REVIEW ARTICLE

Treatable Neuropathies

Satish Khadilkar[1*], Jharna Mahajan[2], Hiral Halani[3], Raymond Rosales[4]

Received: 19 February 2025; *Accepted:* 08 May 2025

Abstract

Peripheral neuropathy is one of the most common neurological problems encountered by physicians, and the broad diagnosis of neuropathy has a wide variety of underlying etiologies and varied clinical presentations. This review aims to cover the spectrum of treatable neuropathies, their etiologies, diagnostic criteria, and advances in treatment. Clinical pattern recognition and neuropathy characterization help narrow the list of differential diagnoses and thus direct the investigations. The list of treatable neuropathies is increasing and mainly includes metabolic, immune, infectious, toxic, and nutritional etiologies. Prompt recognition of treatable neuropathies with early treatment reduces morbidity and disability. In this review, we shall discuss the common treatable neuropathies in detail and tabulate the uncommon conditions.

Journal of The Association of Physicians of India (2025): 10.59556/japi.73.1118

Introduction

Peripheral neuropathy is a spectrum of diseases affecting a peripheral nerve from preganglionic roots, roots, dorsal root ganglion (DRG), postganglionic roots, plexus, and trunk to single or multiple nerves. Neuropathic disorders can affect the cell body (neuronopathy) or they can affect peripheral processes (peripheral neuropathy).[1] Neuronopathies mainly affect the DRG and anterior horn cells, named sensory ganglionopathy or ganglionopathy and motor neuron diseases. Peripheral neuropathies can be classified as per their etiologies, types of nerve fibers affected (sensory, motor, or autonomic), and the portion of the nerve fiber affected (axon or myelin). A proportion of neuropathies respond to treatment. Treatable neuropathies have the potential for treatment and hence reversibility or remission, as seen in chronic inflammatory demyelinating polyneuropathy (CIDP) and its variants, drug/toxin-induced neuropathies, and infectious neuropathies. The groups of treatable neuropathies are many, and some of these conditions are more common than others in clinical practice. Table 1 gives a comprehensive list of the treatable neuropathies with their salient clinical and investigative features and treatments. The common treatable neuropathies are discussed in some detail in this review.

Commonly encountered treatable neuropathies are discussed below under the following headings:

- Metabolic-related neuropathy—diabetic and other uncommon neuropathies.
- Immune-mediated neuropathies—acute inflammatory demyelinating polyneuropathy (AIDP), CIDP, and others.
- Infections-related neuropathy—leprous neuropathy and human immunodeficiency virus (HIV)-related neuropathy.
- Drug/toxin induced neuropathy.
- Cranial neuropathies.
- Entrapment neuropathies.
- Autonomic neuropathy.

Metabolic-related Neuropathy

Diabetes-related Peripheral Neuropathy

Diabetic neuropathy (DN) is the most common cause of peripheral neuropathy worldwide. As per the Diabetes Control and Complications Trial (DCCT), the prevalence of DN is approaching almost 50% in both type 1 and type 2 diabetes mellitus (DM).[11] DN has a much higher incidence in type 2 DM (6,100 per 1,00,000 person-years) compared to type 1 DM (2,800 per 1,00,000 person-years).[12]

Risk Factors

The duration of diabetes and glycosylated/glycated hemoglobin (HbA1c) levels are among the most important risk factors for DN and other microvascular complications.[13] Other metabolic factors that are most associated with diabetes, such as hypertension, hypertriglyceridemia, abdominal obesity, uric acid levels, and low high-density lipoprotein (HDL), are also major predictors of DN. Metabolic syndrome, along with its components, has been found to be an independent risk factor for peripheral neuropathy, especially sensory peripheral neuropathy.[14] Prediabetes is the earliest stage of glucose dysregulation, including the impaired glucose tolerance (IGT) test or impaired fasting glucose (IFG) (American Diabetes Association guidelines). The recent MONICA/KORA trial demonstrated that neuropathy was more common in IGT as compared to the control group, with preferential small fiber involvement in the prediabetes group.[15]

Clinical Manifestations

Diabetic neuropathy involves varied neurological patterns of neuropathy. Distal symmetric polyneuropathy (DSPN) is the most common pattern encountered in DM, which can affect predominantly small fibers, large fibers, or both together. Following is the spectrum of DN, starting from roots on the left to the peripheral nerve on the right (Table 2 and Fig. 1).

Management of Diabetic Neuropathy

Prevention of Diabetic Neuropathy

Periodic assessments for neuropathy with clinical sensory testing with 10 gm monofilament test,[16] correcting any coexistent B12 deficiency,[17] optimizing glycemic control,[10,16] a high suspicion for autonomic involvement, and foot care is important in the prevention, early detection, and reducing the complications of DN.

Pharmacological and Nonpharmacological Treatment of Diabetic Neuropathy

The stability of HbA1c levels is more important than the actual level of control in the treatment of DN. Long-term follow-up of the landmark DCCT demonstrated that more intensive glucose control ameliorated the onset of neuropathy as well as the progression of surrogate electrophysiologic markers of neuropathy.[11,21] The Food and Drug Administration (FDA)-approved

[1]Dean, Professor, and Head; [2]Senior Resident; [3]Associate Consultant, Department of Neurology, Bombay Hospital Institute of Medical Sciences, Mumbai, Maharashtra, India; [4]Professor, Department of Neurology and Psychiatry, University of Santo Tomas Hospital, Manila, Philippines; *Corresponding Author

How to cite this article: Khadilkar S, Mahajan J, Halani H, *et al.* Treatable Neuropathies. J Assoc Physicians India 2025;73(9):73–84.

