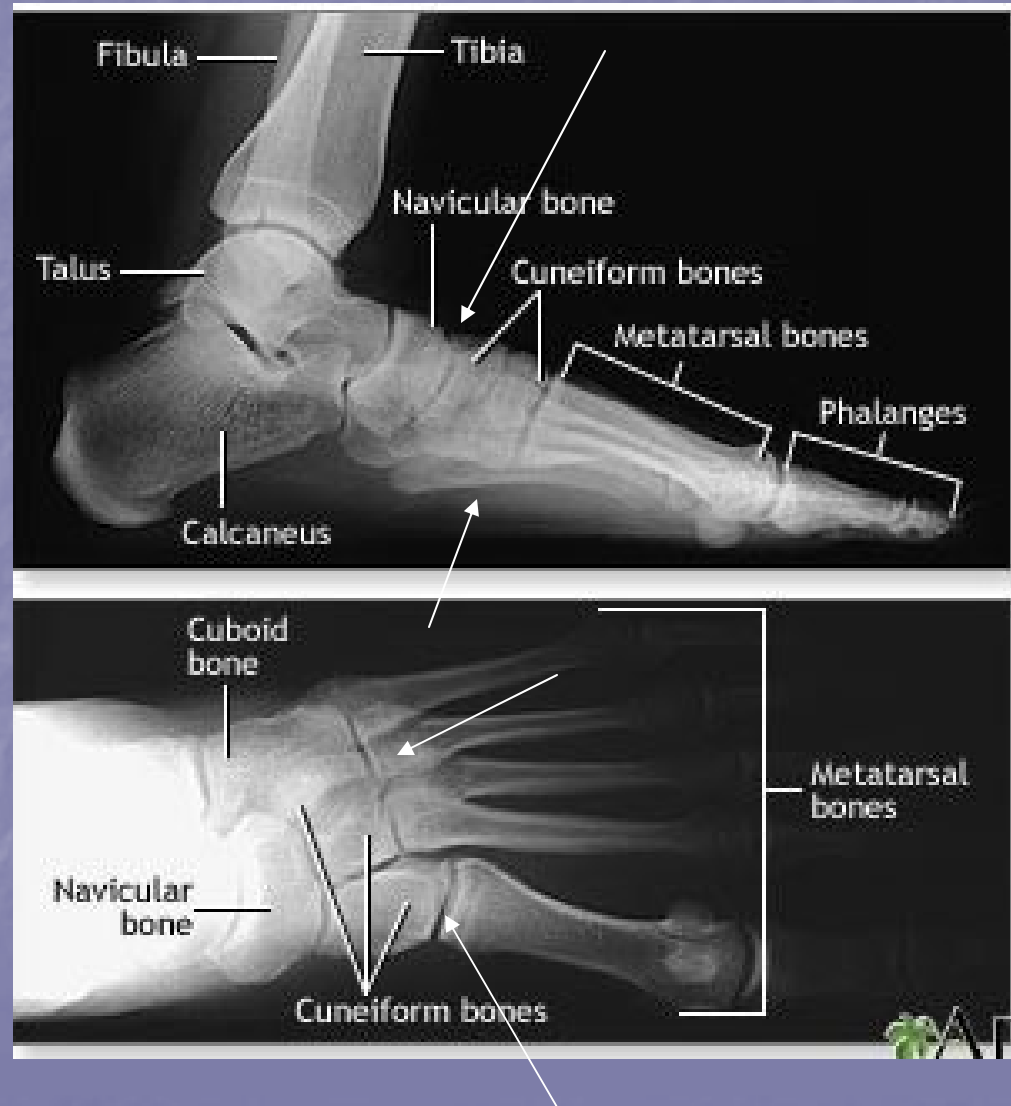
Stages of Charcot joint disease (Eichenholtz stages)

- Stage 0: Typically there is joint edema, but radiographs are negative. A bone scan or MRI may pick up a Charcot joint at this stage.
- Stage 1: “Acute Charcot” – Osseous fragmentation and joint dislocation seen on radiograph
- Stage 2: Decreased local edema, coalescence of fragments and absorption of fine bone debris
- Stage 3: No local edema, with consolidation and remodeling (deformed) of fracture fragments. The foot is now stable.

'Normal' foot radiographs: Lateral and AP views.

Lateral: Note presence of arch and distinct margins/borders of bones as they articulate c other bones.

AP View: Again, noteworthy is the distinction between bone articulations. TMT joint is 'clear', not hazy or crumbled.



Charcot foot: Destroyed tarsometatarsal (TMT) joints (Lisfranc's joint), with fracture and dislocation of fragments.

