

Received: 2025.11.04
Accepted: 2026.03.23
Available online: 2026.04.10
Published: 2026.05.27

e-ISSN 1941-5923
© Am J Case Rep, 2026; 27: e951991
DOI: 10.12659/AJCR.951991

Targeting Neuroinflammation and Peripheral Nerve Dysfunction in Refractory Postherpetic Neuralgia: A Multimodal Injection Case Series

Authors' Contribution:
Study Design A
Data Collection B
Statistical Analysis C
Data Interpretation D
Manuscript Preparation E
Literature Search F
Funds Collection G

ABCDEF 1 **Grady Janitra**
ABCDEFG 1,2 **Dedi Susila** 
ACF 3 **Liong Liem** 

1 Department of Anesthesiology and Intensive Care, Faculty of Medicine, Universitas Airlangga, Surabaya, East Java, Indonesia
2 Department of Anesthesiology and Intensive Care, Dr. Soetomo General Academic Hospital, Surabaya, East Java, Indonesia
3 Department of Anesthesiology and Pain Management Maastricht University Medical Center, Maastricht, Netherlands

Corresponding Author: Dedi Susila, e-mail: dedisusila75@gmail.com
Financial support: None declared
Conflict of interest: None declared

Case series

Patients: Male, 77-year-old • Male, 57-year-old • Female, 62-year-old • Male, 78-year-old
Final Diagnosis: Postherpetic neuralgia
Symptoms: Pain
Clinical Procedure: —
Specialty: Anesthesiology

Objective: Unusual setting of medical care
Background: Postherpetic neuralgia (PHN) is a chronic neuropathic pain condition that often persists despite standard pharmacological therapy. Interventional approaches targeting neurogenic inflammation and peripheral nerve dysfunction are increasingly considered in refractory cases. Perineural or epidural steroid injections exert local anti-inflammatory effects, whereas 5% dextrose water (5DW) injections have been reported to modulate neural activity and reduce neuroinflammation. However, evidence regarding the combined use of these 2 modalities in PHN remains limited.

Case Reports: Four patients with PHN persisting for more than 3 months and refractory to pharmacological therapy underwent steroid injections (supraorbital, lumbar or thoracic epidural, or stellate ganglion block) combined with intralesional 5DW injections. All procedures were performed under ultrasound guidance. Within 2 to 3 weeks, all patients demonstrated clinically meaningful reductions in pain intensity (>50% reduction in visual analog scale scores), with consistent response patterns across different dermatomal distributions (V1, L2-L3, C4-T4, and T2-T4). No adverse events or procedural complications were observed.

Conclusions: The findings of this case series suggest that the combination of steroid and 5DW injections may represent a feasible multimodal approach for refractory PHN, with consistent clinical responses across dermatomes. Although synergistic mechanisms cannot be established based on the present study design, these results provide an initial basis for the hypothesis that simultaneous targeting of neurogenic inflammation and peripheral nerve dysfunction may confer additional benefit. Prospective controlled studies with larger sample sizes are warranted to evaluate comparative effectiveness, durability of benefit, and the positioning of this intervention within PHN management algorithms.

Keywords: Case Reports • Dextrose • Neurology • Pain Management • Postherpetic Neuralgia • Steroids

Full-text PDF: <https://www.amjcaserep.com/abstract/index/idArt/951991>

 4198  1  4  27



Publisher's note: All claims expressed in this article are solely those of the authors and do not necessarily represent those of their affiliated organizations, or those of the publisher, the editors and the reviewers. Any product that may be evaluated in this article, or claim that may be made by its manufacturer, is not guaranteed or endorsed by the publisher

Introduction

Postherpetic neuralgia (PHN) is the most common chronic complication of herpes zoster, characterized by persistent neuropathic pain following the resolution of cutaneous lesions. Its incidence increases with advancing age and immunosuppressive conditions, exerting a significant impact on patients' quality of life, including sleep disturbances, physical limitations, and psychological problems. The pathophysiological mechanisms of PHN involve sensory nerve injury, persistent inflammation within the dorsal root ganglion, and central sensitization, all of which contribute to the development of allodynia and hyperalgesia [1].

The complexity of these mechanisms helps explain why conventional pharmacological therapies – such as gabapentin, pregabalin, tricyclic antidepressants, opioids, and topical agents – often provide only limited improvement and are frequently associated with adverse effects. These limitations have prompted the use of non pharmacological interventions, including steroid injections, pulsed radiofrequency, neuromodulation, and botulinum toxin A, although these modalities are constrained by high costs, the need for specialized facilities, and the risk of complications [2,3].

Such limitations have driven the search for safer, more affordable, and more accessible modalities, one of which is 5% dextrose water (5DW) injection. This modality has a favorable safety profile and is repeatable and non-neurotoxic. Proposed mechanisms include TRPV-1 modulation, reduction of neuroinflammation, and hydrodissection effects that improve nerve microcirculation [4]. Preliminary studies have shown promising results in various neuropathic pain conditions, including carpal tunnel syndrome and refractory PHN [4,5]. In contrast, steroid injections have long been used to reduce inflammation through potent anti inflammatory and immunomodulatory effects, particularly in conditions involving peripheral nerve irritation or compression. Their rapid analgesic response is often attributed to reductions in local edema, membrane stabilization, and suppression of inflammatory mediators [6].

Considering these distinct yet complementary mechanisms, a combined approach using steroids and 5DW is hypothesized to provide additional benefit compared with the serial administration of each agent alone. This combination simultaneously targets 2 major pathophysiological components – neurogenic inflammation and peripheral nerve dysfunction [6,7]. Moreover, this approach remains infrequently reported in the literature, particularly in cases of refractory PHN. This case series provides clinically relevant insight by illustrating the potential of a more accessible, low cost multimodal strategy that may serve as an alternative for patients who do not respond to standard therapy. Based on these considerations, the present study aims to explore the use of combining steroid injections with 5DW as

a multimodal approach in the management of PHN with persistent pain lasting longer than 3 months.

