



Charcot Neuroarthropathy: A Narrative Review of the Diagnosis Routinely Missed at First Presentation

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Abstract

Charcot neuroarthropathy presents acutely as a hot, swollen foot in which pain may be absent or disproportionate, and it is mistaken for cellulitis, deep vein thrombosis, osteomyelitis or injury. In a referral cohort of 22 patients, the referring provider correctly identified the diagnosis in one. The consequence is measurable. Fifteen of those 22 progressed to bone destruction and had a mean of 8.7 weeks between symptom onset and diagnosis, while the seven who were seen an average of 4.6 weeks earlier did not progress; ten of the fifteen subsequently required surgery, at a mean of 2.9 operations per limb. Systematic review found misdiagnosis or delay in a majority of reported cases, with mean time to correct diagnosis approaching three months. The mechanism of the delay is specific: at the earliest stage the plain radiograph is normal, so imaging that appears to exclude the diagnosis does not. The bedside sign is a temperature difference of more than 2 degrees Celsius against the other foot.

Keywords: Charcot neuroarthropathy; Diabetic foot; Diagnostic delay; Misdiagnosis; Offloading

Introduction

Charcot neuroarthropathy is a destructive complication of the neuropathic foot, occurring predominantly in diabetes, with reported prevalence of up to 13 per cent among people with the condition in some series [1,2]. It is understood as an exaggerated inflammatory response to trauma or minor injury, producing bone lysis [3,4,29,33]. Imaging reviews describe the radiological features across stages [30,31], and the pathophysiology has been summarised separately [32,33,34].

The acute presentation is a red, warm, swollen foot. Pain may be absent or disproportionate to the appearance, because the neuropathy that permits the condition also removes the warning [3,5]. Untreated, it progresses to bone and joint destruction and the characteristic deformity, which becomes a route to ulceration, infection and amputation [6,7,25]. Amputation risk after this diagnosis and after foot ulceration has been quantified in cohort data [25,26], and long-term quality of life is reduced [24].

This review examines how often the diagnosis is missed at first presentation, what follows from the delay, and why a

condition with a simple bedside sign continues to be recognised late.

Material and Methods

Search strategy: PubMed and the archives of the major diabetes, foot and ankle and orthopaedic journals were searched for studies of diagnosis and misdiagnosis in this condition. Search terms combined Charcot neuroarthropathy and Charcot foot with misdiagnosis, diagnostic delay, stage zero, temperature and offloading. Reference lists of the systematic review [8] and current guidance [9] were screened by hand for primary sources.

Eligibility: Studies were included if they reported the accuracy or timing of diagnosis, the consequences of delay, or diagnostic methods in defined populations. Individual case reports are cited where they illustrate a described pattern and are identified as such.

Data extraction and handling: Design, population, the stage at presentation and the reported outcome were extracted as published. Cohort sizes are stated alongside every estimate, because the central quantitative findings come from small series

and the precision of the figures should not be overstated. This review reports published findings and does not constitute guidance on the management of any individual patient. No pooling or re-analysis was performed. Figures 1 to 6 and Tables 1 to 3 reproduce published values only. This is a narrative synthesis and was not registered as a systematic review.

Results

How often it is recognised: In a cohort of 22 patients referred to a specialist service, the referring provider had correctly identified the condition as stage zero Charcot neuroarthropathy in one, or 4.5 per cent (Figure 1) [10]. A systematic review of misdiagnosis found that the condition was misdiagnosed or its diagnosis delayed in a majority of reported cases, with pooled delay in approximately 53 per cent of patients and mean time from symptom onset to correct diagnosis approaching three months [8,11].