AP
View



Oblique
View



Charcot foot: Loss of arch and acquired pes planus deformity



Lateral view

Notice the significant difference of L vs. R foot as the pt presents for evaluation – unilateral foot and leg edema, visible L foot deformity.



These are the X-ray films of the L foot for the same patient.

Notice bony destruction at the TMT joints and mid-shaft metatarsals.





Charcot joint showing advanced degenerative changes and dislocation of the midfoot .

**Charcot joint of the midfoot showing
dislocation and advanced degenerative
changes.**







Bony foot deformity creates areas of bony prominence that were not previously present. These bony prominences, combined with ongoing sensory neuropathy, can lead to a high incidence of pressure ulceration, subsequent infection, and possible need for foot or limb amputation.

Charcot treatment plan

- Recognize the condition
- Appropriate imaging and referrals
- Off-load the joint, immobilization, NWB
- Stabilization (casting) until bones stabilize
- Appropriate custom footwear to accommodate deformity once stable

- Pharmacologic therapy:
Bisphosphonates – limited but promising research into using these in acute phase of Charcot joint disease to minimize bony resorption

Treatment goals

- Reduce degree of fracture and deformity
- Reduce risk of future wounds and/or amputation
- Limit morbidity

Left untreated, some possibilities are:

- Joint deformity
- Ulceration +/- infection
- Loss of function
- Amputation

Treatment time: May take 6-9 mos. for edema and erythema of affected joint to recede and bones to stabilize.

Cam/fracture walker



Casts – short-leg or total contact



CROW (Charcot Restraint Orthotic Walker)



Total contact orthosis and custom DM shoes



Selected ACL cases

November 2006 through January 2008

Case #1

55 y/o diabetic male – presented to ER c/o R lower leg and foot swollen and painful since previous evening. No known MOI.

PMH: DM, HTN, ESRD (PD), PVD, Peripheral neuropathy

Upon further questioning, pt remembered having increasing leg and foot swelling x 2-3 weeks.

PT staff called to come give assessment and recommendations. Pt had edema in R lower leg and ‘bowing out’ of plantar surface of foot. No increased warmth, redness, wounds, or drainage.

Recommendation: send pt to radiology for foot and ankle films to r/o Charcot foot – presentation not consistent c cellulitis.

PT Rx: Pt issued Ace wrap to try and help control swelling in R LE. Pt instructed on treatment plan of NWB while casted for months if Charcot foot was found. Pt instructed to keep routine appt. c PCP 4 days later.

Case #1

Initial films:

Ankle and chest films were requested/obtained. Foot films were not done.

Radiology report:

No acute fxrs found. However, “whiskering” of distal aspect of medial malleolus was noted, possibly suggestive of prior avulsion injury.

ER Rx: Pt given dose of IV antibiotics and sent home ambulatory.

Case #1

Visit c PCP 4 days p presentation to ER:

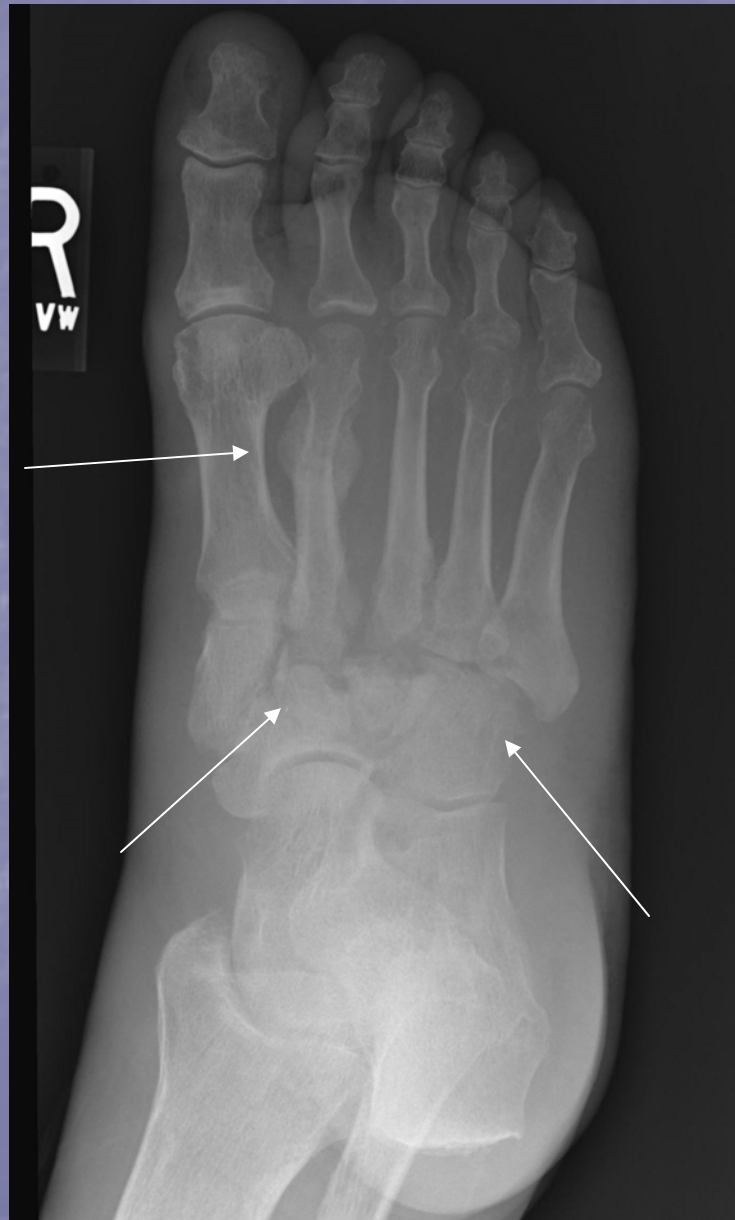
Pt reported light-headedness. Pt reported lack of sensation in R foot. Random blood glucose >600. R leg and foot still edematous, but not warmer than L.

