CHARCOT IN CRISIS:
OPERATING DURING THE STORM

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STUDENT TRANSATLANTIC EDUCATION PODIATRIC SURGERY

STEPS

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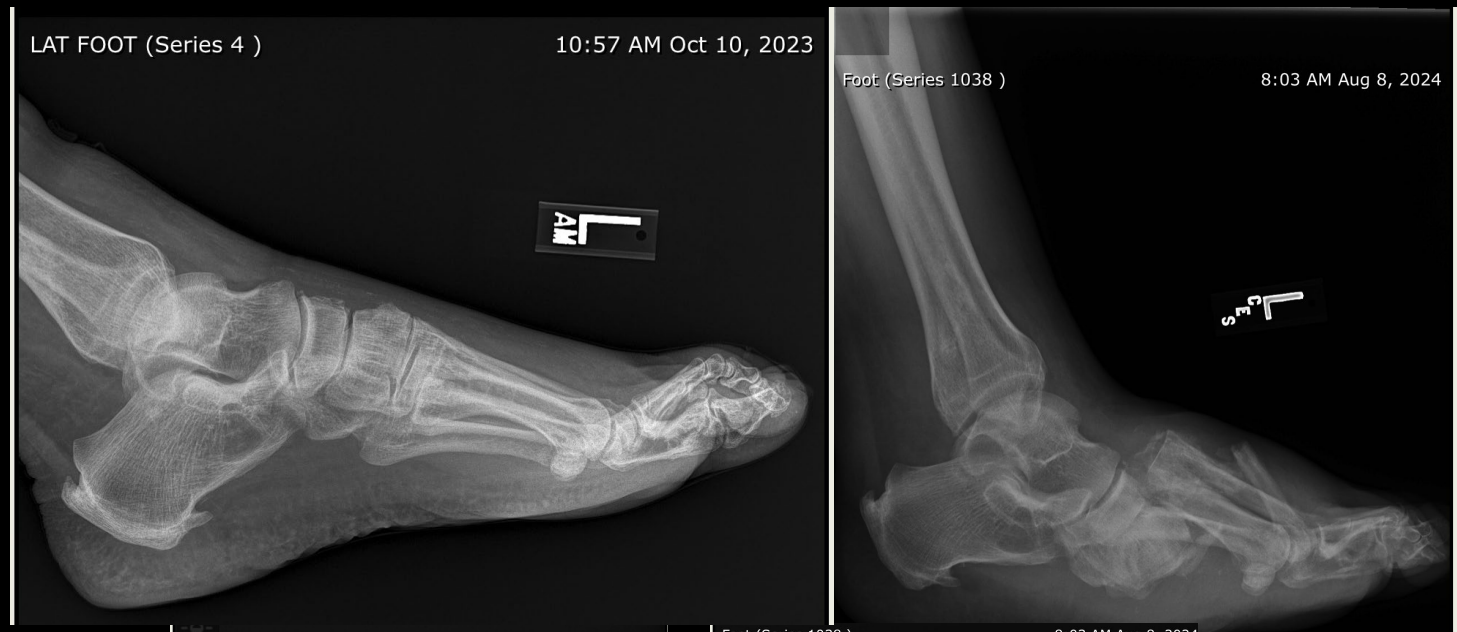
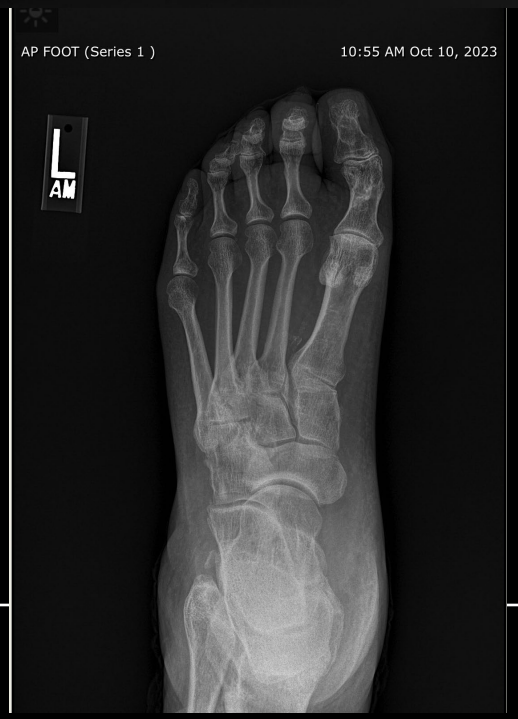
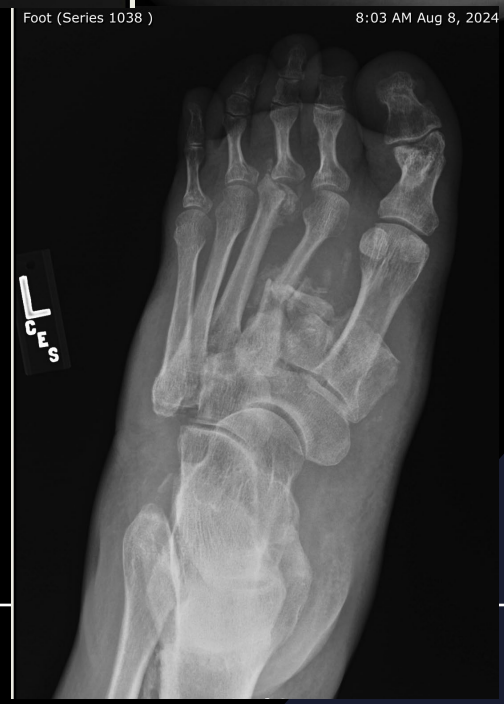
Objectives