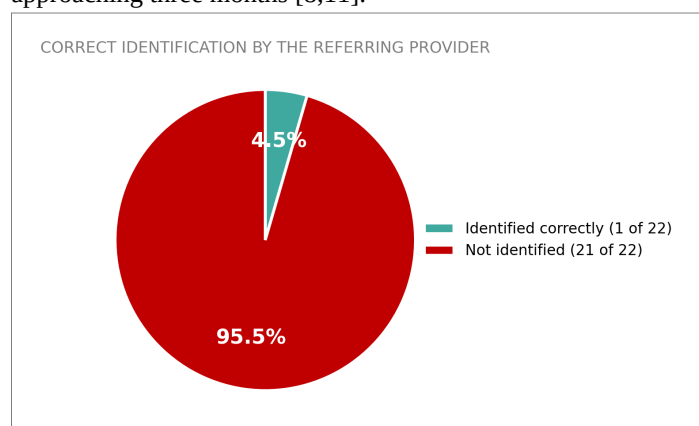


Figure 1: Correct identification by the referring provider in a cohort of 22 [10]

What the delay costs: Within the same cohort, 15 of the 22 progressed to a destructive process and had a mean of 8.7 weeks between onset and formal diagnosis with initial treatment. The seven who were seen an average of 4.6 weeks earlier did not progress to the osseous destructive phase (Figure 2) [10]. Of the 15 in the delayed group, 10 required surgical intervention, at an average of 2.9 operations per limb (Figure 3) [10].

Group	Number	Mean delay	Outcome
Seen earlier	7	4.6 weeks earlier	No osseous destruction
Seen later	15	8.7 weeks	Destructive process
Of the delayed group	10 of 15	—	Surgery, mean 2.9 per limb

Table 1: Delay and outcome in a referral cohort of 22, as reported by the original investigators [10]

Table 2: Key reported findings

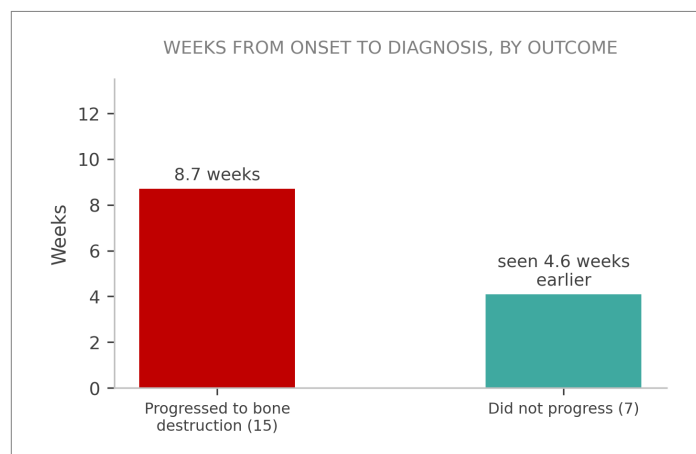


Figure 2: Weeks from onset to diagnosis by whether bone destruction followed [10]

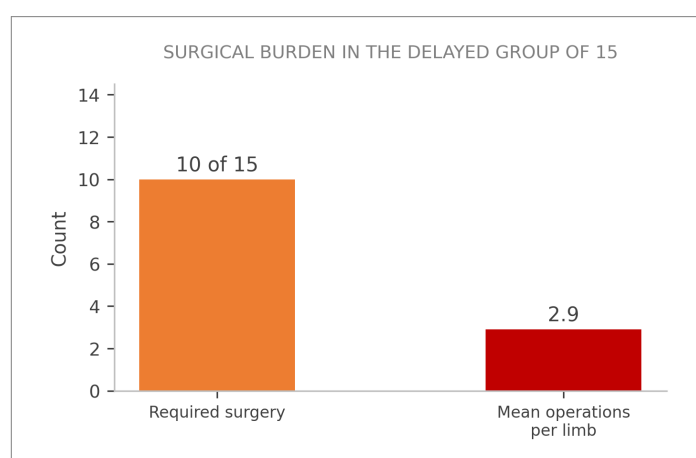


Figure 3: Surgical burden in the delayed group [10]

What it is mistaken for: The acute presentation is confused with cellulitis, osteomyelitis, deep vein thrombosis, gout, sprain or other trauma, and osteoarthritis (Figure 4) [8,12,13]. Each of these is consistent with a warm, red, swollen foot, and several are more common, so the differential reasoning that leads away from the diagnosis is not unreasonable in itself [11,14].