MD Rx: Pt sent back to radiology. Three views of foot (not ankle) were obtained.

Case #1: AP View: Healing 2nd metatarsal fxr c bony callus and collapse of TMT joints c bony fragmentation.



Case #1: Oblique View: Note same 2nd metatarsal fxr c callus and TMT destruction.



Case #1: Lateral view: TMT joint destruction visible here also c collapse of the arch and soft tissue prominence on plantar foot. (Plantar heel spur is only an incidental finding.)



Case #1: Rx

Pt was sent to podiatry, short-leg cast was placed, strict NWB instruction.
Many f/u visits c podiatry to monitor bony healing and change cast.

Case #2

72 y/o female already going to PT for monthly DM foot care for one year prior to foot “problems.”

At monthly foot care f/u visit, pt c/o R ankle pain and reported having had a fall/trip 4 mos. previously. She had not reported this previously nor sought medical attention.

Physical exam: R ankle joint appeared edematous vs. L and there appeared to be a prominence (bony?) on the lateral plantar surface of the R foot.

Pt sent to radiology for radiographs of B feet and ankles.

Case #2: L foot AP and Oblique views



Case #2: Lateral view of L foot.



Case #2: Radiographic Findings L foot

“Mild hallux valgus deformity c mild degenerative OA to 1st MTP joint”

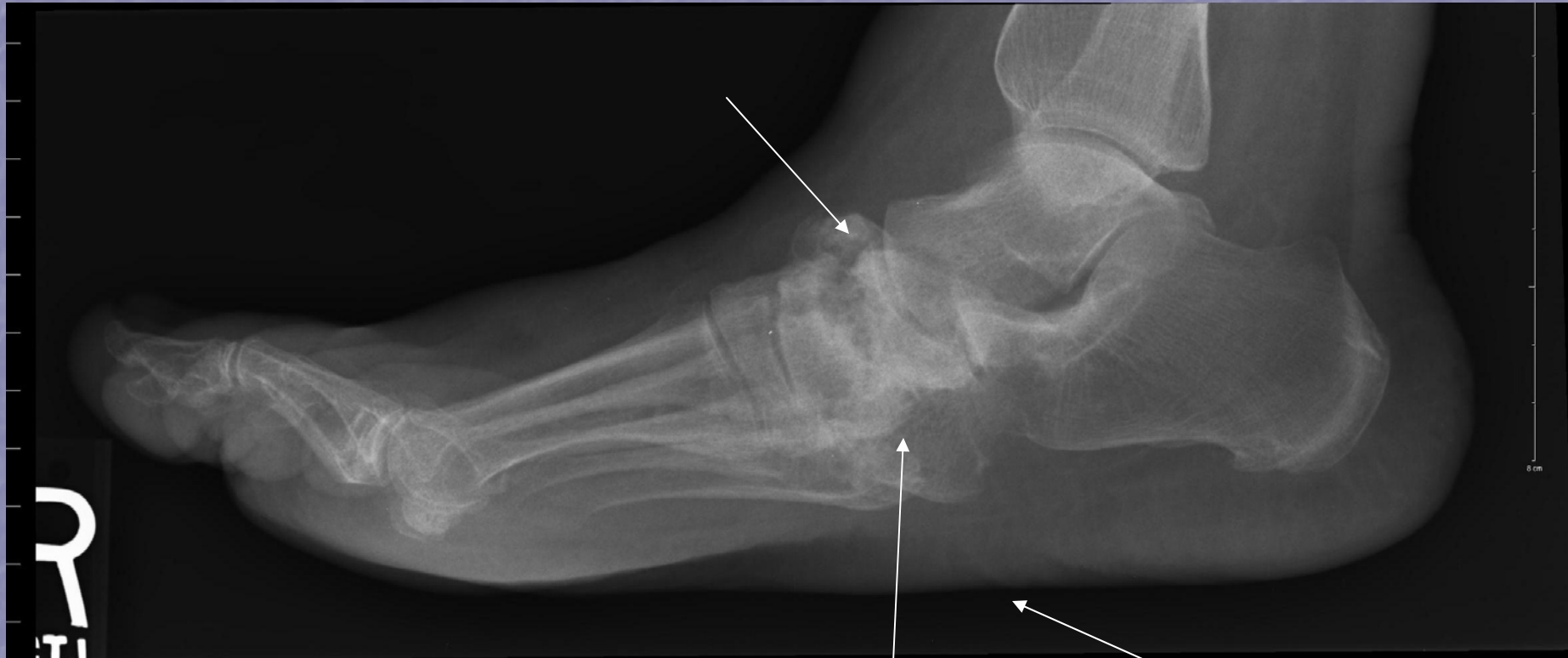
“Healed fracture involving 4th distal metatarsal neck”