Table 1: List of treatable neuropathies with salient features and treatment

Etiology	*Clinical hallmarks*	*Treatment strategies*
Metabolic		
DM	Distal symmetric axonopathy usually with a chronic course, fluctuations in relation to glycemic control Small fiber predominant neuropathy early in the course Less often, asymmetric, painful affection of roots/plexus/isolated nerves	Adequate glycemic control and correction of other metabolic factors like hyperlipidemia, obesity, etc. Drugs for neuropathic pain Trial of immunotherapy in proper clinical settings
Hypothyroidism	Carpel tunnel syndrome Distal symmetric sensorimotor polyneuropathy[2]	Thyroid hormone supplements CTS may require decompression additionally[3]
Renal failure	Distal axonopathy[4]	Correction of uremia, for example, hemodialysis, transplantation[5]
Critical illness polyneuropathy	Generalized sensorimotor polyneuropathy with or without myopathy[6]	Aggressive neurorehabilitation, avoidance of steroids, neuromuscular blockers, and control of hyperglycemia and infections
Celiac disease	Generalized sensorimotor polyneuropathy, small fiber neuropathy, and neuromyotonia	Gluten-free diet may prevent neuropathy and halt the progress of neuropathy[7]
Immunological		
AIDP	Acute onset nonlength dependent polyradiculoneuropathy with additional facial, bulbar, respiratory, or autonomic involvement and a preceding history of infection (refer to text for the common and uncommon variants)	IVIG, PE, and complement inhibitors
CIDP	Subacute or chronic or relapsing-remitting course of nonlength dependent sensorimotor weakness and areflexia usually in a middle-aged male Atypical presentations are known as pure sensory or motor involvement, distal predominant or multifocal involvement, pure sensory ataxia, etc. (refer to the text for details)	Steroids, IVIG, PE, Rtx Maintenance immunosuppressant drugs—AZA and MMF
Vasculitis	Acute/subacute onset mononeuritis multiplex, painful, asymmetric, or multifocal involvement Look for systemic signs of rheumatological disorders, vasculitic skin lesions[8]	Immunomodulatory drugs (Mtx, AZA, MMF, cyclophosphamide, IVIG, etc.)
Infections		
Leprosy	Commonly, mononeuritis multiplex with predominant loss of pain and temperature sensations Look for hypopigmented and hypoesthetic skin patches and thickened nerves	MDT as per WHO recommendations
HIV	Distal symmetric axonopathy is common in chronic infection or related to HAART AIDP and CIDP both presentations are known to occur	HAART, supportive management for neuropathic pain
Cytomegalovirus (CMV)	Lumbosacral polyradiculopathy Mononeuritis multiplex[9]	Ganciclovir, foscarnet, and cidofovir as monotherapy
Lyme's disease	Bilateral facial neuropathy most common Asymmetric polyradiculoneuropathy Mononeuritis multiplex Primary axonopathy Associated systemic features like rash, fever	Cephalosporins and amoxycillin
Toxic		
Drugs like antibiotics, chemotherapy Heavy metals like lead, arsenic, thallium, mercury etc. Alcohol related	Detailed account of all the drugs/alternative medicines and temporal relation to the neuropathic symptoms should be noted Sensory involvement is more common, whereas motor predominance can be seen in lead toxicity, GBS-like syndrome with arsenic or thallium[10]	Removal of the toxin Chelation therapy in metal exposure Supportive measures

Contd…

Contd…

Etiology	*Clinical hallmarks*	*Treatment strategies*
Nutritional		
Vit B12 deficiency	Sensorimotor axonopathy involving large fibers—loss of kinesthetic sense Additional visual or cognitive changes Myelopathy in the form of SACD Systemic signs, for example, skin pigmentation, clinical settings for malabsorption etc.	Vitamin B12 and folate supplements
Other causes are B6 deficiency, thiamine deficiency, and Vit E deficiency	Large fiber sensory predominant axonopathy Systemic signs: atrophic skin changes, cognitive impairment, background of malnutrition, or alcoholism (thiamine deficiency) Disorders of fat absorption and lipoproteins, additional spinocerebellar involvement (Vit E deficiency)	Nutritional supplements

