

Case report

Patient-attributed lunar periodicity in probable ulcerated erythema nodosum leprosum: A case report and proposed psychoneuroendocrine mechanism

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ABSTRACT

Background: Erythema nodosum leprosum (ENL) is a severe, immune mediated type 2 lepra reaction that occurs predominantly in the lepromatous spectrum of leprosy. It is characterized by the eruption of tender inflammatory nodules. The possible contribution of patient belief and the nocebo effect, on precipitating ENL, has not been examined. We present a patient with lepromatous leprosy and probable ulcerated ENL whose flares the patient reported to coincide with the full moon, raising questions about how cultural explanatory models and cognitive pattern recognition intersect with chronic inflammatory diseases.

Case presentation: A 36-year-old Ethiopian male from a rural district presented with a one-year history of recurrent cutaneous bilateral lesions on his distal extremities. Individual lesions evolved from subcutaneous nodules to necrotic ulcers, and healed over up to one week, leaving hyperpigmentation at the site of each healed ulcer. Notably, the patient reported a lunar-based exacerbation pattern and initially sought spiritual healing for perceived demonic possession. Following the onset of epistaxis and nasal phonation, he sought medical evaluation. Physical examination revealed multiple non-tender nodules and clean-based ulcers, but no neurological deficits or nerve thickening.

Conclusion: This case highlights a potential neuroendocrine-immune pathway through which psychological stress and illness perceptions might modulate inflammatory activity in immune-mediated leprosy reactions. It suggests the hypothesis that, in susceptible individuals, anticipatory stress responses could influence immune-mediated reactions, a concept that could be tested prospectively by correlating patient-reported flare triggers with stress biomarkers, and warrants further investigation.

Background

Leprosy is a chronic granulomatous infection caused by the bacterium *Mycobacterium leprae* and, less commonly, *Mycobacterium lepromatosis*, with a clinical spectrum ranging from tuberculoid (paucibacillary) to lepromatous (multibacillary, LL) poles. LL is characterized by high bacterial loads, specific anergy to *M. leprae* antigens,

and a propensity for severe immunologic complications [1,2]. One such complication is Erythema Nodosum Leprosum (ENL), a painful, systemic reaction driven by a complex interplay of neutrophilic inflammation, dysregulated cytokine pathways, and immune-mediated mechanisms that affects up to 50% of these patients. While ENL most commonly presents as tender subcutaneous nodules with systemic symptoms, a minority of patients develop severe necrotizing, ulcerative forms that

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carry significant morbidity [3].

Ethiopia, despite achieving the World Health Organization's elimination target (prevalence $<1/10,000$ population), remains a high-burden country. Data from the WHO indicate an improving prevalence (from 0.39 per 10,000 in 2014 to 0.22 per 10,000 in 2024) and a decline in new cases (from 3758 to 2523). Nevertheless, Ethiopia remains the world's seventh highest-burden nation, following India, Brazil, Indonesia, Bangladesh, the Democratic Republic of the Congo, and Mozambique [2].

While lunar influences on human biology are largely refuted by meta-analyses showing $<1\%$ variance in human incidents [4], this topic has been recently revisited following evidence that lunar cycles may influence various aspects of human physiology [5,6]. However, direct gravitational or photo-immunological effects remain biologically implausible.

The nocebo effect, where negative expectations exacerbate symptoms via the HPA axis [7], manifests in its most extreme form as "voodoo death" [8]. This psychogenic phenomenon occurs when intense fear or belief in a curse triggers fatal autonomic overactivity. In chronic infections like leprosy, where immune-mediated reactions fluctuate, these belief-driven processes could theoretically influence flare timing.

This case of probable recurring uENL in an untreated patient, featuring a patient-reported lunar pattern and seasonal remission, provides a unique context to examine the interplay between traditional explanatory models, cognitive pattern recognition, and immune-mediated flares.

Case presentation

A 36-year-old Ethiopian man from a rural district in North Shewa Zone presented to the outpatient department with a one-year history of recurrent cutaneous lesions. The onset coincided with mixing an unspecified, unusually malodorous pesticide; however, given the chronic, year-long, and recurrent nature of the lesions, the clinical team deemed this exposure not directly contributory to the pathogenesis. Instead, this narrative reflection is interpreted as a manifestation of the patient's explanatory framework and pattern-seeking behavior.