Case Reports

The study included patients with postherpetic neuralgia (PHN) who experienced persistent pain for more than 3 months that was refractory to pharmacological therapy and underwent steroid injections combined with 5DW under ultrasound guidance. The interventions were administered directly to the areas affected by herpes zoster according to the involved dermatomal distribution, with the aim of targeting anatomically relevant neural structures.

This study received approval from the Institutional Review Board (IRB) of the affiliated hospital, and written informed consent was obtained from all patients prior to the procedures and the use of their clinical data. Patient confidentiality was maintained in accordance with ethical principles of medical research.

In this study, 4 PHN cases with varying dermatomal distributions were prospectively documented. Clinical data collected included demographic characteristics, pain location, prior treatments, type and dosage of interventions, and pain intensity assessments using the visual analog scale (VAS) before and after the procedures. Statistical analysis was performed descriptively in accordance with the case series design and the limited sample size. Inferential analysis was not conducted, as the primary objective of this study was to evaluate clinical feasibility and patterns of pain response as a basis for hypothesis generation for future research. The results are presented as changes in VAS scores to illustrate the clinical response to the combination therapy.

Patients with PHN who experienced pain lasting more than 3 months received steroid injections combined with 5DW. The injections were administered directly to the areas affected by herpes. We report 4 cases in this study, as follows.

Case 1

A 77-year-old man presented with a history of vesicular fluid-filled eruptions on the right side of his face approximately 2 months prior to the visit, accompanied by severe pain around the eye, forehead, temple, and right side of the head. After the acute phase resolved and the rash crusted over, mild residual hyperpigmentation remained without active lesions. However, the pain persisted and evolved into chronic neuropathic pain.

The pain was described as a nearly constant burning and sharp sensation, accompanied by marked cutaneous hypersensitivity

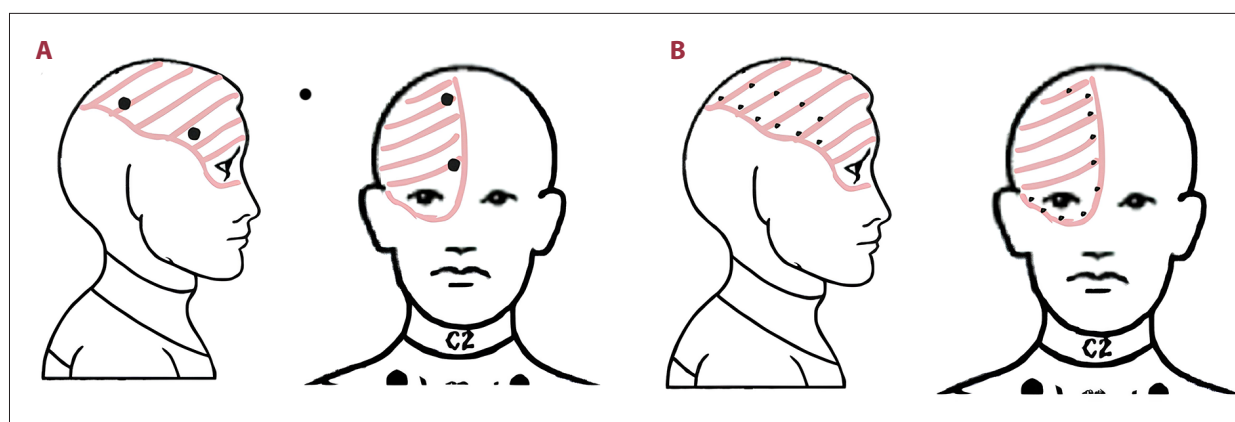


Figure 1. Distribution of pain and intralesional 5% dextrose water injection sites in a patient with post-herpetic neuralgia. (A) Initial treatment session. (B) Follow-up session.

and allodynia, in which mild stimuli such as touch, bathing, or wearing head coverings triggered disproportionate pain. This condition caused significant sleep disturbance, fatigue, and limitations in daily activities, including difficulty performing self-care and social activities, negatively affecting the patient's quality of life and psychological well-being.

The clinical presentation was consistent with postherpetic neuralgia involving the V1 dermatome of the trigeminal nerve. Differential diagnoses such as idiopathic trigeminal neuralgia, sinusitis, odontogenic pain, and non-herpetic cranial neuropathy were considered but deemed less likely due to the preceding herpes zoster episode, persistent neuropathic pain lasting more than 2 months after rash resolution, pain distribution consistent with the V1 dermatome, and the absence of active infection or focal neurological deficits.

Erythrocyte sedimentation rate (ESR) and C-reactive protein (CRP) levels were within the reference range, with no evidence of active systemic inflammation. A non-contrast-enhanced head computed tomography (CT) scan was performed to exclude intracranial structural abnormalities and showed normal findings.

Before referral, the patient had received antiviral therapy with acyclovir and several neuropathic pain medications, including diclofenac sodium, pregabalin, amitriptyline, and gabapentin, without meaningful clinical improvement. At the first visit to the pain clinic, pain intensity was rated as severe, with a VAS score of 8-9, corresponding to the V1 dermatome of the trigeminal nerve (**Figure 1**).

The patient subsequently underwent injections of 40 mg triamcinolone targeting the supraorbital and infraorbital nerves, combined with intralesional 5DW injections totaling 10 mL across 10 points. The selected dose and volume were based on literature demonstrating favorable efficacy and safety profiles. Injection sites were chosen to target the most relevant

neural structures, aiming to achieve local anti-inflammatory effects and modulation of nociceptive transmission.

Follow-up evaluation demonstrated gradual improvement, with approximately 30% pain reduction in the first week (VAS 5-6), minimal residual pain in the second week localized to the infra-orbital area (VAS 1-2), and significant improvement by the third week, marked by reduction of sharp pain, burning sensations, and allodynia, indicating an excellent therapeutic response.