Table 2: Spectrum of DN

Radiculoplexopathy	*Type C nerve fibers/autonomic neuropathy*	*Mononeuropathy*	*DSPN*
• Three types—lumbar, cervical, and thoracic radiculoplexopathy • Lumbar radiculoplexopathy is most common • Subacute in onset, monophasic • Asymmetric, severe pain in thigh initially followed by proximal muscle weakness with atrophy • Secondary to ischemic injury from altered immunity and hence may respond to some extent with IVIG[16]	• Cardiovascular: reduced HRV, resting tachycardia, orthostatic hypotension, and sudden death (malignant arrhythmia) • Gastrointestinal: diabetic gastroparesis, diabetic enteropathy (diarrhea), and colonic hypomotility (constipation) • Urogenital: diabetic cystopathy (neurogenic bladder), erectile dysfunction, and female sexual dysfunction[17]	• Isolated cranial neuropathy (III nerve, IV nerve) • Peripheral nerve—median nerve, ulnar nerve, femoral nerve, and peroneal nerve • When mononeuropathy is sudden in onset, restricting to the area supplied by the nerve, it is less likely to be associated with entrapment and more likely to be secondary to uncontrolled diabetes[18]	• Small-fiber neuropathy—positive symptoms like burning sensation, tingling, allodynia, hyperalgesia, and negative symptoms like numbness, sensory loss (pinprick and temperature). Type C and A delta are affected. Autonomic dysfunction is noted. Nerve conduction studies will be usually negative. It is specifically seen in patients with prediabetes and metabolic syndrome[19,20] • Large-fiber neuropathy—imbalance, sensory ataxia, loss of vibration sensation, loss of position sense, and areflexia. Nerve conduction studies usually show distal symmetric length-dependent sensorimotor loss with ± abnormal somatosensory evoked potentials (SSEP). Patients are at higher risk of falls, fractures, and the development of Charcot neuropathy[12,19,20]

first-line therapy includes duloxetine, pregabalin, gabapentin, venlafaxine, and amitriptyline.[22–24] The time to peak response is different for different drugs, but in general, 2–3 months is typically required for titration and to gauge the initial response of medications. In patients with inadequate response to initial treatment, either switching to second-line therapy or the addition of second first-line therapy is recommended. Topical treatments with capsaicin 8% with or without lignocaine are effective local therapy for DN-related pain.[24,25] Nutraceutical agents like alpha-lipoic acid (ALA), benfotiamine, acetyl-L-carnitine, gamma-linolenic acid (GLA), vitamin B12, and vitamin D3 are a few of the important molecules that have shown modest decreases in pain related to DN. Table 3 depicts the medications that can be used in the management of pain.

Immune-mediated Neuropathies

Acute Inflammatory Demyelinating Polyneuropathy

Acute inflammatory demyelinating polyneuropathy or Guillain–Barré syndrome (GBS) is acute immune-mediated polyneuropathy presenting as a variable degree of symmetrical ascending weakness of all limbs with occasional respiratory failure and autonomic dysfunction that reaches maximal severity within 4 weeks. The main pathophysiology behind GBS is molecular mimicry between microbial and nerve antigens causing an aberrant autoimmune response. Preceding infection, mostly by *Campylobacter jejuni*, triggers an autoimmune response that mainly targets peripheral nerves and their spinal roots. The variants of GBS include:

1. Acute inflammatory demyelinating polyneuropathy	
• Acute motor axonal neuropathy • Acute motor-sensory axonal neuropathy	IgG autoantibodies to GM1 and GD1a
• Acute motor conduction block neuropathy • Pharyngeal-cervical-brachial weakness	IgG autoantibodies to GT1a, GQ1b, and GD1a
2. Miller Fischer syndrome	
• Acute ophthalmoparesis without ataxia • Acute ataxic neuropathy without ophthalmoplegia	IgG autoantibodies to GM1 and GD1a
3. CNS variant—Bickerstaff's Brainstem encephalitis	

Given the immune-mediated nature of the illness, standard treatment includes intravenous immunoglobulin (IVIG) and plasma exchange (PE). One or the other should be started as soon as possible after the diagnosis of GBS has been made. PE was reported to be first used in GBS between 1978 and 1981. PE is a therapeutic procedure that separates plasma from cells using a filter in a dialysis machine, where cells are reinfused back into circulation and plasma is removed and replaced with either fresh frozen plasma (FFP) or reconstituted human protein (albumin). Trials comparing the efficacy of IVIG with PE showed equal efficacy in decreasing hospital stay, hastening recovery, and preventing mechanical ventilation and respiratory depression.[26–28] Different dosages of IVIG (0.4 gm/kg/day) were administered over 3 vs 6 days, which showed the time required to regain the ability to walk with assistance was shorter in the latter group with lower infusion-related side effects.[29] For a proportion of patients with refractory GBS, the utility of a second course of IVIG was studied in a recent RCT (SID-GBS), but the outcomes were negative.[30]

Treatment-related fluctuations (TRF) are often seen in 10% of GBS within 2 weeks to 2 months after first treatment initiation.[31] Retrospective studies have shown that treating with more than one modality in cases of clinical deterioration, lack of improvement, or TRF has no significant benefits. Distinguishing such cases from acute-onset CIDP or subacute inflammatory demyelinating polyneuropathy (SIDP) becomes important since the therapeutic and prognostic implications vary. Recently, a new method has been experimented with in children, known as the "Zipper method," using immediate IVIG after each session of PE in nine patients, which has been shown to reduce mortality,[32,33] speed up weaning from mechanical ventilation, and shorten