He reported recurrent, bilaterally symmetric lesions predominantly affecting the distal halves of his extremities. These lesions followed a distinct progression: starting as subcutaneous nodules, evolving into vesicle-like formations, becoming necrotic with purulent discharge, and ultimately ulcerating. Intriguingly, he reported cyclical exacerbation of lesions, consistently peaking (ulcerating) around the full moon, a pattern he has observed over approximately thirteen lunar cycles.

After 4–5 months of symptoms, attributing them to demonic possession, he consulted a local spiritual healer. Following six months of unsuccessful spiritual interventions and rituals, such as animal sacrifice,

these lesions remained, and then he began experiencing epistaxis and progressive nasal phonation. The epistaxis increased in frequency and volume, ultimately prompting his presentation.

The patient experienced a two-month period of relief while visiting a *Holy Water* site during the rainy summer season. However, upon returning home, his episodic symptoms recurred, following his previously observed lunar-based pattern.

He specifically denied fever, other skin rashes, numbness, tingling sensations, eye pain, visual disturbances, or other systemic manifestations. He also denied any known allergies, was not on any medications, and reported no family history of similar illnesses.

Upon examination, the patient appeared emaciated and apathetic. His vital signs were within normal limits. On integumentary System (Fig. 1) Multiple subcutaneous non-tender nodules of varying sizes were noted on both lower limbs (below the knees) and upper limbs (below the elbows). Some of these nodules exhibited necrotic, crusted edges and ulceration, revealing clean-based ulcers without evidence of superinfection. Neurological System: Sensation to light touch and pinprick was intact in all extremities. There was no palpable peripheral nerve thickening and no evidence of madarosis or saddle nose deformity.

Laboratory investigations revealed normal complete blood cell count, renal and hepatic function panels, and liver enzymes. Serological testing was non-reactive for hepatitis B, hepatitis C, and HIV. The erythrocyte sedimentation rate (ESR) was not elevated. Definitive diagnosis was established by slit skin smear examination and fine-needle aspiration cytology (Fig. 2). Smears obtained from the earlobe, and FNAC of the nodular lesion on the forearm all showed abundant acid-fast bacilli (AFB), graded 6+ on Ridley's logarithmic scale (the morphological index was not assessed). These bacilli frequently formed globi and appeared both singly and in pathognomonic arrangements, accompanied by Virchow (lepra) cells and poorly formed granulomas containing sparse epithelioid cells. The aspirate was negative for *Mycobacterium tuberculosis* on GeneXpert MTB/RIF testing.

The patient was initiated on a multidrug regimen consisting of clofazimine (50 mg daily plus a 300 mg monthly pulse dose), rifampicin (600 mg monthly), and dapsone (100 mg daily). The patient was treatment-naïve at presentation and was referred to a local leprosy treatment centre, where the decision was made to initiate clofazimine-based MDT with close monitoring rather than adding systemic corticosteroids. Although WHO guidelines recommend systemic corticosteroids as first-line therapy for severe ENL, including ulcerating lesions, this decision was based on the absence of systemic manifestations (fever, malaise, lymphadenopathy, arthralgia) and clinical assessment that the lesions were already regressing at presentation. Under WHO guidance, clofazimine alone is indicated for severe ENL when corticosteroids are contraindicated. While no absolute contraindication was present, the resolving clinical picture was judged by the treating centre to make



Fig. 1. Illustrate the diverse cutaneous findings. A (lower extremities): presents a spectrum crusted ulcerations in various stages. Newly emerging, non-tender papules are indicated by arrowheads. Active lesions (red arrows) are well-demarcated, round to curvilinear, and exhibit necrosis, crusting, and eschar formation; some show a hyperpigmented halo and reveal a clear ulcer base upon sloughing. Older, hyperpigmented lesions, consistent with healed areas, are highlighted by yellow arrows. Images B (Left Elbow) and C (Right Forearm): Provide magnified views of these characteristic skin changes, including active lesions with similar features.