Case 2

A 57-year-old man with a history of herpes zoster presented to the pain and palliative care clinic of a tertiary referral hospital with severe right thigh pain that had persisted for approximately 5 months, following the onset of the herpes zoster rash, fulfilling the criteria for PHN. The previous rash involved the right thigh and extended to the right posterior lumbar region, and had since resolved, leaving residual hyperpigmentation without active lesions.

The pain had progressed into persistent neuropathic pain described as burning and sharp, accompanied by paresthesia in the form of numbness and pruritic sensations, as well as cutaneous hypersensitivity that caused discomfort even with light touch. This condition significantly limited daily activities, including walking, prolonged sitting, and work-related tasks, and also resulted in sleep disturbances and fatigue.

Prior to referral, the patient had completed antiviral therapy and had taken gabapentin and paracetamol for 1 month without meaningful clinical improvement. He had no comorbidities or history of trauma. On initial examination, pain intensity was severe, with a VAS score of 7-8, distributed along the L2-L3 dermatomes (**Figure 2**), accompanied by hypoesthesia and allodynia without motor deficits. ESR and CRP levels were within the reference range, with no evidence of active systemic inflammation.

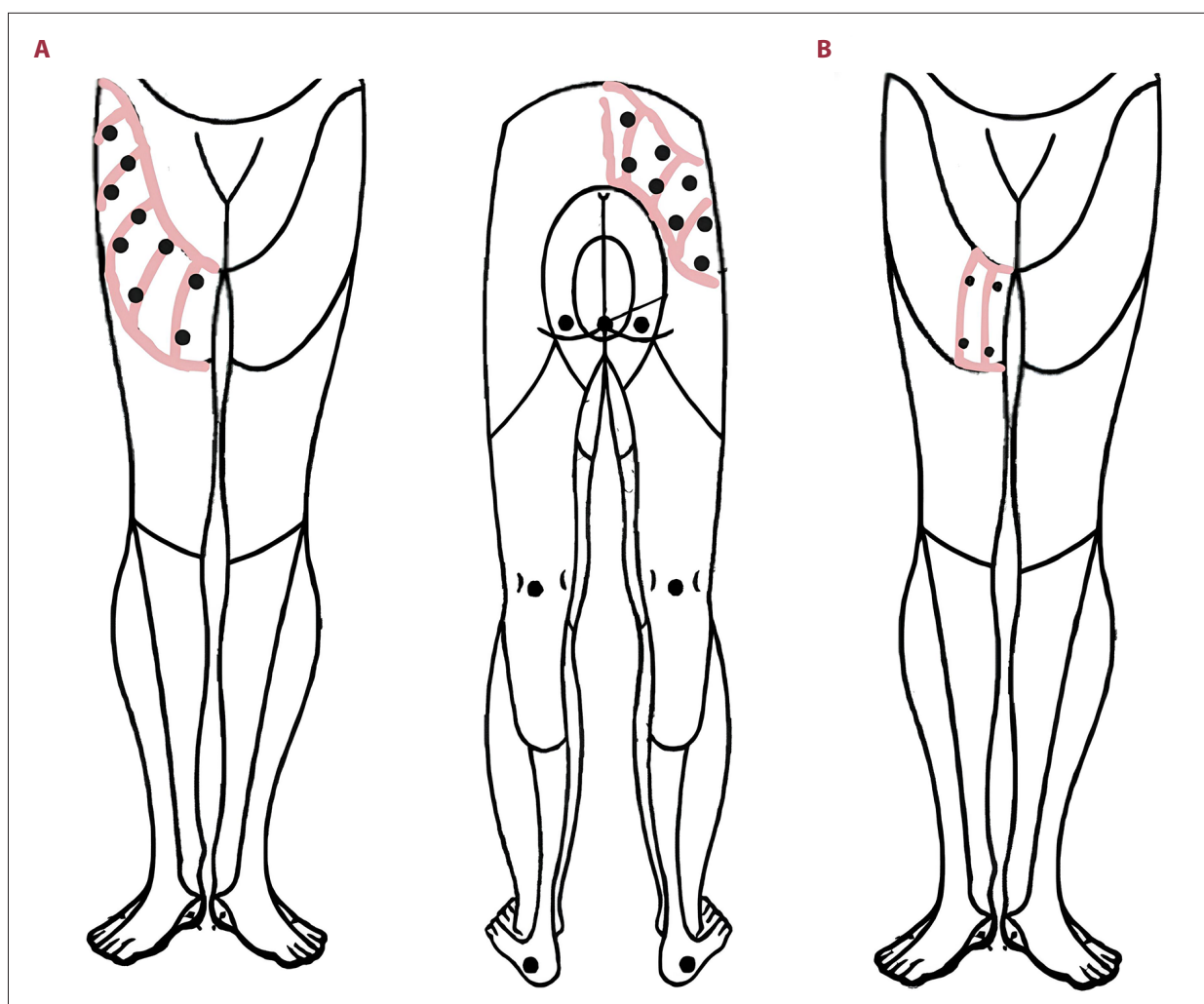


Figure 2. Distribution of pain and intralesional 5% dextrose water injection sites in the right thigh extending to the back waist, corresponding to the L2-3 dermatomes. (A) Initial treatment session. (B) Follow-up session.

Differential diagnoses such as lumbar radiculopathy, non-herpetic peripheral neuropathy, and musculoskeletal pain were considered but deemed less likely due to the absence of motor deficits, structural compression signs, or trauma history, as well as the clear temporal relationship between pain onset and the prior herpes zoster episode, with a pain distribution consistent with the L2-L3 dermatomes.