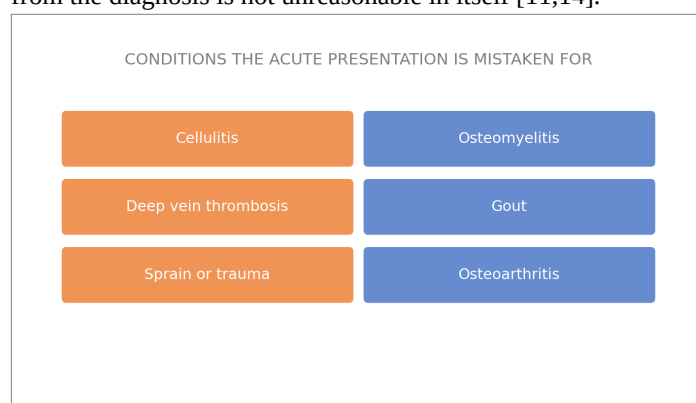


Figure 4: Conditions the acute presentation is mistaken for [8,12,13]

Why imaging can mislead: The earliest stage in the standard classification is characterised by mild inflammation and soft tissue oedema with normal plain radiographs, while magnetic resonance imaging shows microfracture, bone marrow oedema and bone contusion (Figure 5) [3,15]. A normal radiograph

therefore does not exclude the condition at the point when treatment is most effective. In a series where magnetic resonance imaging was performed very early, a substantial majority of patients at that stage recovered [3,16].

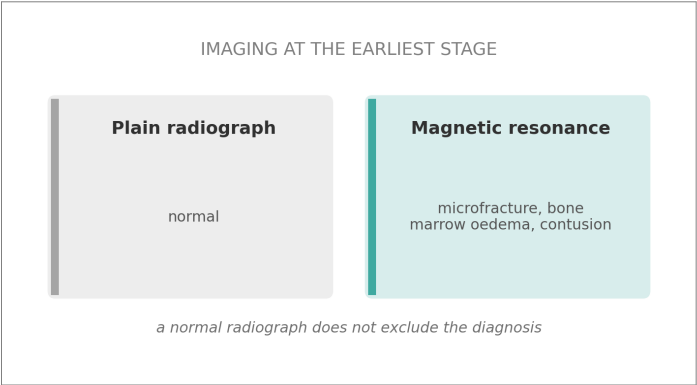


Figure 5: Imaging findings at the earliest stage [3,15]

The bedside sign: The typical clinical presentation includes a temperature difference of more than 2 degrees Celsius between the affected and unaffected foot (Figure 6) [3,17]. Comparison of skin temperature between the feet, supported by imaging where needed, is described as a valuable tool for early recognition, and resolution of the temperature difference is used to guide treatment duration [9,18].

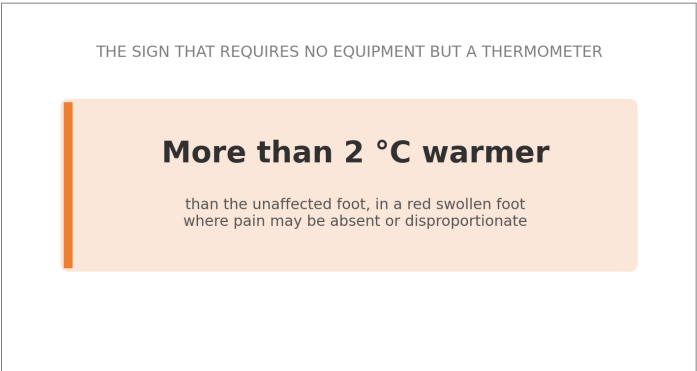


Figure 6: The bedside sign in the acute presentation [3,9,17]

What treatment involves: Current guidance recommends immediate knee-high immobilisation, with a non-removable device such as a total contact cast considered standard care, maintained until the inflammatory phase consolidates [9,19]. Resolution commonly requires several months of casting, with duration guided by the temperature difference and follow-up imaging [9,18]. Medical therapies have a limited role, and surgery becomes necessary where deformity, ulceration and infection coexist and conservative measures have failed [6,20]. A national audit described presentation and management across services [21], and evidence-based pathways for assessment and management have been developed [19]. Removable devices have been compared with non-removable ones in terms of offloading duration and recurrence [22], and techniques for monitoring remission have been systematically reviewed [27].