Table 3: Medication to treat neuropathic pain

Drug class	*Dose*	*Comorbidities favoring use*	*Comorbidities favoring avoidance*	*Side-effects*
Serotonin norepinephrine reuptake inhibitors				
• Duloxetine • Venlafaxine	Duloxetine—starting dose of 20–30 mg/day titrated up to a max of 60–120 mg/day	Depression and anxiety	Restless leg syndrome Sexual dysfunction Angle-closure glaucoma[22]	Nausea, somnolence, dizziness, decreased appetite, constipation, diaphoresis, and sexual dysfunction[22,24]
Tricyclic antidepressants (TCA)				
Amitriptyline	Starting dose—10–25 mg/day titrated up to a maximum 200 mg/day	Depression, anxiety, and insomnia	Dry mouth, somnolence, and urinary retention	Cardiac dysfunction, prolonged Qtc, and orthostatic hypotension
Gabapentoid antiseizure medications				
Gabapentin, pregabalin	Starting dose of 75–150 mg/day titrated up to a maximum dose of 600 mg/day	Restless leg syndrome, essential tremor, and insomnia	COPD and substance abuse	Peripheral edema, weight gain, somnolence, and dizziness[23]

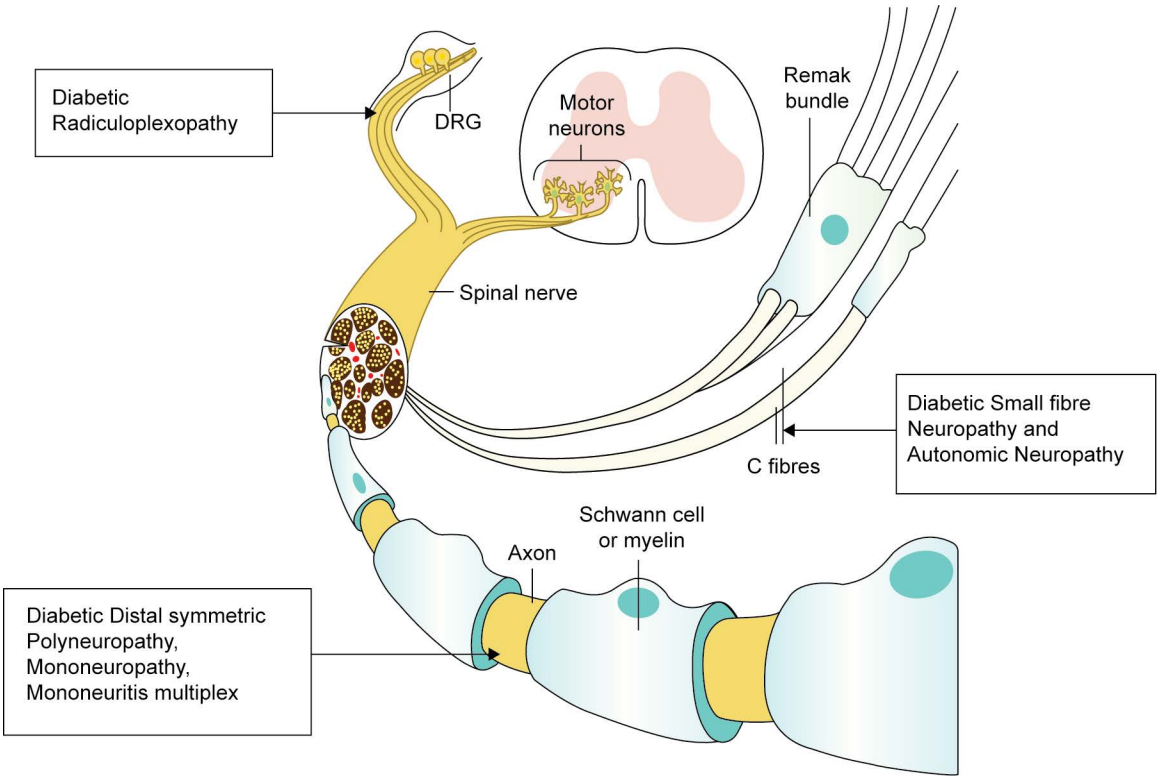


Fig. 1: Spectrum of DN affecting different levels of a peripheral nerve

hospital stay, although RCT is not available for this method and hence the efficiency of this method is currently questionable. Eculizumab, a humanized monoclonal antibody against the complement protein C5, was tested in two randomized, double-blind, placebo-controlled phase 2 trials. Neither showed benefit vs immunoglobulins alone on disability level at 4 weeks, although one study importantly suggested possible, clinically highly relevant late effects on normalizing function. A phase 3 trial is in progress.[34,35] One RCT with 19 participants compared interferon beta-1a (IFNβ-1a) and placebo. It is uncertain whether IFNβ-1a improves disability after 4 weeks (very low-certainty evidence).[36]