Based on these findings, the patient underwent a lumbar interlaminar epidural steroid injection using 40 mg triamcinolone, combined with intralesional 5DW injections totaling 10 mL across 10 points corresponding to the affected dermatomal distribution. The dosage and injection sites were selected according to literature demonstrating favorable efficacy and safety profiles and to target the most anatomically relevant neural structures.

Evaluation 2 weeks after the intervention showed significant clinical improvement, with pain intensity reduced to VAS 2-3, although mild discomfort persisted in the medial thigh. To optimize therapeutic outcomes, intralesional injections were repeated at 4 additional points (total of 4 mL 5DW). At the 2-week follow-up after the final intervention, the patient reported complete resolution of pain, with a VAS score of 0, indicating an excellent therapeutic response.

Case 3

A 62-year-old woman presented with persistent pain in the neck, right chest, and right upper back that had been ongoing for approximately 5 months following a herpes zoster eruption in the same areas, fulfilling the diagnostic criteria for PHN. After the acute phase resolved, the rash subsided, leaving residual hyperpigmentation without active lesions.

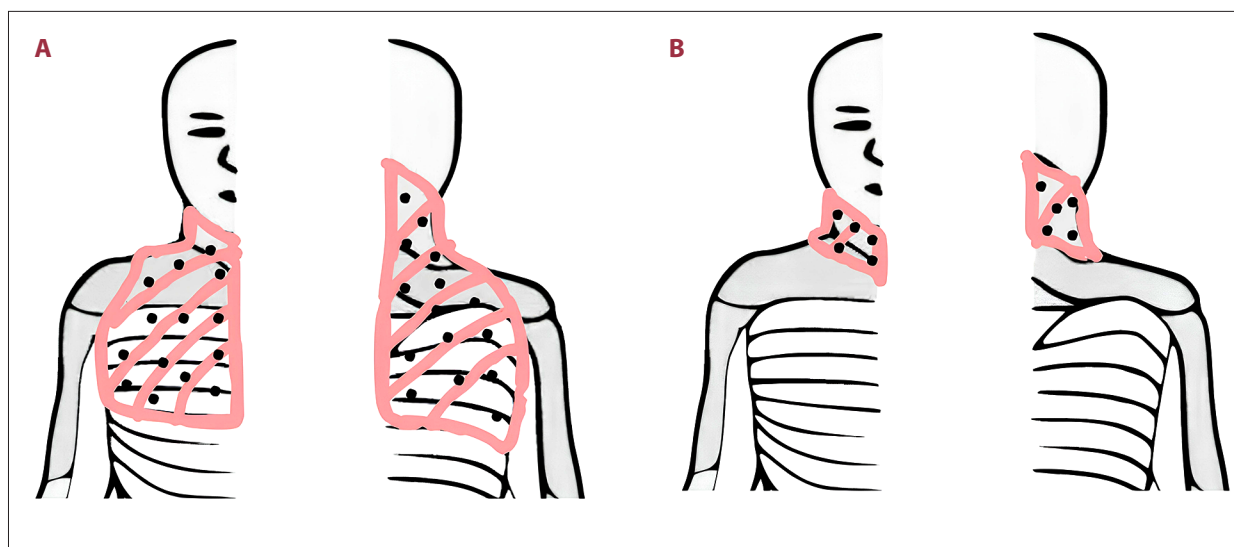


Figure 3. Distribution of pain and intralesional 5% dextrose water injection sites in the neck, right anterior chest, and upper back corresponding to dermatomes C4-T4. (A) First and second treatment sessions. (B) Third treatment session.

The pain progressed into persistent neuropathic pain characterized by sharp, burning, and pruritic sensations, accompanied by marked cutaneous hypersensitivity and allodynia, in which light touch triggered disproportionate pain. This condition resulted in ongoing sleep disturbances, fatigue, and limitations in daily activities, including difficulty performing household tasks and social activities.

Before referral, the patient had completed antiviral therapy and had been taking gabapentin as first-line treatment for neuropathic pain; however, her symptoms did not improve and progressively worsened. She had no history of comorbidities or trauma. On initial evaluation, the pain intensity was severe, with a VAS score of 8, and the distribution corresponded to the C4-T4 dermatomes (Figure 3), accompanied by hypoesthesia and allodynia without motor deficits.

Differential diagnoses such as cervicothoracic radiculopathy, musculoskeletal pain, and non-herpetic peripheral neuropathy were considered but deemed less likely due to the absence of motor deficits, structural compression signs, or trauma history, as well as the clear temporal association between the onset of pain and the preceding herpes zoster episode, with a dermatomal distribution consistent with C4-T4 involvement. Laboratory test results, including ESR and CRP, were within the reference range, indicating no evidence of active systemic inflammation.

Based on these findings, the patient underwent a stellate ganglion block under ultrasound guidance using 40 mg of methylprednisolone, combined with intralesional injections of 5% 5DW. The dosage and intervention approach were selected based on literature supporting their safety and therapeutic

effectiveness, as well as their relevance in targeting the affected neural structures.

During the first session, 25 intralesional injections of 5DW were administered, totaling 25 mL, resulting in a reduction of pain to a VAS score of 5-6. The second session targeted residual pain areas with an additional 10 intralesional injections (totaling 10 mL of 5DW). At the final evaluation in the third week, the patient reported complete resolution of pain, indicating an excellent therapeutic response.

Case 4

A 78-year-old man presented to the pain and palliative clinic at a tertiary referral hospital with persistent pain in the right chest and back that had lasted for approximately 6 months following an episode of herpes zoster, fulfilling the criteria for PHN. The pain was described as sharp, burning, and numb, accompanied by sleep disturbances that significantly affected his quality of life.

Before referral, the patient had received various pharmacological therapies, including gabapentin, diclofenac sodium, pregabalin, and amitriptyline; however, his symptoms did not improve and instead progressively worsened. On initial evaluation, pain intensity was severe, with a VAS score of 8-9, distributed along the T2-T4 dermatomes (Figure 4), accompanied by hypoesthesia and allodynia without motor deficits.