Element	What is reported
Prevalence in diabetes	Up to 13% in some series [1]
Correct identification at referral	1 of 22 [10]

Element	What is reported
Delay in reported cases	About 53%, mean near three months [8,11]
Radiograph at earliest stage	Normal [3,15]
Temperature difference	More than 2 degrees Celsius [3,17]
Reason the diagnosis is missed	Consequence
Presentation mimics commoner conditions	Differential leads elsewhere [8,12]
Pain absent or disproportionate	Severity is underestimated [3,5]
Plain radiograph normal at stage zero	Imaging falsely reassures [3,15]
Condition is uncommon in general practice	Low index of suspicion [10,11]

Table 3: Why recognition fails at first presentation

Outcomes after diagnosis: Even once recognised, the condition carries substantial long-term burden. Cohort data report increased lower-extremity amputation risk following this diagnosis and following diabetic foot ulceration [25,26], and long-term quality of life is reduced relative to comparable populations [24]. Comparison of patients with and without concurrent foot wounds shows worse outcomes where the two coexist [26].

How treatment duration is decided: Immobilisation continues until the inflammatory phase consolidates, and the endpoint is judged rather than fixed. Temperature difference and follow-up imaging are the measures used, and a systematic review of techniques for monitoring remission found no single agreed standard [9,18,27]. Retrospective cohort data describe determinants of treatment duration, which commonly runs to several months [18,22].

Differences between diabetes types: Presentation has been reported to differ between type 1 and type 2 diabetes, in age at onset and in the joints involved [28]. That variation, together with differing prevalence estimates depending on the population screened, means a single clinical picture understates the range of ways this condition arrives [1,2,28].

Discussion

The figure that anchors this literature is that referring providers identified the condition in one patient out of 22 [10]. That is not a marginal shortfall in diagnostic accuracy; it is a diagnosis that is essentially not being made outside specialist services. The cohort is small, and the figure should not be treated as a precise rate, but the direction is corroborated by systematic review finding delay in around half of reported cases [8,11].

What makes this consequential rather than merely embarrassing is that the delay maps onto outcome within the same cohort. Those seen roughly four and a half weeks earlier did not progress to bone destruction; those seen later largely did, and two thirds of them went on to surgery [10]. Four weeks is a short interval in most clinical reasoning, and here it appears to separate a foot that recovers from one that is rebuilt.

The mechanism of the delay is worth isolating because it points at the remedy. The presentation resembles cellulitis and deep vein thrombosis, both commoner and both requiring urgent attention, so the initial differential is defensible [12,13]. What converts a reasonable differential into a missed diagnosis is the radiograph: at the stage where treatment works, the film is normal [3,15]. A clinician who images and is reassured has done something ordinarily sensible and been misled by it.

Against that sits the simplicity of the positive sign. A temperature difference greater than 2 degrees Celsius between the feet requires an infrared thermometer and thirty seconds [3,9,17]. It is not a subtle finding, it does not require specialist training, and it is the same measurement used later to decide when casting can stop [18]. The gap between the availability of that test and the rate of correct diagnosis is the practical problem this literature describes.

A caution about what the evidence can bear. The quantitative findings rest on 22 patients from one referral service, published in 2011 [10]. Practice, awareness and access to magnetic resonance imaging have changed since. The systematic review corroborates the direction but pools heterogeneous case material [8]. Nothing here establishes what proportion of cases are missed in current practice, and a contemporary study with a defined denominator would be more useful than another case series [21,27]. Presentation differs between type 1 and type 2 diabetes, which complicates any single estimate [28], and bone turnover measures have been explored as adjuncts without entering routine use [23].

Two things would change practice more than further description of the problem. The first is a defined denominator: a prospective study of people with neuropathy presenting with a hot swollen foot, recording how many prove to have this condition and how many were suspected at first contact, would establish the miss rate in current practice rather than in a referral population [10,21]. The second is evaluation of a simple rule, since the temperature comparison is cheap enough to apply to every such presentation and has not been tested as a triage step [17,27].

It is worth noting what this review does not claim. Nothing here shows that clinicians who miss the diagnosis are reasoning carelessly. The presentation genuinely resembles commoner and more urgent conditions, the radiograph genuinely appears normal, and the condition is uncommon enough that most practitioners will see few cases [11,12,14]. The argument is about which test is applied, not about the quality of the thinking around it.