Chronic Inflammatory Demyelinating Polyneuropathy

Chronic inflammatory demyelinating polyneuropathy is an immune-mediated neuropathy that has a progressive or relapsing nature extending over 2 months. It can be divided into two types based on clinical presentation, typical and atypical. Typical CIDP presents with largely symmetrical weakness involving proximal and distal parts of extremities. Atypical CIDP takes many forms. For example, the distal acquired demyelinating symmetric (DADS) presents as symmetric length-dependent sensory or sensorimotor distal weakness with increased distal latencies; multifocal acquired demyelinating sensory and motor neuropathy [MADSAM or Lewis–Sumner syndrome (LSS)] has a multifocal distribution and the electrophysiological hallmark of conduction block, while chronic immune sensory polyradiculopathy (CISP) is restricted to sensory nerve roots only. Patients with POEMS syndrome have organomegaly, skin pigmentation, endocrinal changes, and M band in the serum. Pathophysiology of CIDP involves cellular as well as humoral immune mechanisms. Inflammatory T cells and macrophages infiltrate a nerve through the perivascular space and thus disrupt the blood–nerve barrier.[37] The humoral immune mechanism plays an equally important role; this can be inferred by the rapid response of a few CIDP patients with PE.[38] Antibodies to myelin proteins P0, P2, and PMP22, along with nodal and paranodal proteins like neurofascin NF186 and NF185, respectively, are a few of the detected target antigens in various studies.[38,39]

Owing to immune-mediated mechanisms, the mainstay of treatment in CIDP remains IVIG, PE, and corticosteroids. The first study to demonstrate the short- and long-term efficiency of IVIG in CIDP is the ICE study[26] (IVIG-C CIDP efficacy trial), which is a double-blind, placebo-controlled RCT of 24 weeks. The standard dose for maintenance IVIG used in this study was 1 gm/kg every 3 weeks. Subcutaneous immunoglobulin (SCIG) as a maintenance therapy has been shown to have similar efficacy as IVIG with better tolerance and convenience. This has been demonstrated in the PATH and PATH open-label extension study.[40] PE is an effective modality for CIDP as demonstrated by multiple studies,[41,42] but its effect lasts only for a few weeks, leading to mainly short-term benefits. IV pulse corticosteroids have been proven to show benefits in active CIDP patients. The PREDICT trial compared daily oral prednisolone with high-dose monthly dexamethasone and demonstrated moderate-quality evidence of shorter median time to improvement in the latter group.[43] Side effects like cushingoid facies, uncontrolled diabetes, and hypertension were more common in the daily oral steroid limb. IFNβ initially was considered as an adjunctive option for CIDP based on case reports, but RCT of IM IFNβ in CIDP did not show any superiority compared to the placebo.[44] Methotrexate (Mtx) as an immunomodulatory agent in CIDP was tested in an RCT recruiting 56 patients,[45] which demonstrated no benefit of Mtx as compared to a placebo. Mycophenolate mofetil (MMF) is used as an add-on steroid-sparing drug for maintenance therapy in CIDP; it is found to stabilize the clinical condition and help in reducing the steroid dose, but in a controlled trial, the agent did not show any significant improvement in modified Rankin score or muscle strength.[46] The most recent treatment modality for CIDP is rituximab (Rtx), a selective B-cell-depleting monoclonal antibody. As per a systematic review by Chaganti et al.,[47] RTX was effective in 63% of CIDP patients, 48% of anti-MAG neuropathy, and 96% of patients with autoimmune nodopathy. Neurophysiological improvement was evident in 58% of CIDP and 40% of anti-MAG neuropathy patients. Rtx has been used in resistant CIDP, but it may be used earlier in the coming years based on its efficacy. Multifocal motor neuropathy, MADSAM, is treated on the lines of typical CIDP. Gammopathies need to be treated as per the primary reason for the gammopathy, and DADS patients can prove resistant to available treatment options (Fig. 2).

Vasculitis Neuropathy

Vasculitis of small and medium vessels frequently affects peripheral nerves secondary to inflammation and eventually causes ischemic injury to the vasa nervorum. Vasculitis-related neuropathy can be broadly divided into systemic and nonsystemic vasculitic neuropathy (NSVN) depending on the presence of multiorgan involvement and systemic features. Peripheral neuropathy is most frequently associated with polyarteritis nodosa (PAN) and antineutrophil cytoplasmic antibody (ANCA)-associated vasculitis.[48] Distal asymmetric, multifocal, or nonlength-dependent sensorimotor weakness, mononeuritis multiplex with lower limb predominance, is the most common pattern observed. Pain is the hallmark of vasculitic neuropathy. Nerves with moderate clinicoelectrophysiological involvement should be used for biopsy, which may show transmural inflammation with vascular damage.[49,50] The treatment recommendations in the Peripheral Nerve Society guidelines on NSVN are based on observational studies of NSVN and extrapolation from studies of systemic vasculitis, suggesting pulse glucocorticoids as monotherapy and the addition of other immunomodulatory agents like cyclophosphamide, Mtx, and azathioprine (AZA) for rapidly progressive NSVN.[50]