“No evidence of acute fractures nor dislocations... there is evidence of severe PVD... Osteoporosis probably secondary to pt’ diabetes... No signs of neurovascular joint disease... pt is flatfooted consistent c pes planus.”

Case#2 R foot AP and Oblique views



Case #2: R foot lateral view



Case #2: Radiographic findings R foot/ankle

“Ankle mortise is anatomic”

“Severe PVD”

“considerable abnormally increased sclerosis, disorganization, debris, fragmentation, and collapse of the midfoot. This is consistent c a severe pes planus secondary to moderate to severe neurovascular joint disease...”

“partial collapse of the navicular and almost complete collapse of the lunate... partial collapse of the 1st, 2nd, and 3rd cuneiforms c joint destruction and disorganization...”

“The talus has migrated forward into the distal tarsal row.”

Case #2: Rx

- Fractures/Charcot foot found
- DVT ruled-out c ultrasound
- Pt sent to podiatry:
 - short-leg cast placed
 - NWB
 - pt instructed to elevate leg
 - F/u c podiatry q 2 weeks to monitor bony healing and make decision regarding when WB appropriate
 - Short-leg cast d/c'd 3 mos. Later, short cam walker placed (by podiatry), cont. using w/c.
 - Currently short cam walker s w/c for short distances, still use w/c for longer distances.

Case #3

46 y/o male already under care of PT for a stage 3 pressure ulcer on R foot (MTH #1)

Pt c/o L foot warmth, redness, pain, and swelling. Pt had started using Ace wrap on L foot to try and reduce edema.

Physical exam: Increased redness, warmth, and dorsal foot edema noted on L foot vs. R.

Pt was sent to radiology for radiographs of L foot.

Case #3: L foot lateral view



Case #3: L foot
Oblique view





Case #3: L foot
AP view

Case #3: Radiographic Findings

“Questionable soft tissue swelling over dorsum of foot..”

“No signs of fractures, dislocations, no evidence of osteomyelitis or a bone destructive process.”

“Severe peripheral vascular disease beyond the patient’s age strongly consistent c diabetes.”

Bottom line: “By plain film evidence, there is no evidence for developing neurovascular joint disease at this point. MRI is more sensitive. If warranted, this should be considered.”

Case #3: Rx

PT called Dr. Mirmiran, podiatrist, to discuss case. Asked podiatrist about her interpretation of “Stage 0 Charcot foot” compared c this pt and what Rx she would recommend.

Pt referred to podiatry by PCP after discussion c PT and podiatrist.

Short leg cast was placed on L leg by podiatrist. Initially NWB c crutches, then pt given walking shoe for use c cast and crutches.

Cast changed by podiatrist q 2 weeks while she took serial radiographs and also monitored redness and edema of L foot.

Case #4

61 y/o male had been referred to PT by ER 3 mos. previously for wound care for L ring finger and “shoe padding and care causing R medial foot and ankle pain.” PT unable to reach pt after repeated phone calls and a letter.

Pt eventually contacted PT (3 mos. later); referral had to be tracked down in medical record to find out why the pt had been referred. Pt has longstanding uncontrolled DM, HTN, dialysis x 3 years.

Pt denied having any wounds on fingers – he had had dry gangrene and had no open wounds upon presentation to PT.

Pt c/o “burning” from R medial foot/ankle up medial aspect of R tibia. Also c/o occasional swelling in R foot. Pt c/o pain in R foot and lower leg “when I step on it.”

Pt denied any specific MOI, but said that about 4 mos. previously he was walking for 1-1.5 miles – started limping and felt a burning sensation and aching in R foot. Pt denied having any pain sitting in PT for eval.