Study limitations

The limitations belong to the underlying literature. The central cohort comprises 22 patients at a single referral centre, so proportions derived from it carry very wide uncertainty and the comparison between those seen earlier and later was not randomised [10]. The systematic review draws on case reports and small series, which are selected for being instructive and cannot establish frequency [8,11]. Referral cohorts by definition exclude patients whose condition was recognised and managed locally, which would bias the apparent miss rate upward [10]. Definitions of delay differ between reports, being measured variously from symptom onset, first presentation and first imaging [8,14]. Prevalence estimates vary widely with the population screened and the diagnostic criteria applied [1,2]. Magnetic resonance access differs substantially between settings, so the stage at which diagnosis is possible is not uniform [15,16]. And the principal quantitative source predates current guidance and imaging practice [9,10].

2. Rogers LC, Frykberg RG, Armstrong DG, Boulton AJM, Edmonds M, Van GH, et al. "The Charcot foot in diabetes". *Diabetes Care* 34(2011):2123-2129.
3. Bilateral case authors. "Delayed diagnosis of bilateral neuroarthropathy: serious impact on the development of Charcot foot, a case report". *Medicina* 58(2022):1837.
4. Jeffcoate WJ, Game F, Cavanagh PR. "The role of proinflammatory cytokines in the cause of neuropathic osteoarthropathy (acute Charcot foot) in diabetes". *Lancet* 366(2005):2058-2061.
5. Boulton AJM, Vinik AI, Arezzo JC, Bril V, Feldman EL, Freeman R, et al. "Diabetic neuropathies: a statement by the American Diabetes Association". *Diabetes Care* 28(2005):956-962.

Conclusion

Charcot neuroarthropathy is missed at first presentation with striking regularity: in one referral cohort the referring provider identified it in one patient of 22, and systematic review finds delay in around half of reported cases with mean time to diagnosis approaching three months. The cost of that delay is measurable in the same data, where those seen roughly four weeks earlier avoided bone destruction and those seen later largely did not, two thirds of them proceeding to surgery. The delay has a specific and remediable cause: at the stage when treatment is effective the plain radiograph is normal, so the imaging that appears to settle the question does not. The sign that does discriminate is a temperature difference of more than 2 degrees Celsius between the feet, which costs nothing and takes seconds.

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Conflict of Interest

The authors declare no competing interests.

Ethics Statement

This article reviews previously published studies only. No new patient data were collected and no participants were recruited, so ethical approval was not required.