- Recognize When Charcot is “In Crisis”
- Review Nonsurgical Options
- Compare Surgical Strategies
- Apply a Pragmatic Algorithm







Charcot “Storm” Snapshot: Pathophysiology & Staging

- Neuroinflammation + autonomic dysregulation → osteolysis, collapse.
- **Eichenholtz** stages (0–3) still useful for language; MRI improves early detection.
- Crisis = hot, swollen foot ± ulcer/infection, gross instability.

Classifications in Brief: Eichenholtz Classification of Charcot Arthropathy

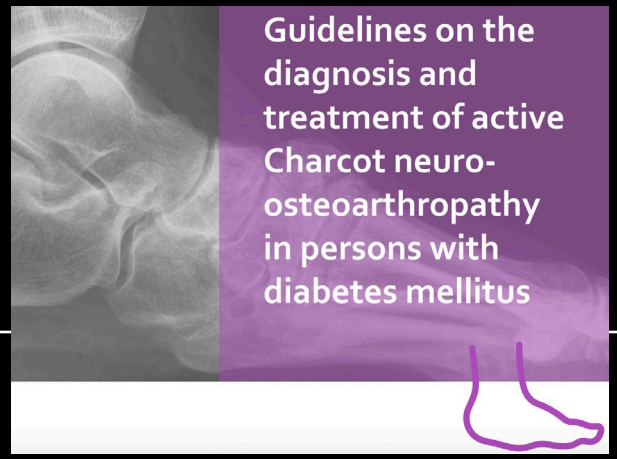
Rosenbaum, Andrew J. MD[1,a]; DiPreta, John A. MD[1]

Author Information

Clinical Orthopaedics and Related Research 473(3):p 1168-1171, March 2015. | **DOI:** 10.1007/s11999-014-4059-y

Non-Surgical Stabilization

- **Immediate knee-high immobilization/offloading** when active CNO suspected (don't wait for XR changes).
- **Total Contact Cast (TCC):** median ~4 months to remission; complications per cast low.
- **CROW boot** for protected WB during/after consolidation or post-recon.
- (The International Working Group on the Diabetic Foot)