Case #4: Physical Exam

Bony prominence of R medial midfoot and ankle noted. Clawing of B toes #2-5, s/p R great toe amputation, prominent plantar metatarsal heads.

No swelling or redness noted.

R ankle/foot warm to the touch vs. L.

Thermistor (IR) skin temp.	L	R
Lateral ankle	87.1	92.4
Anterior ankle	89.8	93.7
Medial ankle	88.9	94
Dorsum of foot	89.7	93.1

Immediate Rx:

- 1) Cam walker issued to pt for use c any walking. Pt said this decreased his pain.
- 2) Radiographs of R foot/ankle ordered by PCP.

Case #4: R ankle films



Case #4: R ankle lateral view



Case #4:
R foot AP view



Case #4: R foot
Oblique view



Case #4 Radiographic findings

“Diffuse atherosclerosis compatible c DM or renal disease”

“Prior amputation of distal phalanx and distal portion of proximal phalanx of first toe”

“Medial and inferior displacement of the navicular bone relative to the talus. The navicular bone is increased in density, and there is disorganization of the bones of the midfoot. Sclerosis is present involving the proximal cuboid, the navicular, and distal talus and calcaneus. These findings are compatible c developing Charcot midfoot.”

Case #4: Rx

Referral to podiatry written by PCP the following day, seen by Dr. Mirmiran 6 days later.

Repeat X-rays taken by podiatry, who concurred c Dx of Charcot foot. Fragmentation of navicular; TMT joints okay, mild changes over talar head.

L foot/ankle films also taken – normal.

Short leg cast placed – NWB c either crutches or w/c.

Cast changed 3 times (q 2 weeks) while fxr healing, then scrip. written for custom DM shoes (by podiatry).

Case #5

60 y/o female c PMH of being admitted to ACL ~10x in the past for cellulitis of either the R or L side.

Pt presented to ACL ER/walk-in c/o R leg swelling and pain x 1 week.

Initial radiographs were taken of R tibia. Neither ankle nor foot films were ordered. Labs were drawn. Pt was started on antibiotics (suspicion was cellulitis).

Two days later, venous doppler was done to r/o DVT.



C2461 P11074
2015-10-19

PAIN AND SWELLING RI. LT.
JACL HOSPITAL



CASEY PHOTOS
3814/151

PAN AND SHIELLO BIRT, LE.
[A/C] HOSPITAL

Case #5: Tibia radiograph report

“Diffuse soft tissue swelling over entire visualized right lower extremity”

“No bony abnormalities. No bone destructive lesions nor abnormal periosteal reactions to suggest osteomyelitis by plain film.”

Case #5

Pt called PT 6 days prior to being seen in PT (for routine DM foot care visit) reporting inability to bear weight on R foot. (This was 13 days after starting treatment for cellulitis.) PT consulted c PCP, who recommended that pt go through walk-in/ER. This information was conveyed to pt by phone.

Pt went to ACL ER c/o R leg warmth, pain, redness. She reported inability to stand on R foot. She had just completed course of Bactrim the day prior.

No X-rays were taken. CBC and blood culture were ordered. Pt given IV antibiotics, treated daily for 3 days.

Case #5: PT appointment

Pt came to PT 6 days later in w/c saying that she was having trouble/pain bearing weight on R foot, even a few steps, so she had started using her w/c. Appt. was for DM foot care and f/u of chronic LE edema.

“I can’t even step on it.” 4/10 pain at rest, 10/10 pain c WB.

Case #5: PT evaluation

Girth measurements	L	R
Calf	41.2cm	42cm
Ankle	23.1cm	23.4cm

Thermistor (IR) skin temp.	L	R
Dorsum of foot	89.1	87.9
Anterior ankle	89.2	93.1
Medial ankle	87.1	93.5
Lateral ankle	88.8	92.5

Also noted: routine DM foot care: onychomycosis, callus B heels, dried blood blister R plantar MTH #2

Immediate Rx: toenail/callus debridement, cam walker issued to pt (better than nothing), pt sent to radiology for R foot/ankle films to r/o Charcot foot or other bony destructive process