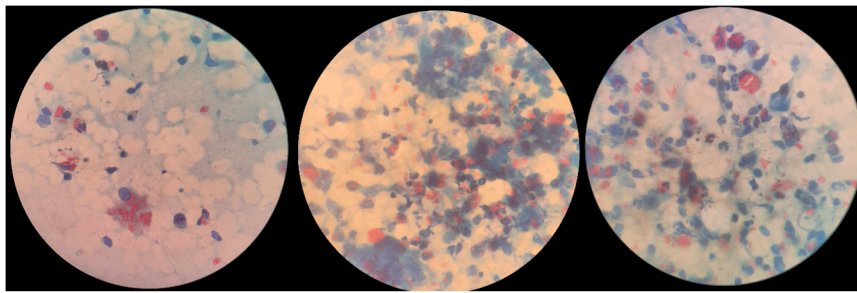


Fig. 2. Microscopic examination of a slit-skin smear obtained from the earlobe (left) and fine-needle aspiration (FNA) samples obtained from nodular lesions (center and right) reveals acid-fast bacilli with a Ridley-Jopling logarithmic bacterial index of 6 +. The bacilli appear both isolated and grouped as globi inside Virchow (lepra) cells. Additionally, a neutrophilic infiltrate and occasional epithelioid cells indicate the presence of poorly formed granulomas. The morphological index was not assessed.

corticosteroid therapy unnecessary at that juncture, with the understanding that prednisolone could be promptly introduced if lesions progressed or systemic features emerged. We acknowledge this represents a deviation from standard guidance.

The patient was initiated on standard multibacillary multidrug therapy consisting of monthly rifampicin (600 mg) and dapsone (100 mg daily), along with clofazimine (50 mg daily plus a 300 mg monthly pulse dose). The patient was treatment-naïve at presentation and was referred to a local leprosy treatment centre. No additional systemic anti-inflammatory therapy or high-dose clofazimine specifically targeted at the ENL reaction was administered. This decision was based on the absence of systemic manifestations (fever, malaise, lymphadenopathy, arthralgia) and the clinical assessment that the lesions were already spontaneously regressing at presentation. While WHO guidelines recommend systemic corticosteroids as first-line therapy for severe ENL, including ulcerating lesions, the resolving clinical picture led the treating centre to deem corticosteroids unnecessary at that juncture, with the understanding that prednisolone could be promptly introduced if lesions progressed or systemic features emerged. We acknowledge this represents a deviation from standard guidance regarding active severe ENL management.

Beyond pharmacological intervention, we provided comprehensive counseling to address the patient's potential sense of isolation. We explained that while the condition is uncommon, accounting for why he had not encountered others with similar symptoms, it is a recognized and manageable medical entity. This was intended to reassure him that his experience was understood by the medical community and had a predictable, favorable prognosis with treatment. We also addressed his belief regarding the lunar cycle's influence, clarifying the lack of a clinical link while maintaining a supportive therapeutic alliance. The patient remained adherent and exacerbation-free for eight months before being lost to follow-up. While it is likely that the multidrug regimen was the primary driver of clinical improvement, we cannot exclude the possibility that addressing his psychosocial distress contributed to his overall well-being and treatment adherence.

Discussion

The patient's clinical and laboratory findings confirm lepromatous leprosy (LL). Slit-skin smear and fine-needle aspiration showed abundant acid-fast bacilli, including globi formations, with poorly formed granulomas, features pathognomonic for the multibacillary pole of the disease [9]. Severe necrotizing, ulcerative erythema nodosum leprosum (uENL) in a treatment-naïve patient is unusual but not unheard of; as spontaneous ENL occurs in 15–20% of untreated LL patients, and a smaller subset develops ulcerative lesions. Pathogenically, ENL involves a complex interplay of immune-complex-mediated hypersensitivity, complement fixation, neutrophilic inflammation, cytokine cascades, and altered cellular immunity [3,10].