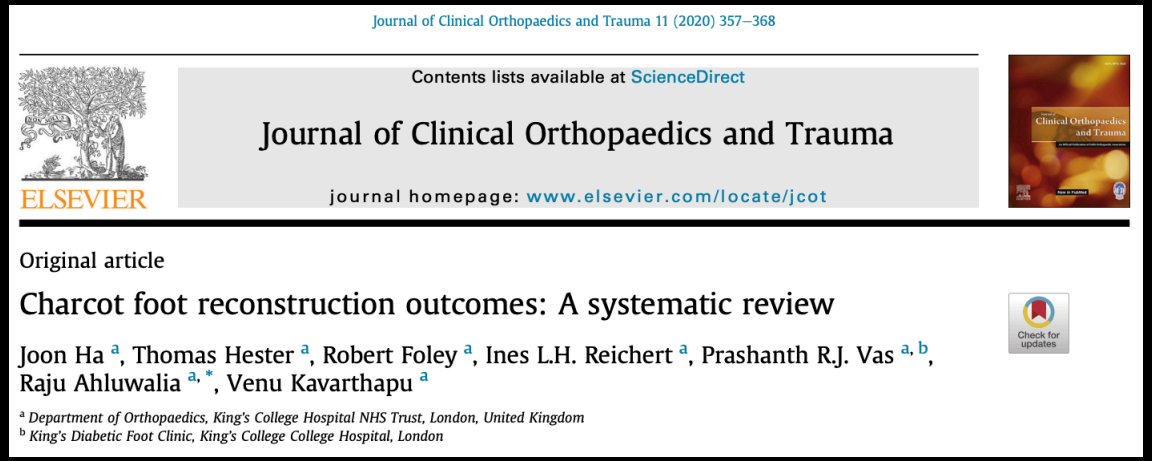


Time to Sharpen Our Scalpels?

- Indications: **recurrent/impending ulcer from bony deformity, non-braceable instability, acute collapse threatening skin, nonunion after conservative care, infection with deformity**, failure of offloading.
- Timing: many operate in **coalescent/reconstruction phases**; select centers perform **acute-stage fixation** in unstable deformity/skin-threatening collapse.

Midfoot Surgery
Exostectomy & Limited Reconstruction

- **Exostectomy** for isolated ulcer-causing prominences (esp. lateral column).
- **Osteotomy** + **fixation** to restore plantigrade foot.
- Goal: ulcer resolution and braceability.



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Original article

Charcot foot reconstruction outcomes: A systematic review

Joon Ha [a], Thomas Hester [a], Robert Foley [a], Ines L.H. Reichert [a], Prashanth R.J. Vas [a, b], Raju Ahluwalia [a, *], Venu Kavarthapu [a]

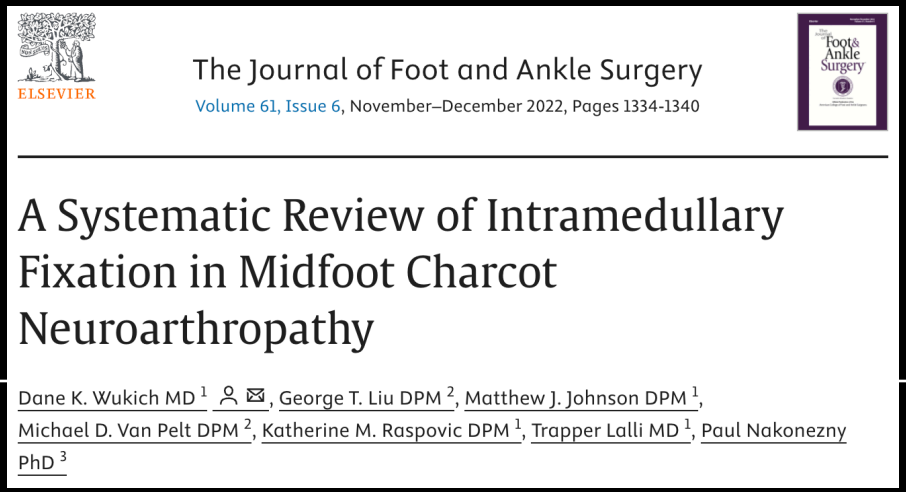
[a] Department of Orthopaedics, King's College Hospital NHS Trust, London, United Kingdom
[b] King's Diabetic Foot Clinic, King's College College Hospital, London

Ha et al., Journal of Clinical Orthopaedics and Trauma, 2020

- Results: A total of 1116 feet (1089 patients) were reported to have undergone reconstruction with significant heterogeneity in patient selection. Of these, 726 (65%) were reported to undergo internal fixation, 346 feet (31%) external fixation and 44 (4%) undergoing simultaneous internal and external fixation. No single technique demonstrated a significant benefit over the other. Overall, the bone fusion rate was 86.1%. Complications directly attributable to the technique employed were noted in 36% of individuals. The reported post-reconstruction amputation rate was only 5.5% with 91% apparently returning to ambulation.
- Conclusions: Although no preferential method of fixation was identified, we find that the current options for surgical reconstruction could offer limb salvage with a low amputation risk in a highly selected population. However, the lack of controlled studies, inconsistent reporting of outcomes and heterogeneity of patient selection mean that the quality of evidence is low.