Pt instructed to elevate R LE, limit WB

Case #5: R foot AP/oblique radiographs



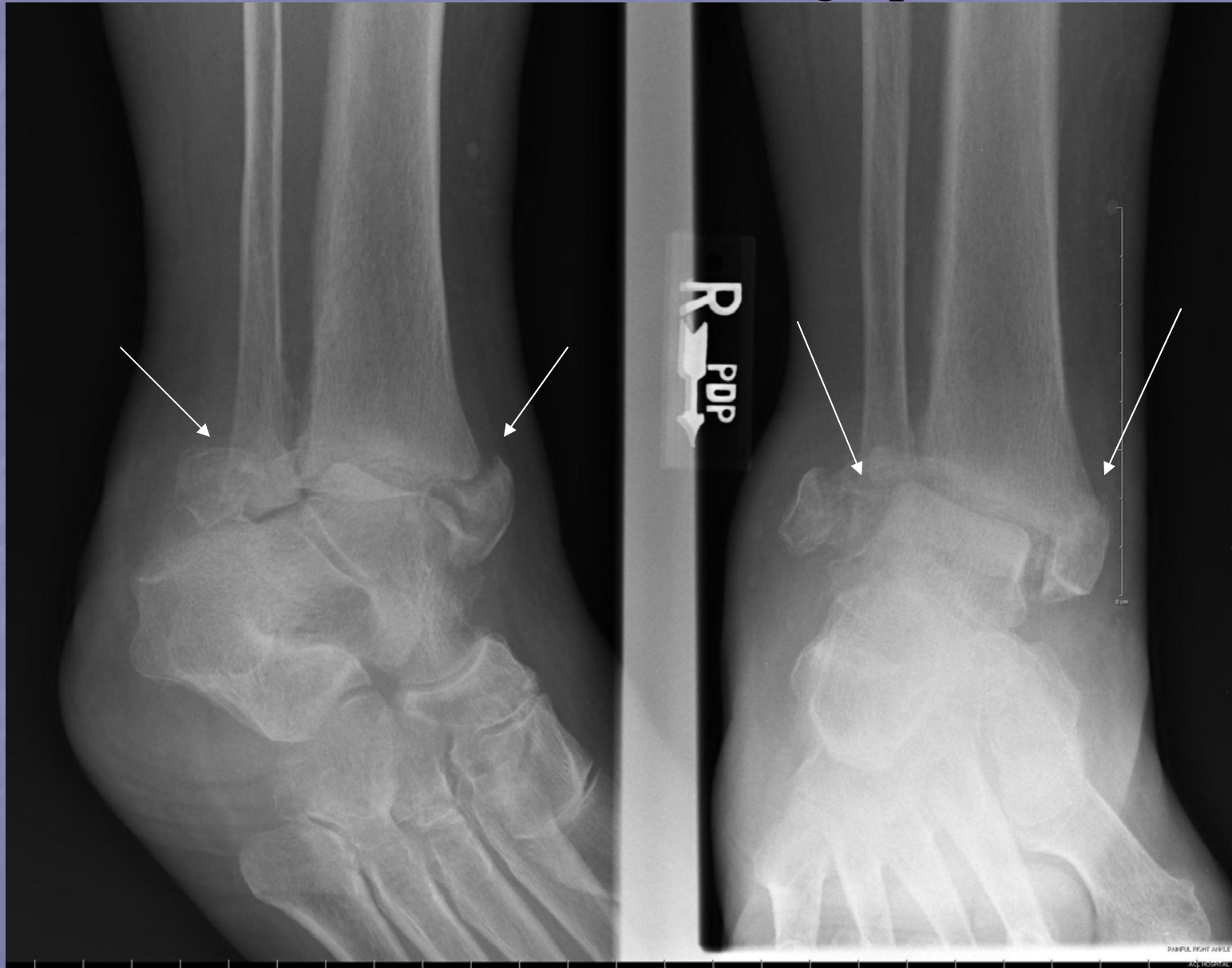
Case #5: R foot lateral radiograph



Case #5: R foot radiographic findings

“Edema in the foot is also present, and there is mild deformity of the proximal phalanx of the second digit which is felt to represent the result of prior injury. Dorsal soft tissue swelling over the distal metatarsals is present.”

Case #5: R ankle radiographs



Case #5: R ankle
lateral view



Case #5: Ankle radiographic findings

“This examination is markedly abnormal. There are fractures of both the medial and lateral malleoli c lateral and anterior displacement of the talar dome relative to the distal tibia.

...there is marked irregularity of the distal tibial articular surface with extensive areas of lytic destruction and sclerosis of the tibia.

Increased density involving the talar dome and distal tibia is also present.”

“Though these findings could be the result of a neuropathic joint, osteomyelitis cannot be excluded...”

Case #5: Rx (1)

Pt instructed to NOT bear weight on R LE until further f/u.

Podiatry/ortho. consult written by PCP.