The differential diagnosis of necrotizing lesions in LL includes Lucio phenomenon (LP), a severe vasculitic reaction caused by direct bacillation of vascular endothelium leading to thrombotic ischemia [11]. Several features argue against LP in this case: the lesions progressed from subcutaneous nodules to vesicle-like formations to ulceration, consistent with ENL's neutrophilic inflammation rather than LP's ischemic infarction, and ulceration with purulent discharge is a recognized severity feature of ENL according to the ENLIST ENL Severity Scale [12]. Although skin biopsy was unavailable, cytology demonstrated abundant AFB in globi accompanied by a predominantly neutrophilic infiltrate, a finding characteristic of ENL and notably rare or absent in other leprosy reactions, whereas LP is characterized histologically by necrotizing vasculitis with fibrin thrombi and without significant inflammatory infiltrate. We also note that systemic manifestations are not required for ENL diagnosis; the WHO technical guidance defines the key diagnostic feature of a Type 2 reaction as the presence of inflamed nodules in the skin (erythema nodosum). Definitive distinction from LP would nonetheless require lesional histopathology to assess for endothelial bacillation and vascular thrombosis, which was unavailable. We therefore classify this as probable ulcerative ENL, a severe but recognized variant of Type II leprosy reaction [13,14].

To account for the patient-reported temporal association between symptom worsening and the lunar cycle, we consider two questions separately: what makes this patient susceptible to recurrent ENL, to which a high bacterial index is frequently contributory [3,10,12], and what could impose a regular rhythm on that susceptibility.

A high bacillary or antigenic burden is a well-established risk factor predisposing patients to ENL [3,10,12], particularly within the lepromatous spectrum where cellular immunity is impaired and complete sterilization is rarely achieved [1,9]. ENL is characterized by inflamed subcutaneous nodules involving, to varying degrees, immune-complex deposition, complement activation, and a marked neutrophilic infiltrate. While this high baseline bacterial load provides the necessary biological substrate for immune-mediated reactivity, it does not account for a regular rhythm or periodicity; the timing of the reported episodes therefore requires a separate explanation.

We therefore consider a neuroendocrine and perceptual mechanism as the principal candidate for that timing. Although the moon has no known direct biological activity, its gravitational pull is negligible at the cellular level, its illumination too weak for photo-immunological effects, and lunar phase accounts for less than 1% of variance in human health incidents [4], the perceived alignment may nonetheless acquire biological consequences. The association potentially originates in cognitive pattern-seeking reinforced by confirmation bias and cultural expectation [15,16]. Once established, such a belief can operate as a recurring psychological trigger through the nocebo effect, whereby anticipation of unexplained ulcerating lesions at each full moon generates a recurring psychogenic stressor [8]. In parallel, full-moon phases have been linked to altered sleep architecture and suppressed melatonin secretion [5].

Neither observation establishes causation, but both provide plausible routes by which a perceived lunar cycle could be transduced into a measurable physiological signal.

In this framing Fig. 3, the timing of the reported periodicity is attributed to the psychoneuroendocrine pathway, while bacterial burden determines susceptibility. This would explain why the reported episodes are regular without requiring a bacterial oscillator, and why a patient in the lepromatous spectrum with impaired cell-mediated immunity and possible HPA axis blunting might be vulnerable to such entrainment.

If baseline HPA responsiveness were chronically blunted in this patient, a phenomenon supported by psychoneuroimmunological evidence linking chronic systemic disease to HPA axis suppression [7], modern frameworks on stress vulnerability and cortisol hypo-responses to acute stress [17], and data demonstrated specifically in leprosy cohorts [18], the failure to mount an adequate cortisol surge during acute psychological stress could plausibly occur [17]. Operating through potential nocebo effects, sleep disruption, or melatonin suppression, this compromised glucocorticoid response would remove normal anti-inflammatory restraint, dysregulating neuroendocrine-immune interactions and triggering an inflammatory reaction against the residual

bacillary load to precipitate a clinically manifest flare. While serial cortisol measurements were not performed in this case, this framework is grounded in established principles of stress-induced HPA dysregulation [7,19], contemporary stress-response models [17], and empirical data from leprosy populations [18]. It is therefore offered as a biologically plausible hypothesis for further investigation rather than a demonstrated cause of periodicity.

Regardless of the exact pathway, the patient’s belief itself is a clinically significant source of distress. Cognitive-behavioral strategies and stress reduction have improved outcomes in other chronic immune-mediated conditions by lowering inflammatory markers and improving HPA axis regulation [18]. In this rural Ethiopian setting, formal psychotherapy is scarce, but simple psychoeducation about stress and inflammation, basic relaxation techniques, and a respectful exploration of his explanatory model, without directly challenging deeply held beliefs, could reduce the psychological burden and, potentially, the frequency of flares.