Differential diagnoses such as thoracic radiculopathy, musculoskeletal pain, and non-herpetic peripheral neuropathy were considered; however, they were deemed less likely, as no motor deficits, structural compression signs, or trauma history were identified.

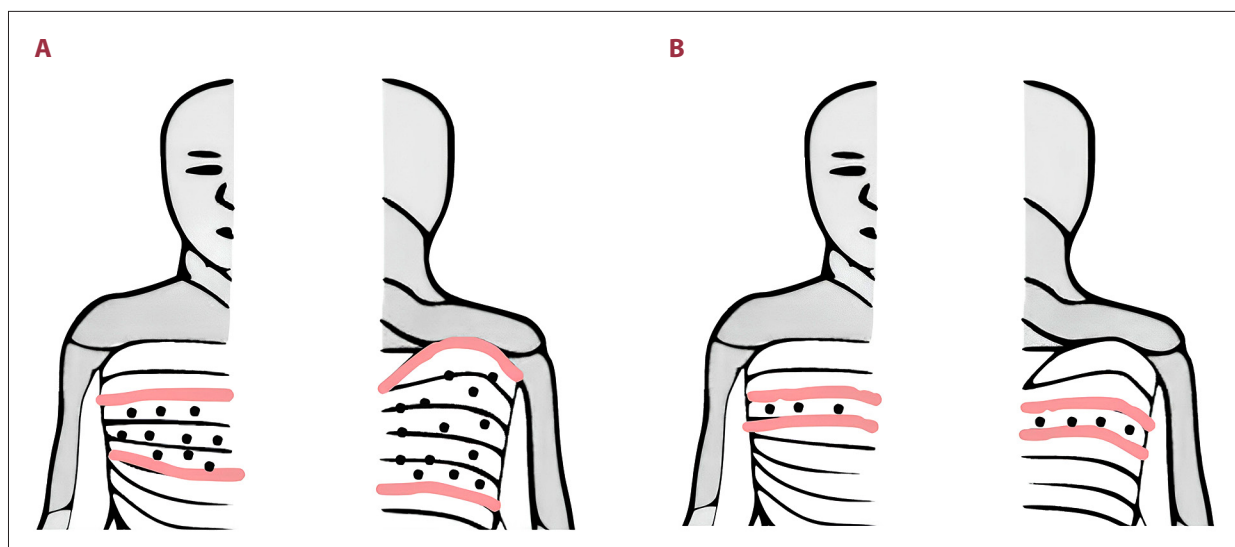


Figure 4. Distribution of pain and intralesional 5% dextrose water injection sites in the right chest and upper back corresponding to dermatomes T2-T4. **(A)** First treatment session. **(B)** Second treatment session.

Moreover, there was a clear temporal relationship between the onset of pain and the prior herpes zoster episode, with a consistent dermatomal distribution. ESR and CRP levels were within the reference range, with no evidence of active systemic inflammation.

Based on these findings, the patient underwent thoracic interlaminar epidural steroid injection using 40 mg triamcinolone under ultrasound guidance, combined with intralesional injection of 5DW. The dosage and type of intervention were selected according to literature demonstrating favorable efficacy and safety profiles, and to target the most anatomically relevant neural structures.

During the first session, 15 intralesional injections of 5DW were administered, with a total volume of 15 mL, resulting in a reduction of pain intensity to VAS 4-5 at the 1-week follow-up. The second session involved repeating 15 intralesional injections (total 15 mL of 5DW). At the 3-week evaluation, pain further decreased to VAS 2-3, accompanied by marked improvement in sleep quality, indicating a favorable therapeutic response.

A summary of the demographic characteristics, chief symptoms, treatment history, and pain evaluation outcomes of all 4 patients with PHN is presented in **Table 1**. Although dermatomal distribution varied, all patients demonstrated a consistent clinical response to the combination of steroid and 5DW injections, as evidenced by clinically meaningful reductions in VAS scores.

Discussion

Across all 4 patients in this case series, a highly consistent clinical pattern of PHN was observed, reflecting the typical

spectrum of persistent PHN. All patients experienced neuropathic pain lasting more than 3 months after rash resolution [8], with similar sensory descriptors – burning, sharp, pruritic sensations accompanied by paresthesia and allodynia – indicating involvement of Aδ and C fibers as well as ongoing peripheral and central sensitization [9]. Sleep disturbances, fatigue, and reduced functional capacity emerged as direct consequences of high pain intensity, underscoring the multidimensional impact of PHN on quality of life [10]. The absence of motor deficits in all cases further supports that the pathological process primarily involves sensory fibers, consistent with dorsal root ganglion injury caused by varicella-zoster virus reactivation [10,11]. Normal ESR and CRP values in all patients indicated the absence of active systemic inflammation, reinforcing that the pain experienced was not due to recurrent infection or acute inflammatory processes, but rather chronic neural dysfunction [10,12]. The uniformity of these clinical findings, despite the involvement of different dermatomes, highlights the stable and predictable core characteristics of PHN and provides a strong foundation for evaluating responses to targeted neuropathic interventions [8,10,11].

Clinically, all 4 cases can be classified as refractory to standard pharmacologic therapy, as each patient had undergone the commonly recommended treatment sequence without meaningful improvement: antiviral therapy during the acute phase (ideally administered early to reduce symptom duration, acute pain severity, and potentially the risk of PHN), followed by neuropathic pain pharmacotherapy, such as gabapentin/pregabalin with or without amitriptyline, and adjunctive analgesics, such as NSAIDs [13,14]. Conceptually, failure to respond after this therapeutic trajectory reinforces that the pain had progressed beyond ordinary post-rash peripheral inflammation and

Table 1. Demographic characteristics, pain location, treatment history, and pain evaluation outcomes in 4 patients with postherpetic neuralgia.