Midfoot Beaming / Hybrid Internal Fixation

- **Intramedullary "beams" (screws/bolts)** across columns ± plates to resist plantar collapse.
- Outcomes: high **limb-salvage** with nontrivial hardware complication rates; technique selection depends on bone quality and columns involved.
- 92% Salvage Rates



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The Journal of Foot and Ankle Surgery

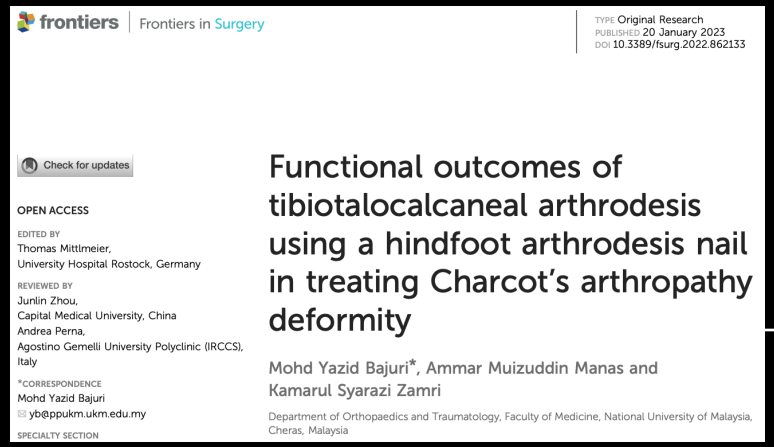
Volume 61, Issue 6, November–December 2022, Pages 1334-1340

A Systematic Review of Intramedullary Fixation in Midfoot Charcot Neuroarthropathy

Dane K. Wukich MD [1], George T. Liu DPM [2], Matthew J. Johnson DPM [1], Michael D. Van Pelt DPM [2], Katherine M. Raspovic DPM [1], Trapper Lalli MD [1], Paul Nakonezny PhD [3]

Ankle/Hindfoot Reconstruction

- **Retrograde IM nail** TTCA for CN ankle/hindfoot deformity (often before ulcer occurs).
- Reported **functional improvement** and acceptable fusion times; consider **hydroxyapatite-coated screws** for poor bone.
- Plate-nail **hybrid** constructs increasingly used.



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SPECIALTY SECTION

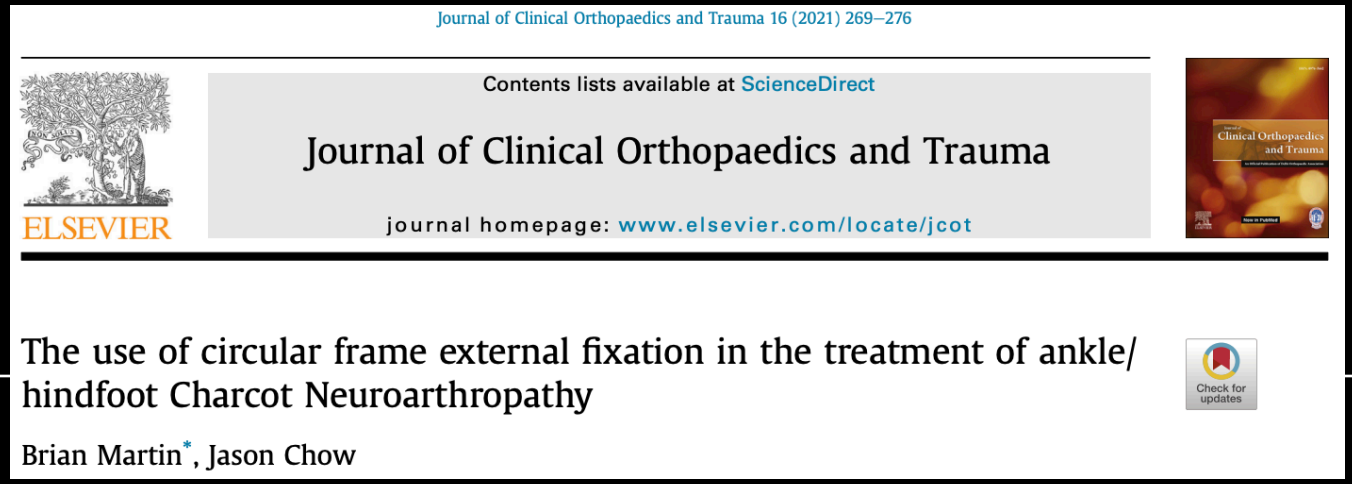
Functional outcomes of tibiotalocalcaneal arthrodesis using a hindfoot arthrodesis nail in treating Charcot's arthropathy deformity