Our report has clear limitations, including the timing of flares relies entirely on patient recall; no prospective diary was kept. We lacked objective stress and immune measurements. The single-case design cannot establish cause and effect, and the observed lunar association

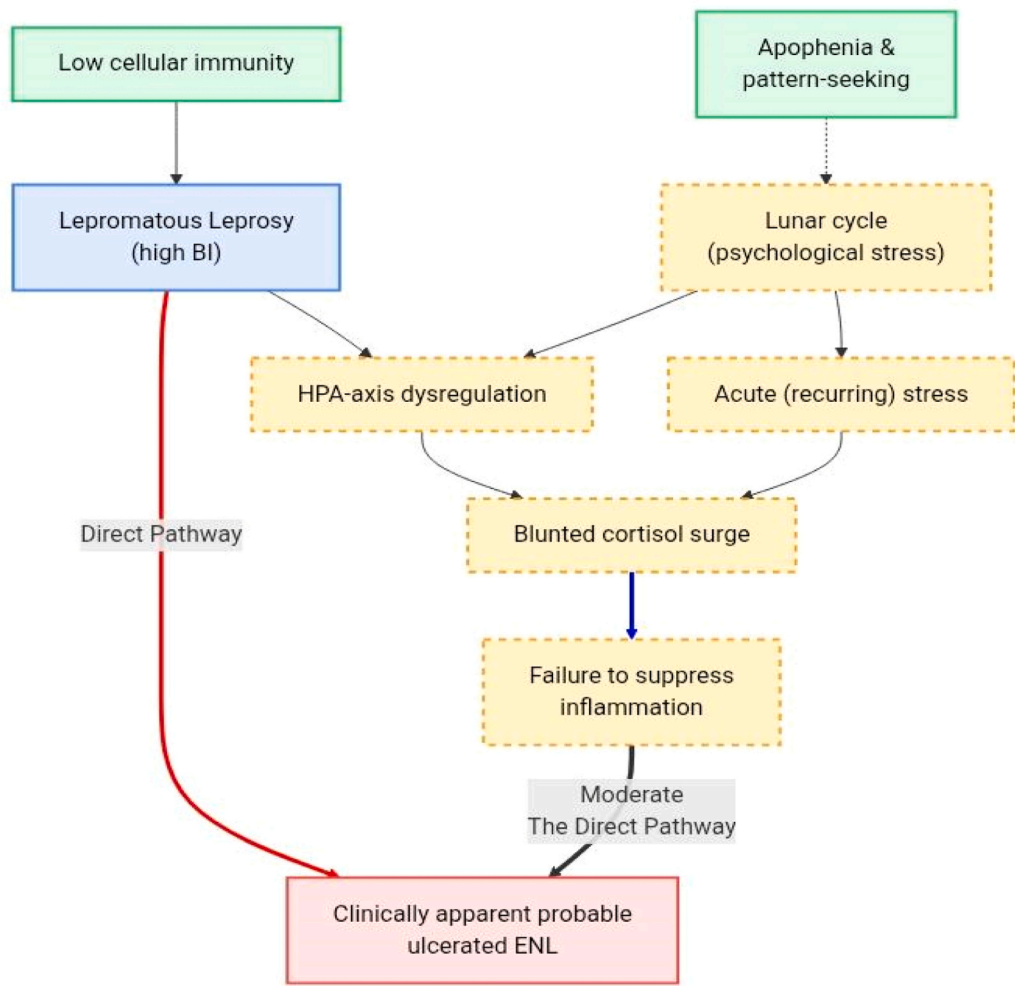


Fig. 3. A testable conceptual framework proposing the temporal moderation of ENL pathogenesis in LL. This schematic illustrates a hypothesis-generating model based on a patient with LL (high Bacterial index). While low cellular immunity and apophenia are established concepts in the literature (green boxes), the proposed mechanisms driving the clinical outcome are hypothetical and require future validation (orange dashed boxes). The model posits a primary direct pathway from LL (establishing a high-BI permissive substrate) to clinically apparent probable ulcerated ENL (red arrow). More centrally, it proposes a testable hypothesis: that a psychological cascade (lunar cycle acting as a psychological stressor, to which the HPA axis response inadequately) acts as a temporal moderator. Specifically, the failure to suppress inflammation during acute recurrent stress is hypothesized to moderate the direct pathway, determining the timing rather than the occurrence of the clinical flare. Prospective studies measuring serial cortisol, inflammatory markers, and flare timing are required to test this framework.

could be entirely coincidental. Furthermore, because biopsy was not performed, the diagnosis of probable ENL.

and the exclusion of Lucio phenomenon in our case relied on cytological findings (predominant neutrophilic infiltrate) and epidemiological context rather than confirmatory histopathology; consequently, Lucio phenomenon cannot be definitively excluded.