Characteristic	Case 1	Case 2	Case 3	Case 4
Sex (Age)	Male (77 years)	Male (57 years)	Female (62 years)	Male (78 years)
Pain location	V1 dermatome of the trigeminal nerve, mainly involving the eye, forehead, temple, and right side of the head	Right anterior thigh to right posterior waist, corresponding to L2 dermatome	Neck, right chest to right back, corresponding to C4-T4 dermatomes	Right chest to right back, corresponding to T2-T4 dermatomes
Duration of pain before therapy	4 months	5 months	5 months	6 months
Previous treatment	Oral analgesics and antivirals	Oral analgesics	Oral analgesics	Oral analgesics
Primary intervention	Supraorbital and infraorbital steroid injections	Lumbar interlaminar epidural steroid injection	Stellate ganglion steroid injection	Thoracic interlaminar epidural steroid injection
5DW	Yes	Yes	Yes	Yes
Number of injection sites	10	10	25	15
Duration of intervention	3 weeks	4 weeks	3 weeks	3 weeks
Initial VAS	8-9	7-8	8	8-9
Second VAS	4-5	2-3	5-6	4-5
Third VAS	1-2	0	4-5	2-3

VAS – visual analogue scale; 5DW – 5% dextrose in water.

was more consistent with persistent neuropathic pain maintained by mechanisms such as afferent hyperexcitability, partial deafferentation, and, especially, central sensitization (eg, amplified pain signaling, allodynia, and impaired descending inhibition). As a result, single-modality modulation through gabapentinoids or tricyclic antidepressants often yields only moderate population-level effects, leaving a substantial unmet clinical need among non-responsive subgroups [15,16]. From this perspective, the designation of “refractoriness” is not merely a narrative that “medications have been tried,” but a pathophysiological and algorithmic argument that patients have exhausted evidence-based pharmacologic lines – each with modest number needed to treat values and inherent limitations – thereby justifying escalation to interventional approaches aimed at modulating pain generators and transmission pathways no longer controlled by standard pharmacotherapy [15,17].

The combined approach using steroids, 5DW, and ultrasound guidance in this case series was grounded in mechanistic understanding of persistent neuropathic pain involving neurogenic

inflammation, peripheral nerve dysfunction, and central sensitization. Steroids were selected to suppress inflammatory processes within neural and perineural tissues, including the release of proinflammatory neuropeptides such as substance P and calcitonin gene-related peptide, which contribute to sustained afferent hyperexcitability and facilitate central sensitization. Through these local anti-inflammatory effects, steroids help reduce perineural edema, stabilize neuronal membranes, and inhibit the phospholipase A2 pathway, thereby interrupting the inflammation-sensitization cycle that is often inaccessible to systemic pharmacotherapy [18]. Although no large-scale clinical trials have evaluated steroids as a definitive monotherapy for PHN, available evidence indicates that steroid based interventions – particularly via epidural or transforaminal routes – can provide meaningful pain relief in patients refractory to standard therapy, as demonstrated in serial transforaminal epidural steroid injections reported by Dinh et al (2022) [19] and in findings by Lin et al (2019) [20].

Meanwhile, 5DW acts through mechanisms that differ from but may complement those of steroids. Wu et al (2021)

demonstrated that perineural dextrose injections can modulate TRPV1 activity, reduce ectopic firing, and support neural recovery through mild neuroregenerative effects [4]. Additionally, Chen et al (2018) reported that 5DW can facilitate perineural hydrodissection, which is the mechanical separation of fibrotic tissue or adhesions compressing the nerve, thereby improving perfusion and reducing chronic mechanical irritation [21]. Thus, the combination of steroids and 5DW may theoretically target inflammatory and mechanical neuropathic components of persistent pain [19-21]. However, these mechanisms remain hypothetical and cannot be confirmed from this case series; therefore, interpretation must be approached with caution.

All procedures were performed under ultrasound guidance, enabling real-time visualization of nerves, blood vessels, and surrounding structures. Ultrasound use not only enhances the accuracy of drug deposition within the intended interfascial or perineural planes but also significantly improves safety by minimizing the risk of intravascular injection, intraneural injury, or unintended spread. Accordingly, the integration of 3 principles – local anti-inflammatory effects of steroids, peripheral neuromodulation by 5DW, and anatomical precision through ultrasound – was designed to address pathophysiological mechanisms no longer responsive to standard pharmacologic therapy while providing an opportunity for more optimal neural recovery [22-24].

Injection sites in this case series were selected based on functional anatomy and the clinical distribution of pain in PHN. Injection locations were directed toward dermatomes corresponding to symptomatic regions, with the aim of maximizing local exposure of therapeutic agents to peripheral neural tissues implicated in persistent neuropathic pain. This approach aligns with clinical practice emphasizing dermatomal-targeted interventions in neuropathic pain, in which local modulation is considered more relevant than systemic effects. Injection site selection also accounted for safety, anatomical accessibility, and prior clinical experience, indicating that dermatomal-targeted injections can provide meaningful symptom improvement without increasing complication risk [17,25].

Dosing decisions for steroids and 5DW were based on balancing clinical effectiveness and safety, referencing doses commonly used in neuropathic and musculoskeletal pain management. Steroid doses were selected within ranges known to provide local anti-inflammatory effects without increasing systemic adverse events, particularly in patients with comorbidities. Meanwhile, 5DW was used at concentrations widely regarded as safe and commonly applied in various clinical contexts, including as an injectable agent with minimal toxicity. It should be emphasized, however, that the 5DW dose was not intended to test specific pharmacologic or molecular mechanisms but rather to serve as part of an exploratory combination approach [6,7].