Mohd Yazid Bajuri*, Ammar Muizuddin Manas and Kamarul Syarazi Zamri

Department of Orthopaedics and Traumatology, Faculty of Medicine, National University of Malaysia, Cheras, Malaysia

External Fixation & Hybrid Strategies

- **Circular frame external fixation** (Ilizarov/Taylor) for **infection, poor soft tissue, severe bone loss, active ulceration**, or as **staged** approach.
- Advantages: spanning infected zones, gradual correction, load sharing.
- Often combined with limited internal fixation (**hybrid**) to improve stability.



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Journal of Clinical Orthopaedics and Trauma

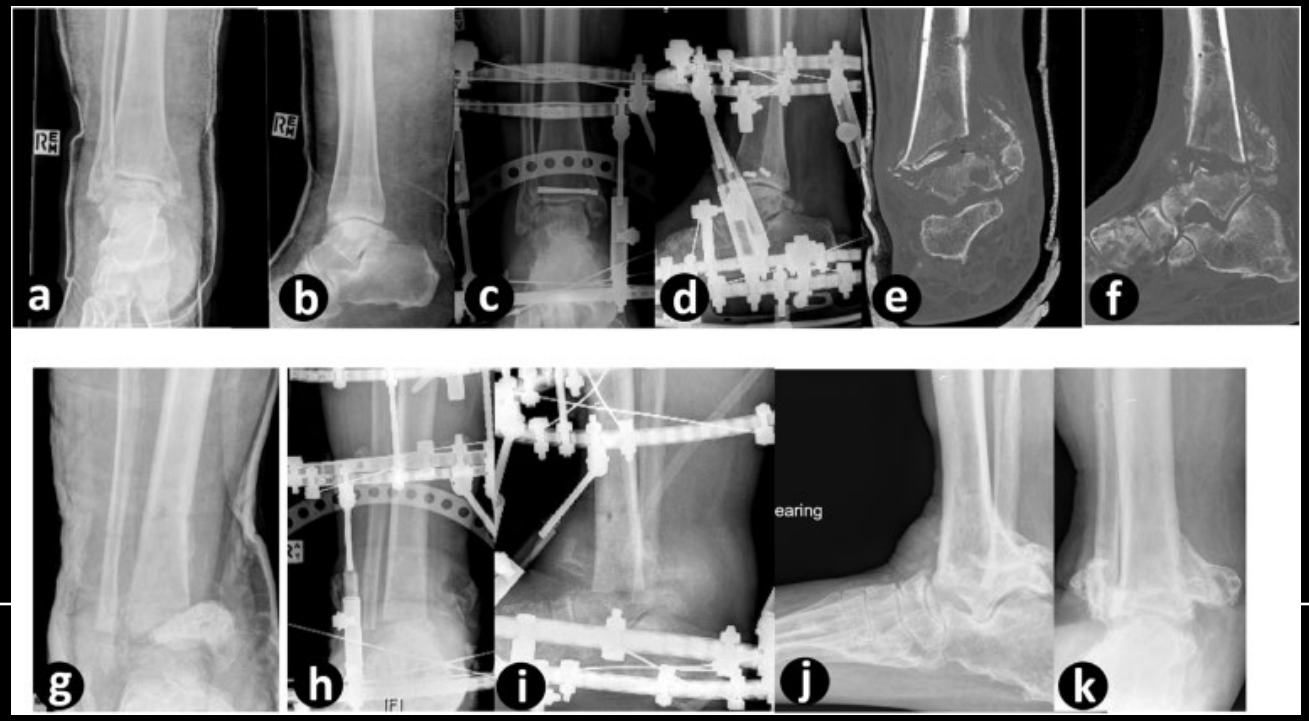
journal homepage: www.elsevier.com/locate/jcot