References

1. Safavi KS, Torian JS, Jimoh RO, Jupiter D. "A systematic review of Charcot neuroarthropathy misdiagnosis". *Foot Ankle Orthop* 7(2022):1-8.
6. Management review authors. "New concepts in the management of Charcot neuroarthropathy in diabetes". *World J Diabetes* 11(2020):39-51.
7. Armstrong DG, Boulton AJM, Bus SA. "Diabetic foot ulcers and their recurrence". *N Engl J Med* 376(2017):2367-2375.
8. Safavi KS, Torian JS, Jimoh RO, Jupiter DC. "A systematic review of Charcot neuroarthropathy misdiagnosis". *Foot Ankle Orthop* 6(2021):2473011421S00428.
9. Wukich DK, Schaper NC, Gooday C, Bal A, Bem R, Chhabra A, et al. "Guidelines on the diagnosis and treatment of active Charcot neuro-osteoarthropathy in persons with diabetes mellitus (IWGDF 2023)". *Diabetes Metab Res Rev* 40(2024):e3646.
10. Wukich DK, Sung W, Wipf SAM, Armstrong DG. "The consequences of complacency: managing the effects of unrecognized Charcot feet". *Diabet Med* 28(2011):195-198.
11. Diagnostic algorithm authors. "Current insights on the diagnostic algorithm for Charcot neuroarthropathy". *Podiatry Today* (2023).
12. Trauma masquerade authors. "Charcot neuroarthropathy masquerading as severe acute orthopedic trauma: severe ramifications of untreated diabetes mellitus". *Cureus* 17(2025):e58721.
13. Chantelau E. "The perils of procrastination: effects of early vs delayed detection and treatment of incipient Charcot fracture". *Diabet Med* 22(2005):1707-1712.
14. Petrova NL, Edmonds ME. "Acute Charcot neuro-osteoarthropathy". *Diabetes Metab Res Rev* 32(2016):281-286.
15. Chantelau E, Poll LW. "Evaluation of the diabetic Charcot foot by MR imaging or plain radiography: an observational study". *Exp Clin Endocrinol Diabetes* 114(2006):428-431.
16. Chantelau EA, Grutzner G. "Is the Eichenholtz classification still valid for the diabetic Charcot foot?". *Swiss Med Wkly* 144(2014):w13948.
17. Armstrong DG, Lavery LA. "Monitoring neuropathic ulcer healing with infrared dermal thermometry". *J Foot Ankle Surg* 35(1996):335-338.
18. Casting duration authors. "Determinants of treatment duration in active Charcot neuro-osteoarthropathy: a retrospective cohort study". *J Foot Ankle Res* 14(2021):41.
19. Milne TE, Rogers JR, Kinnear EM, Martin HV, Lazzarini PA, Quinton TR, et al. "Developing an evidence-based clinical pathway for the assessment, diagnosis and management of acute Charcot neuro-arthropathy: a systematic review". *J Foot Ankle Res* 6(2013):30.
20. Schneckloth BJ, Lowery NJ, Wukich DK. "Charcot neuroarthropathy in patients with diabetes: an updated systematic review of surgical management". *J Foot Ankle Surg* 55(2016):586-590.
21. Game FL, Catlow R, Jones GR, Edmonds ME, Jude EB, Rayman G, et al. "Audit of acute Charcot disease in the UK: the CDUK study". *Diabetologia* 55(2012):32-35.
22. Christensen TM, Gade-Rasmussen B, Pedersen LW, Hommel E, Holstein PE, Svendsen OL. "Duration of off-loading and recurrence rate in Charcot osteo-arthropathy treated with less restrictive regimen with removable walker". *J Diabetes Complications* 26(2012):430-434.
23. Bem R, Jirkovska A, Dubsky M, Fejfarova V, Buncova M, Skibova J, et al. "Role of quantitative bone scanning in the assessment of bone turnover in patients with Charcot foot". *Diabetes Care* 33(2010):348-349.
24. Pakarinen TK, Laine HJ, Maenpaa H, Mattila P, Lahtela J. "Long-term outcome and quality of life in patients with Charcot foot". *Foot Ankle Surg* 15(2009):187-191.
25. Sohn MW, Stuck RM, Pinzur M, Lee TA, Budiman-Mak E. "Lower-extremity amputation risk after Charcot arthropathy and diabetic foot ulcer". *Diabetes Care* 33(2010):98-100.
26. Wukich DK, Sadoskas D, Vaudreuil NJ, Fourman M. "Comparison of diabetic Charcot patients with and without foot wounds". *Foot Ankle Int* 38(2017):140-148.
27. Gooday C, Gray K, Game F, Woodburn J, Poland F, Hardeman W. "Systematic review of techniques to monitor remission of acute Charcot neuroarthropathy in people with diabetes". *Diabetes Metab Res Rev* 36(2020):e3328.
28. Petrova NL, Foster AVM, Edmonds ME. "Difference in presentation of Charcot osteoarthropathy in type 1 compared with type 2 diabetes". *Diabetes Care* 27(2004):1235-1236.
29. Jeffcoate W. "Vascular calcification and osteolysis in diabetic neuropathy: is RANK-L the missing link?". *Diabetologia* 47(2004):1488-1492.
30. Roskopf AB, Loupatatzis C, Pfirrmann CWA, Boni T, Berli MC. "The Charcot foot: a pictorial review". *Insights* 5

Imaging 10(2019):77.

31. Ergen FB, Sanverdi SE, Oznur A. "Charcot foot in diabetes and an update on imaging". *Diabet Foot Ankle* 4(2013):21884.
32. Schmidt BM, Holmes CM. "Updates on diabetic foot and Charcot osteopathic arthropathy". *Curr Diab Rep* 18(2018):74.
33. Kaynak G, Birsal O, Guven MF, Ogut T. "An overview of the Charcot foot pathophysiology". *Diabet Foot Ankle* 4(2013):21117.
34. Dodd A, Daniels TR. "Charcot neuroarthropathy of the foot and ankle". *J Bone Joint Surg Am* 100(2018):696-711.

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