Clinical findings across the 4 patients demonstrated a consistent pattern of improvement despite involvement of different dermatomes. All patients experienced rapid reductions in pain intensity within the first 1 to 2 weeks, followed by gradual improvement after additional intervention sessions, ultimately achieving complete or near-complete pain resolution within 2 to 3 weeks. This relatively uniform response suggests that underlying pathophysiological mechanisms, such as neurogenic inflammation, peripheral nerve dysfunction, and central sensitization, are shared across dermatomes. Accordingly, interventions targeting these mechanisms may yield predictable therapeutic effects, although such interpretations must remain cautious given the case-series design [9,26].

The consistency of therapeutic responses across dermatomes in patients with PHN refractory to standard therapy is a relatively uncommon observation, given the clinical heterogeneity typically encountered in practice. This finding provides additional insight by suggesting that interventional approaches targeting core neuropathic mechanisms may produce uniform clinical responses regardless of anatomical variation in dermatomal involvement [8,27].

All procedures in this case series demonstrated an excellent safety profile, with no serious adverse events, new neurological deficits, or injection-related complications. This aligns with literature showing that ultrasound guidance significantly enhances the accuracy and safety of perineural interventions by enabling real-time visualization of nerves, vessels, and surrounding tissues, thereby minimizing the risk of intraneural or intravascular injection [22,24]. Furthermore, 5DW has a well-established safety profile as a perineural injectate, being non-neurotoxic, easily absorbed, and shown to be safe in multiple peripheral neuropathy studies, including a controlled trial in carpal tunnel syndrome by Wu et al (2021), which reported no significant complications [4]. Similar findings were reported by Chen et al (2018), demonstrating that perineural 5DW is safe even in cases of nerve compression neuropathy [21]. Low-dose steroids administered perineurally or interfascially also carry minimal neurotoxicity risk when injected with anatomical precision, as shown in clinical reports by Dinh et al (2022) and Lin et al (2019) in refractory PHN patients [19,20]. Thus, the combination of safe agents and precise ultrasound guidance resulted in an intervention that was not only effective but also highly tolerable, without imposing additional risk on already compromised nerves.

Although the 4 patients in this series presented with involvement of different dermatomes – from V1 to thoracic and lumbar segments (L2-L3, C4-T4, T2-T4) – the therapeutic responses achieved were consistent, reinforcing that intervention effectiveness is not determined by dermatomal location. This consistency aligns with literature indicating that the pathophysiology

of PHN is universal, characterized by neurogenic inflammation, peripheral nerve dysfunction, and central sensitization arising from dorsal root ganglion injury due to varicella-zoster reactivation. Johnson and Rice (2014) described PHN as a sensory neuropathy with a stable clinical phenotype across dermatomes because its underlying mechanisms – sensory fiber injury, spontaneous neuronal activity, and central sensitization – are uniform [27]. Similar findings were reported by Li et al (2024), who emphasized that PHN exhibits a homogeneous sensory profile due to shared neuropathic pathways across nerve segments [10]. Finnerup et al (2021) likewise demonstrated that neuropathic conditions such as PHN maintain consistent clinical characteristics because their peripheral and central mechanisms do not depend on anatomical location [8]. Thus, the uniform therapeutic response across dermatomes in this study supports the notion that multimodal interventions targeting inflammation, peripheral nerve dysfunction, and central sensitization can be effective across anatomical regions, reflecting the underlying homogeneity of PHN pathophysiology.

The findings of this case series have practical implications for clinical management, particularly for patients with PHN refractory to standard pharmacologic therapy. The combination of steroid and 5DW injections may be considered a relatively safe, affordable, and repeatable interventional multimodal approach, especially for patients with persistent neuropathic pain that significantly impairs function and quality of life. Moreover, the consistent clinical responses observed across dermatomes provide an initial basis for more structured future research. Future studies should be designed as randomized controlled trials comparing the steroid-5DW combination with steroid monotherapy, evaluating variations in injection location and dosage, and assessing long-term outcomes such as durability of pain relief, safety of repeated interventions, and functional impact. Such studies are expected to clarify the role of this combination therapy within the PHN management algorithm and support the development of more robust evidence-based interventional strategies.

Conclusions

This case series demonstrates that the combined administration of steroid and 5DW injections can be performed safely and is clinically feasible in patients with PHN refractory to standard pharmacological therapy. Across all 4 reported cases, this approach was associated with clinically meaningful reductions in pain intensity during short-term follow-up, without

the occurrence of serious adverse events or procedural complications. One of the key clinical lessons derived from this case series is the consistency of pain-reduction responses observed across different dermatomal distributions, suggesting that this approach may be applied uniformly in refractory PHN regardless of the anatomical location of the lesions. However, these findings should be interpreted with caution given the descriptive nature of the study design, which does not allow for comparative effectiveness assessment or evaluation of causal or synergistic mechanisms. Accordingly, the results of this case series are not intended to imply therapeutic superiority over existing protocols, but rather to document early clinical experience regarding tolerability, pain-response patterns, and the potential role of a relatively simple and accessible combination approach in a refractory PHN population. The primary contribution of this study lies in providing preliminary clinical data that may serve as a basis for hypothesis generation in future research, particularly prospective controlled clinical trials designed to evaluate efficacy, durability of benefit, and the positioning of this approach within PHN management algorithms. In this context, the present case series represents an initial exploratory step toward expanding safe and practical interventional options for patients with PHN who have limited responses to standard therapies.

Informed Consent

Informed consent was obtained from the patient and their guardian in accordance with the Declaration of Helsinki.

Ethics Statement

This study was conducted in accordance with the ethical principles outlined in the Declaration of Helsinki. Ethics approval was obtained from the Health Research Ethics Committee of Dr. Soetomo General Academic Hospital, Surabaya, Indonesia (approval ID: 1097/KEPK/I/2025).

Acknowledgement

We express our sincere appreciation and gratitude to Fis Citra Ariyanto for his contribution as the translator in the preparation of this manuscript.