The use of circular frame external fixation in the treatment of ankle/hindfoot Charcot Neuroarthropathy

Brian Martin*, Jason Chow

Infection, Osteomyelitis & Staging

- **Two-stage** protocol common: I&D + resection, **temporary ex-fix**, targeted antibiotics → definitive reconstruction when soft tissues quiet.
- Avoid internal hardware through infected/compromised zones when possible.



A Two-Stage Surgical Approach for Limb Salvage in Severe Charcot Neuroarthropathy Cases

Cleveland Clinic Foundation
Hancock E, Clougherty CO.

- The 91.4% limb salvage rate with 32 out of 35 patients achieving a functional limb demonstrates that, when performed in a controlled and staged manner, Charcot reconstruction can be both safe and effective even in high-risk patients with multiple comorbidities.

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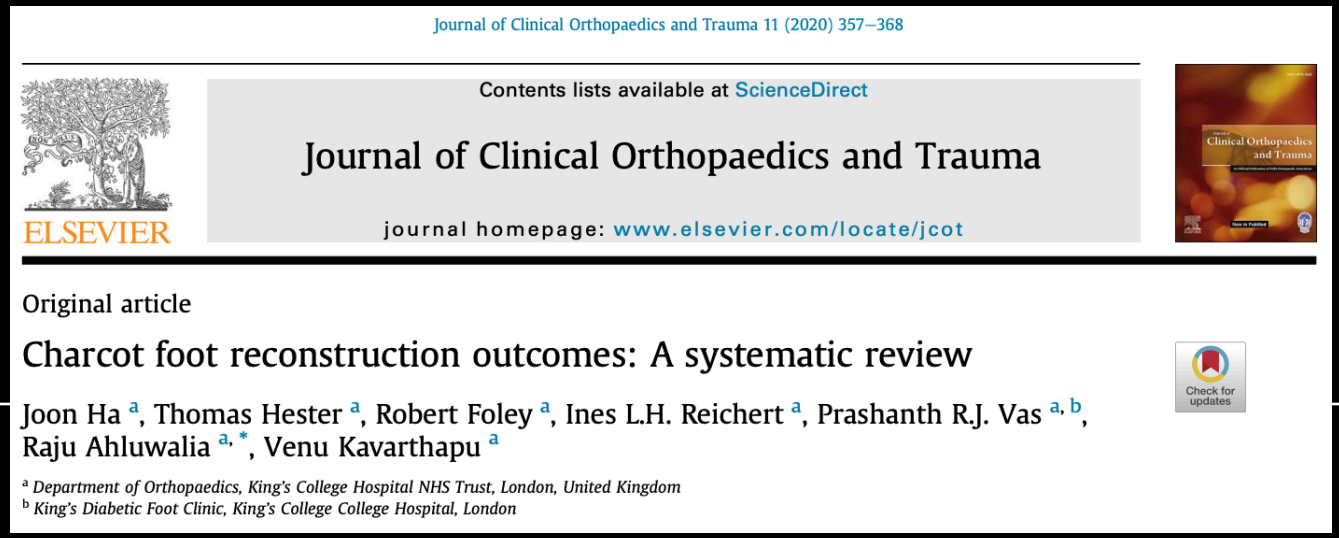
Pending Publication

Complications & Outcomes

- Expect **nonunion, hardware failure, recurrent ulceration**, need for revision; amputation risk persists but **limb salvage is high** in selected patients.
- Example pooled outcomes: reconstruction shows limb salvage with **low major amputation** in carefully chosen cases; TTC nails = acceptable fusion/complication rates.



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[b] King's Diabetic Foot Clinic, King's College College Hospital, London

Peri-operative Principles

- **Glycemic optimization**, nutrition, **vitamin D**/bone metabolism considerations; manage **VTE risk**, prolonged protected WB, and long-term bracing.
- **Bone stimulation** for delayed unions can be considered.