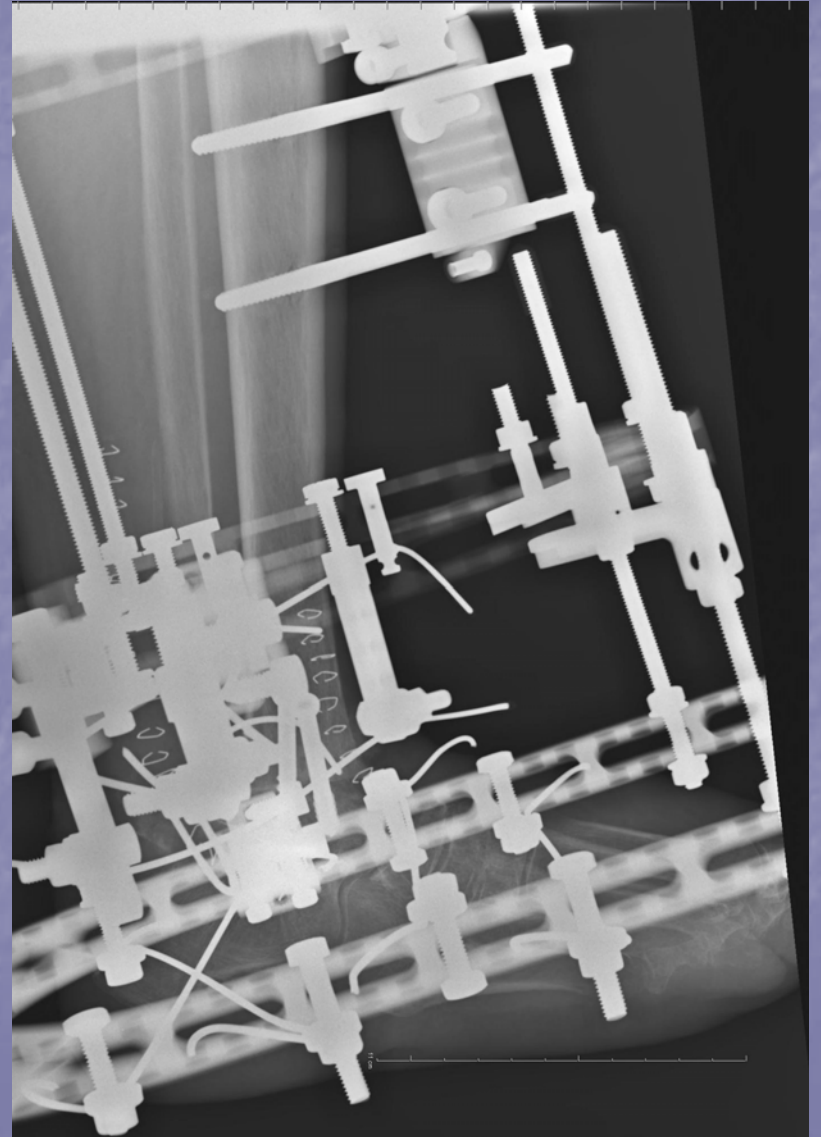
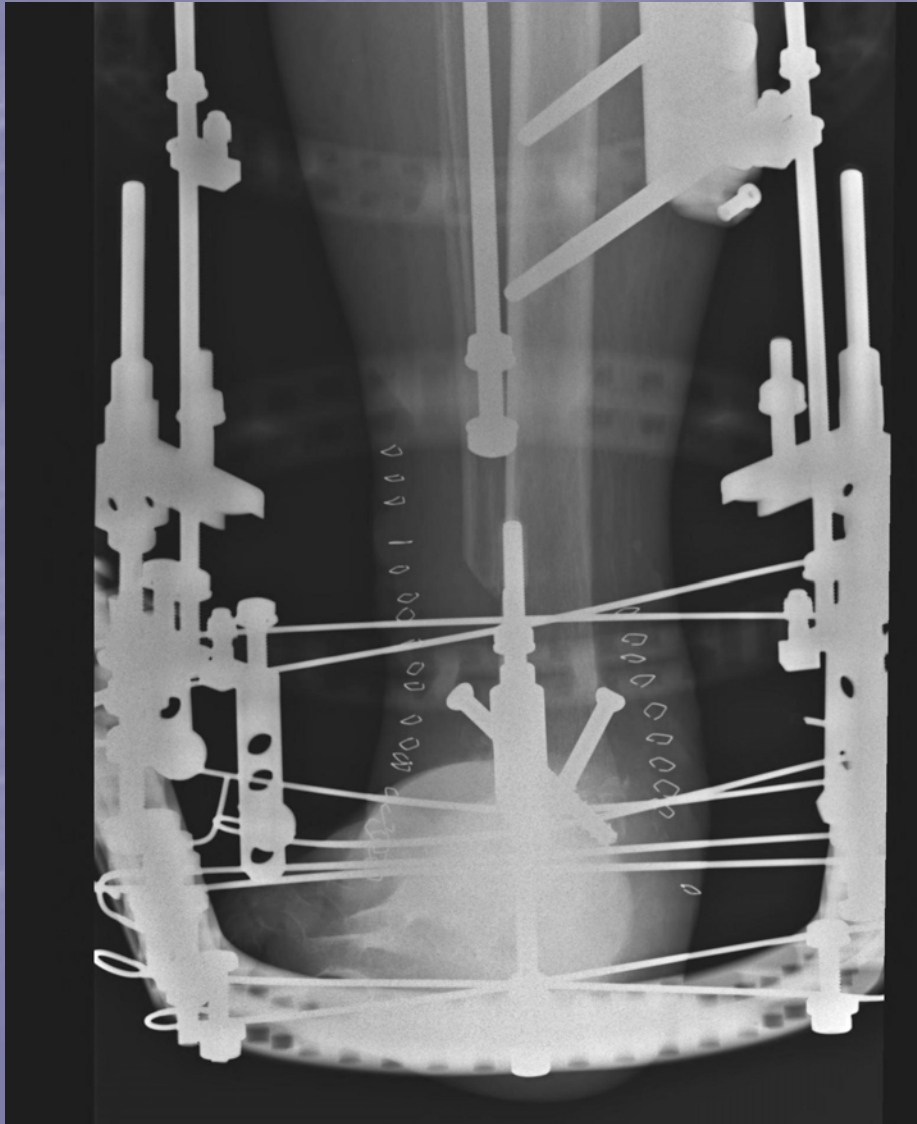
Pt seen the following day by podiatry, and remained in w/c and cam walker.