Declaration of Figures' Authenticity

All figures submitted have been created by the authors who confirm that the images are original with no duplication and have not been previously published in whole or in part.

References:

- Liu Y, Liu H, Bian Q, et al. Impact of herpes zoster and postherpetic neuralgia on the quality of life in China: A prospective study. *Clin Cosmet Investig Dermatol*. 2024;17:1905-15
- Mallick-Searle T, Snodgrass B, Brant JM. Postherpetic neuralgia: Epidemiology, pathophysiology, and pain management pharmacology. *J Multidiscip Healthc*. 2016;9:447-54
- Shi Y, Wu W. Multimodal non-invasive non-pharmacological therapies for chronic pain: mechanisms and progress. *BMC Med*. 2023;21(1):372
- Wu YT, Wu CH, Lin JA, et al. Efficacy of 5% dextrose water injection for peripheral entrapment neuropathy: A narrative review. *Int J Mol Sci*. 2021;22(22):12358
- He JJ, Wei XM, Dou ZL, et al. Ultrasound-guided nerve hydrodissection with 5% dextrose 4 weeks after steroid injection in treatment of carpal tunnel syndrome: A retrospective study. *Front Neurol*. 2021;12:782319
- Couch B, Hayward D, Baum G, et al. A systematic review of steroid use in peripheral nerve pathologies and treatment. *Front Neurol*. 2024;15:1434429
- Benzon HT, Elmofly D, Shankar H, et al. Use of corticosteroids for adult chronic pain interventions: Sympathetic and peripheral nerve blocks, trigger point injections – guidelines from the American Society of Regional Anesthesia and Pain Medicine, the American Academy of Pain Medicine, the American Society of Interventional Pain Physicians, and the International Pain and Spine Intervention Society. *Reg Anesth Pain Med*. 2025 [Online ahead of print]
- Finnerup NB, Kuner R, Jensen TS. Neuropathic pain: From mechanisms to treatment. *Physiological Rev*. 2021;101(1):259-301
- Zhang P, Zhang C, Zheng B, Liu Y, Zhang D, Xiao H. The “brain–gut” mechanism of postherpetic neuralgia: A mini-review. *Front Neurol*. 2025;16:1535136
- Li Y, Jin J, Kang X, Feng Z. Identifying and evaluating biological markers of postherpetic neuralgia: A comprehensive review. *Pain Ther*. 2024;13(5):1095-117
- Leone CM, Truini A. Understanding neuropathic pain: The role of neurophysiological tests in unveiling underlying mechanisms. *J Anesth Analg Crit Care*. 2024;4(1):77
- Wang Y, Jia T. Causal links between blood inflammation markers and postherpetic neuralgia risk: Insights from a two-sample Mendelian randomization study. *Front Neurol*. 2024;15:1411541
- Sagui A, Kane S, Mercado M, Lauters R. Herpes zoster and postherpetic neuralgia: prevention and management. *Am Fam Physician*. 2017; 96(10): 656-663.
- Yeh CH, Chang KS, Huang SS, Tsay SL, Tsai JM, Wang YJ. Comparing prodrugs with acyclovir for treating postherpetic neuralgia among herpes zoster patients: A systematic review and meta-analysis. *Healthcare*. 2022;10(7):1181
- Finnerup NB, Attal N, Haroutounian S, et al. Pharmacotherapy for neuropathic pain in adults: A systematic review and meta-analysis. *Lancet Neurol*. 2015;14(2):162-73
- Mayoral V, Galvez R, Ferrándiz M, et al. Pregabalin vs. gabapentin in the treatment of neuropathic pain: A comprehensive systematic review and meta-analysis of effectiveness and safety. *Front Pain Res*. 2024;5:1513597
- Kaye AD, Armistead G, Amedio LS, et al. Evolving treatment strategies for neuropathic pain: A narrative review. *Medicina*. 2025;61(6):1063
- Echeverria-Villalobos M, Tortorici V, Brito BE, et al. The role of neuroinflammation in the transition of acute to chronic pain and the opioid-induced hyperalgesia and tolerance. *Front Pharmacol*. 2023;14:1297931
- Dinh BN, Le H, Dinh J, Mouhanna J, Sanchez-Gonzalez MA. Serial thoracic transforaminal epidural steroid injections for post-herpetic neuralgia: A case report. *Cureus*. 2022;14(2):e21808
- Lin CS, Lin YC, Lao HC, Chen CC. Interventional treatments for postherpetic neuralgia: A systematic review. *Pain Physician*. 2019;22(3):209-28
- Chen SR, Shen YP, Ho TY, et al. Ultrasound-guided perineural injection with dextrose for treatment of radial nerve palsy: A case report. *Medicine*. 2018;97(23):e10978
- Prasad BPK, Joy B, Raghavendra VA, et al. Ultrasound-guided peripheral nerve interventions for common pain disorders. *Indian J Radiol Imaging*. 2018;28(1):85-92
- Buntragulpontawee M, Chang KV, Vitoonpong T, et al. The effectiveness and safety of commonly used injectates for ultrasound-guided hydrodissection treatment of peripheral nerve entrapment syndromes: A systematic review. *Front Pharmacol*. 2020;11:621150
- Lin TY, Chang KV, Wu WT, et al. Ultrasound-guided interventions for neuropathic pain: A narrative pictorial review. *Life*. 2025;15(9):1404
- Bies M, Ashmore Z, Qu W, Hunt C. Injectable biologics for neuropathic pain: A systematic review. *Pain Med*. 2022;23(10):1733-49
- Liu Q, Han J, Zhang X. Peripheral and central pathogenesis of postherpetic neuralgia. *Skin Res Technol*. 2024;30(8):e13867
- Johnson RW, Rice AS. Clinical practice. Postherpetic neuralgia. *N Engl J Med*. 2014;371(16):1526-33