In addition to recall bias and absence of biomarker measurements, we explicitly acknowledge that the present case cannot distinguish between psychological expectancy, intrinsic disease periodicity, environmental influences, or any putative circalunar biological rhythm. Consequently, causal inference is not possible. The proposed HPA-axis mechanism is speculative and requires formal investigation. Nonetheless, the case illustrates how patient-held illness perceptions and anticipatory stress responses may interact with neuroendocrine pathways in a chronic, immune-mediated disease. Integrated care that addresses both the infection and the patient's emotional experience may be beneficial and is worthy of consideration in similar settings, though further studies are needed to confirm its independent impact on clinical outcomes.

Conclusion

While the reported periodicity cannot be verified, and the diagnosis remains probable rather than confirmed, this case offers a testable proposition: that a perceived lunar cycle may be transduced into a physiological signal capable of modulating an immune-mediated reaction, examinable prospectively by blinding the patient to lunar phase and by measuring cortisol and inflammatory markers across successive cycles. If flares persist unchanged once lunar cues are removed, the proposed pathway would be substantially less likely. The case does not establish that the periodicity is biologically real; it suggests only that the patient's explanatory framework warrants examination rather than dismissal.

Abbreviations

AFB: Acid-Fast Bacilli
CBT: Cognitive Behavioral Therapy
ENL: Erythema Nodosum Leprosum
ESR: Erythrocyte Sedimentation Rate
HPA: Hypothalamic-Pituitary-Adrenal (axis)
LL: Lepromatous Leprosy
LP: Lucio Phenomenon
uENL: Ulcerative Erythema Nodosum Leprosum
WHO: World Health Organization

CRediT authorship contribution statement

Behaylu Tesfamaryam Hagos: Writing – original draft, Visualization, Formal analysis, Data curation, Conceptualization. **Shimels Getaneh Weldemedhn:** Writing – review & editing, Formal analysis, Conceptualization. **Rediwan Gashaw Geto:** Writing – review & editing, Formal analysis. **Kaleab Dadi Wordofa:** Writing – review & editing, Formal analysis. **Getu Alemayehu Meshesha:** Writing – review & editing, Formal analysis. **Adane Alemayehu Abera:** Writing – review & editing, Formal analysis. **Elias Muche Kebede:** Writing – review & editing, Formal analysis. **Kbreab Amare Kidanu:** Writing – review & editing, Formal analysis. **Binyam Mohammedbirhan Berhe:** Writing – review & editing, Formal analysis.

Ethics declaration

Written informed consent to take part in the study and to publish the article has been obtained from all participants or their legal representatives. The privacy rights of participants have been observed.

This study included organ or tissue donors. This study includes human biological material and consent was obtained by donors, or their

next of kin or legal representatives, for use in this study and for publication of the article. The samples used in this research were not sourced from executed prisoners or prisoners of conscience.

This study was performed in compliance with relevant laws, regulatory frameworks and guidelines where the research took place. This study was conducted in accordance with The Declaration of Helsinki. Ethics committee approval was not required under relevant laws and institutional guidelines. Ethics committee approval was not required for this article, in compliance with institutional policies and national regulatory guidelines governing retrospective individual case descriptions and studies using data, samples, or tissue that already exist. The patient provided full written informed consent for publication.

This research follows the CARE guidelines and the CARE checklist.

Consent for publication

Written informed consent was obtained from the patient for publication of this case report and accompanying images. A copy of the written consent is available for review by the Editor-in-Chief of this journal on request.

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Conflict of Interest

The authors declare that there are no conflicts of interest related to this case report.

Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Availability of Data and Materials

All supporting data necessary to validate the findings of this case report are available upon request.

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