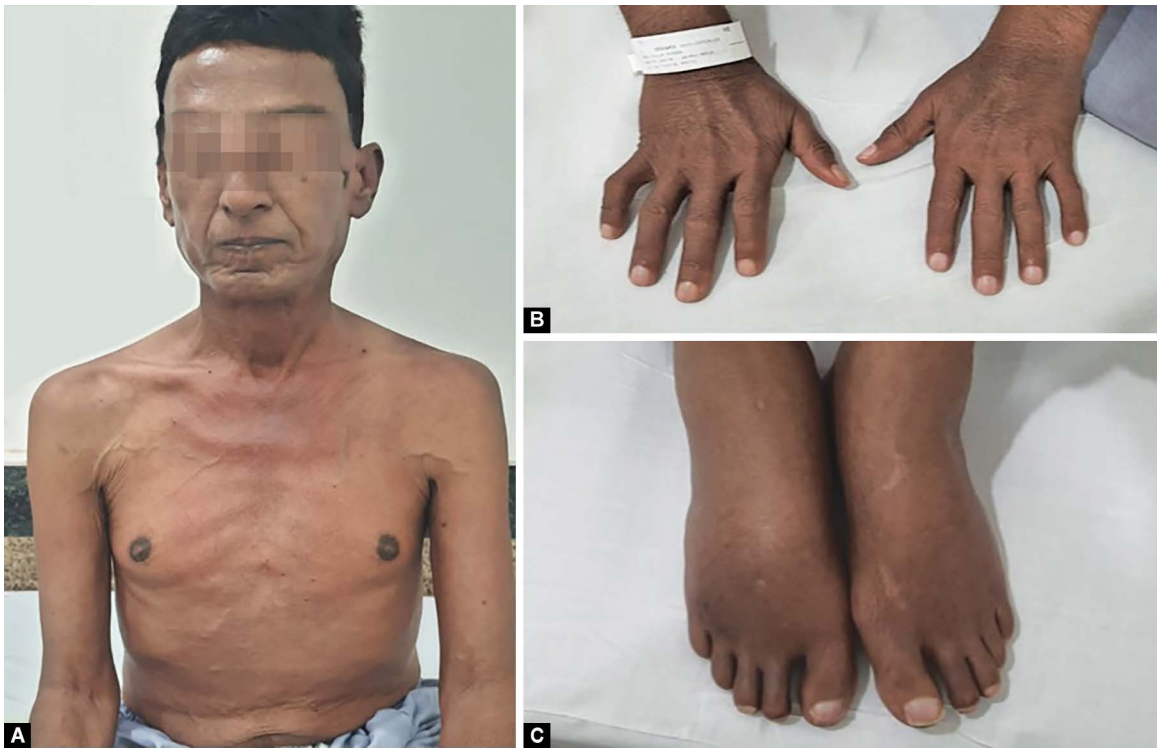
Infection-related Neuropathy

Neuropathy in Leprosy

Leprosy is one of the most common treatable infectious causes of peripheral neuropathy, especially in tropical countries like India, Brazil, and other Southeast Asian countries. Leprosy classically presents with cutaneous symptoms, with a spectrum ranging from tuberculoid leprosy (TT), in which there are well-defined lesions, to lepromatous leprosy (LL) with ill-defined multiple skin lesions. Cutaneous features include hypo-/anesthetic skin patches in the buttock, back, trunk, face, and earlobes (predominantly cooler areas of the body). Pure neuritic leprosy, presenting as predominant neurologic features without significant cutaneous symptoms, causes a delay in diagnosis and treatment, thus causing increased disability related to progressive neuropathy.[51] The clinical spectrum of leprous neuropathy is wide and has been presented in Table 4 (Fig. 3).

Diagnosis of leprosy is mostly clinical, but tests like nerve conduction, skin and nerve biopsy, nerve ultrasonography, and MR neurography help confirm the clinical findings. The WHO Expert Committee on Leprosy defines a case of leprosy as an individual who has one of the following cardinal signs of leprosy but who has not received a full course of multidrug therapy (MDT) appropriate for the type of leprosy.[60]

- Definite loss of sensation in a pale (hypopigmented) or reddish skin patch.



Figs 2A to C: A 55-year-old male, with atypical CIDP (distal > proximal sensorimotor weakness in all four limbs with paresthesia) along with systemic features like; (A) hepatosplenomegaly, facial hyperpigmentation, dilated veins on trunk, and fixed and raised Jugular venous pressure: (B) white nails, clubbing, and hyperpigmentation of skin; and (C) bilateral pedal edema. The patient had POEMS syndrome with monoclonal gammopathy of IgG subtype

Table 4: Neuropathies in leprosy

Type of neuropathy	*Clinical features*
Mononeuritis and mononeuritis multiplex	• Most common presentation • Upper limb nerves are affected more than lower limb[52] • Can be associated with rheumatological manifestations like positive rheumatoid factor, arthralgia, and rash
Polyneuropathy	• Distal symmetric small fiber sensory polyneuropathy[53] • Usually, no muscle weakness and deep tendon reflexes are preserved • Preferentially involves temperature > touch > pain.[54] Proprioception is rarely involved in multibacillary leprosy[55] • Higher association with ulceration and deformities
Autonomic neuropathy	• Seen in patients with multibacillary leprosy[52] • Anhidrosis causing dry and scaly skin with ulcerations • Widespread dysautonomia involving the cardiac and respiratory systems is well documented[56,57]
Cranial neuropathies	• Cranial nerves may be involved in up to 18% cases[52,58] • Facial nerve is the most common cranial nerve affected in leprosy[57] • Hallmark of cranial neuropathy in leprosy is its patchy involvement of the nerve[59]
Acute neuritis	• Seen during lepra reactions more commonly with type I lepra reaction • Spontaneous nerve paresthesia and pain followed by objective sensory-motor loss
Ganglionitis	• DRG involvement causing severe proprioceptive impairment, pseudoathetosis with areflexia in ataxic limbs • The extent and the severity of the process do not seem to link to the duration of the disease; but to an extent, correlate with the bacterial load[55]