Pt's desire was to have surgery to be able to walk again.

Cardiology clearance and vascular status studies (AVI/TBI and arterial flow studies) were necessary prior to surgery.

About 3 weeks p initial radiograph findings of bimalleolar fxr, external fixation was performed to R ankle.

Case #5: external fixation



Case #5: External fixator ankle films

“Views of the ankle are almost impossible to interpret due to the extensive overlying orthopedic metallic hardware. Previous ORIF c external wire transfixing devices is appreciated. This totally obscures radiographic assessment of the ankle mortise itself. Diffuse soft tissue swelling is evident.”

Case #5: Rx

Infection in R leg despite fixation.

Failed attempt to correct fxrs c fixation.

Pt underwent below knee amputation.

Case #6

58 y/o female who presented to OPD-2 c c/o “My foot went flat.”

PMH: uncontrolled Type 2 DM, ASCVD, ESRD (hemodialysis), HTN

Pt reports having a lump on R foot arch x 3-4 mos. Pt admits having DM shoes and said she normally wore them, but was not wearing them when seen for appt., saying she had lost one of them.

Pt was sent to radiology at request of medical assistant for bilateral foot films.

Case #6: L foot AP/oblique views





Case #6: L foot
lateral view

Case #6: R foot AP/oblique views



Case #6: R foot
lateral view



Case #6: Radiographic findings

“Marked asymmetrical joint space irregularity involving R midfoot ...
1st/2nd cuneiforms, 1st, 2nd, 3rd, 4th, perhaps 5th metatarsal articulations
at the bases.”

Bony erosions, increased sclerosis, debris from navicular to metatarsal
bases.

Early partial collapse of R mid-arch.

Small inferior bilateral calcaneal spurs are an incidental finding.

Case #6: Rx

Referral to podiatrist at orthopedic clinic written by PT, cosigned by clinical director, scheduled by Contract Health.

Cam walker issued by PT c instructions for pt to use w/c and NOT walk – NWB – until assessed by podiatry.

Podiatry placed short-leg cast on R leg, NWB status (w/c).

Clinical signs and symptoms of Charcot foot

- History of fall, sprain, or direct trauma
- May be painless because of diabetic neuropathy or painful if sensory neuropathy is not complete
- Unilateral lower extremity warmth, redness, and/or edema
- Depressed medial arch, “rocker- bottom” foot or other visible deformity
- “Bounding” pedal pulses; no systemic signs of infection
- MHx: Pt has longstanding uncontrolled DM and sensory neuropathy

Charcot foot/ankle initial Rx (when suspected)

- Rule-out cellulitis and/or DVT if suspected
- NWB until deemed unnecessary (crutches work unless pt already has w/c)
- Order ankle AND foot films of at least affected side, maybe other side for comparison
- Consider cam walker for temporary use
- Look at X-ray films – sometimes it's glaringly obvious, sometimes a call to radiology is necessary to make initial determination
- Referral to podiatry/ortho. as appropriate

Treatment progression (podiatry)

- Short-leg cast or total contact cast
- CROW or clamshell brace (possibly)
- Custom DM shoes and/or braces to prevent future wounds/infection/amputation
- This will give the best results, but is not a guarantee that new fxrs will never happen or that wounds will never develop.