The Journal of Foot & Ankle Surgery 56 (2017) 336–356

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The Journal of Foot & Ankle Surgery

journal homepage: www.jfas.org

Review Article

American College of Foot and Ankle Surgeons® Clinical Consensus Statement: Perioperative Management

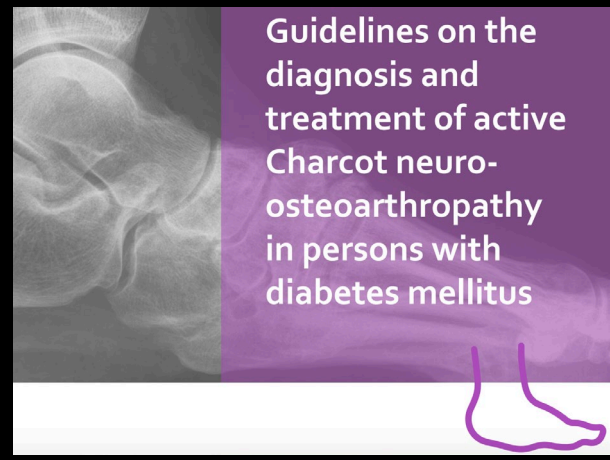
Andrew J. Meyr, DPM, FACFAS [1], Roya Mirmiran, DPM, FACFAS [2], Jason Naldo, DPM, FACFAS [3], Brett D. Sachs, DPM, FACFAS [4,5], Naohiro Shibuya, DPM, FACFAS [6]

PERI-OP PRINCIPLES

Metabolic Optimization	Reasonable glycemic control (e.g., Alc ≤ 8%, stable)	Address malnutrition (protein, calories)	Check/correct vitamin D, calcium, bone metabolism
Infection & Soft Tissue Control	No active ulcer over planned incision	Stage surgery if osteomyelitis present (debridement → antibiotics → recon)	Peri-op antibiotics tailored to risk/cultures
Vascular Assessment	ABI / toe pressures / $TcPO_2$ as needed	Revascularize when perfusion is marginal	Aim for reliable healing environment before major reconstruction
Fixation & Surgical Strategy	Time surgery when possible to coalescent phase	Match fixation to bone & soft tissue: beams/nails vs. circular frames	Plan for multi-planar correction and durable, braceable alignment
Medical Risk & Post-Op Protection	VTE prophylaxis (high-risk, immobilized patients)	Cardiac/renal/OSA optimization pre-op	Prolonged protected WB, then CROW/brace
	Close wound and hardware surveillance		

Practical Algorithm

IWGDF Guidelines



Active hot foot → Immediate immobilization (TCC/CROW).

- If **braceable, ulcer-free** → continue conservative; transition to CROW/orthoses.

- If **non-braceable deformity, recurrent ulcer, infection, or instability** →
  - Midfoot prominence only → **Exostectomy / limited osteotomy**
  - Multi-column collapse → **Beaming ± plates (hybrid)**
  - Ankle/hindfoot collapse → **TTCA nail** (consider plate-nail)
  - **Ulcer/infection/poor soft tissue → Staged and/or circular frame**

  Post-op: prolonged protection, transition to **CROW**, close skin surveillance.

STEPS Student Transatlantic Education Podiatric Surgery

Take-Homes

- **Immobilize early, operate deliberately.**
- Match fixation to **bone quality, soft tissue, and infection status**.
- **Hybrid & frame strategies** expand options in “storm” scenarios.
- Success = **plantigrade, ulcer-free, braceable** limb more than radiographic perfection.

Take-Homes

- **Immediate TCC + protected WB**
- **Metabolic optimization** (Vit D ≥30 ng/mL, Albumin ≥3.5, **Prealbumin**: > **18 mg/dL,** A1c <8%, Calcium, TSH and Renal Function eGFR>45)
- **Evaluate vascular supply** (Toe pressure >55 mmHg, ABI: **0.9–1.3** is normal range (values <0.6 require vascular consult), $TcPO_2$: > **30 mmHg**)
- **No surgery unless** ulcer threat, instability, infection, or dislocation
- **If surgery needed → External fixation first**
- **Definitive reconstruction** once stable, coalescent

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THANK YOU

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