Table 5: Treatment schedules in leprosy[60]

	Paucibacillary	*Multibacillary*
Drugs	Dapsone 100 mg daily and clofazimine 50 mg daily Rifampicin 600 mg monthly and clofazimine 300 mg monthly	Dapsone 100 mg and clofazimine 50 mg daily Rifampicin 600 mg and clofazimine 300 mg monthly
Duration	6 months	12 months

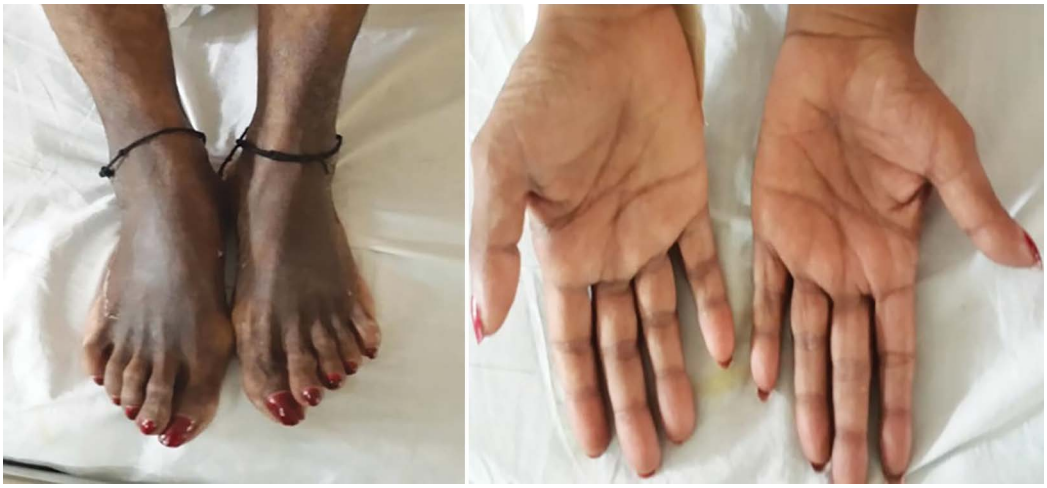
- A thickened or enlarged peripheral nerve with a loss of sensation and/or weakness in the muscles supplied by the nerve.
- The presence of AFB in slit skin smears.

Treatment

- Medical treatment of leprosy.
- Management of neuropathic pains.

Medical Management of Leprosy

As per WHO recommendations, patients fulfilling the diagnostic criteria should be started on MDT including three drugs (dapsone, rifampicin, and clofazimine) for all leprosy patients irrespective of bacillary load. The duration for paucibacillary leprosy is 6 months, whereas for multibacillary it is 12 months.



Figs 3A and B: A 40-year-old female with skin changes in LL secondary to autonomic neuropathy (A) with mononeuritis multiplex—wasting of left hand, and (B) Photo courtesy—Dr Varsha Patil

Table 5 depicts the treatment regimens for various types of leprosy.

Drug-resistant Leprosy

Although not very common, drug-resistant leprosy has been documented. WHO recommends the use of second-line medications such as ofloxacin, minocycline, clofazimine, and clarithromycin.[61]

Usually, leprosy presents with predominantly negative symptoms like numbness or anhidrosis, but during typical lepra reactions, neuropathic pains can be particularly predominant. Corticosteroids are the definitive treatment to reduce the impact of nerve damage, and they also help alleviate the neuropathic pains. Symptomatic treatments that can be offered are gabapentin, pregabalin, and duloxetine. Lepra reactions are treated with high doses of corticosteroids over a few weeks to months, and in resistant cases, clofazimine and thalidomide can be used.[51]

Human Immunodeficiency Virus-related Neuropathy

Among other neurological features of HIV1, peripheral neuropathy is the most common neurological complication, affecting 30–50% of individuals.[62,63] HIV-associated neuropathies may present with varied clinical presentations at different stages of illness. DSPN is the most common, but inflammatory demyelinating neuropathies, progressive polyradiculopathies, mononeuritis multiplex, autonomic neuropathy, and the highly active antiretroviral therapy (HAART)-related neuropathies are encountered from time to time.

Treatment of Human Immunodeficiency Virus-related Neuropathy

Human immunodeficiency virus-related neuropathy can be prevented with adequate suppression of viral load and an increasing trend of CD4 count. The evolution of sensory neuropathy after HAART was observed by Centner et al. in 2017.[64] Results indicated that painful symptoms improved after long-term neuro-safe HAART *via* reduction of exposure to HIV-induced oxidative stress. HAART-induced neuropathy, commonly reported with stavudine, didanosine, nevirapine, zalcitabine, and protease inhibitors, requires switching over to newer drugs for effective management of HIV as well as to help prevent the risk of neuropathy. Lamivudine, abacavir, dolutegravir, emtricitabine, and adjusted doses of protease inhibitors are safer in this regard. Neuropathic pain is the most disabling complaint in HIV-related neuropathy, and drugs like antidepressants (tricyclics), anticonvulsants (gabapentin, pregabalin, lamotrigine), and topical analgesics have been successfully used in the treatment of neuropathic pain. HIV-related DSP has a better response from capsaicin 8% cutaneous patch when compared to mononeuropathy, cervical radiculopathy, and postherpetic neuralgia.[65] Other nonpharmacological interventions like hypnosis,[66] dietary supplements like curcumin and tart cherry extracts,[67] and bromelain[68] which increase the antioxidants and reduce neuronal stress are still under investigation but can be used in refractory conditions with caution.

Drugs/Toxin-induced Neuropathy

Toxic peripheral neuropathies can occur secondarily to environmental, occupational, recreational, and iatrogenic (drug-induced) causes. The most common pattern observed is distal symmetric length-dependent sensory neuropathy along with motor or autonomic neuropathy. Several prescription medicines are known to cause neurotoxicity, like chemotherapy agents and antibiotics such as isoniazid, metronidazole, and nitrofurantoin. Alternative medicine products have been shown to contain heavy metals like lead, mercury, and arsenic, which are known to cause neurotoxicity along with other systemic features. Table 6 presents the important aspects of common drug-induced neuropathies.

Cranial Neuropathies

Various disease categories such as infections, inflammations, tumors, and infiltrations affect the cranial nerves. The commonly encountered conditions are as follows. Among the infections, the herpes zoster virus affects the facial nerve, causing Bell's palsy, and the seventh and eighth nerves, causing Ramsay Hunt syndrome. In children, diphtheria can result in lower cranial neuropathies, producing dysphagia. Tuberculosis of the nervous system, mainly meningitis, is common, and the basal exudates result in various cranial neuropathies, often predominating in the lower segments. Common inflammations are the Tolosa Hunt syndrome, which results from inflammation at the apex of the orbit. A proportion of such patients have the IgG4 antibodies. Patients respond to corticosteroids but may have a recurrent and prolonged course requiring long-term immunotherapies. Lymphomas, leukemias, other lymphoreticular malignancies, and deposits from other bodily tumors can infiltrate or compress the cranial nerves, resulting in their dysfunction. Cerebrospinal fluid centrifuge examination for abnormal cells and contrast MRI scans help the diagnosis, and the treatment depends upon the primary condition. The optic

Table 6: Important aspects of common drug-induced neuropathies

Drugs	*Incidence*	*Site of toxicity*	*Clinical features*	*Treatment*
Chemotherapy drugs				
Cisplatin	30% of symptomatic neuropathy	Sodium channel abnormalities causing axonal hyperexcitability and repetitive discharges ± DRG	First symptoms appear after 1st month of treatment Dose-dependent toxicity Chronic sensory predominant small fiber neuropathy with burning paresthesia, pain, and tingling	After stopping the drug, autonomic and motor symptoms tend to improve. Sensory symptoms worsen after finishing the chemotherapy—coasting stage. Eventually coming back to baseline[69]
Oxaliplatin	10–20% with modest dose	Sodium channel abnormalities	Neurotoxicity presents as two types—acute and chronic sensory neuropathy Cold-induced sensitivities	Acute neuropathy subsides after stopping the drug, and increases after consecutive dose—Sawtooth pattern of neuropathy[70]
Vincristine	Almost all	Microtubular axon transport function abnormalities DRG	Sensory predominant with mild motor weakness (weakness in finger extension first)[71] Sensory ataxia ±[72]	Symptomatic treatment for small fiber neuropathy like gabapentin, pregabalin, and lamotrigine
Bortezomib	30–60%	DRG Small fibers, type C	Along with small fiber neuropathy, bortezomib also presents with severe motor-predominant polyradiculopathy[73]	Symptomatic treatment
Antibiotics				
Metronidazole	5–6%	Nerve	Sensory predominant reversible length-dependent neuropathy Predominantly negative symptoms—numbness and decreased sensations	Stopping the drug usually reverses neuropathy[74]
Isoniazid	10–20%	Nerve	Starts with tingling numbness and decreased sensation distally followed by a glove and stocking-like pattern	Prevented with pyridoxine prophylaxis. Reverses if stopped with early symptoms[75,76]
Dapsone	1–2%	Motor	Upper limb predominant multiple mononeuropathies[77]	Stop the drug
Nitrofurantoin	Incidence is higher in the elderly and patients with renal disease	Sensory nerve Demyelinating	GBS like syndrome Length-dependent sensorimotor polyneuropathy[78,79] Sensory painful DSPN	Most neuropathy related to nitrofurantoin are refractory and have delayed improvement after stopping the drug
Linezolid	As high as 80%	Sensory painful small fiber neuropathy	Dose-dependent toxicity. Small fiber burning, pain, and paraesthesia[78,80,81]	The improvement is mostly seen after 6 months of cessation of the drug. Few can be irreversible
Heavy metals				
Lead	30%	Axonal damage of motor nerves	Acute to subacute form—predominantly motor neuropathy—frequently starts with distal extension weakness in upper limbs Chronic long-term exposure—mild sensory and autonomic neuropathy	Acute neuropathy—chelation is helpful to some extent. Neurotoxic features are not reversible in chronic forms[82,83]
Arsenic		GBS like syndrome	Acute form—GBS-like syndrome, although cranial nerve involvement is rare Chronic form—length-dependent sensory motor axonal neuropathy	Chelation may help with the acute form of neuropathy. Treatment of GBS-like syndrome involves PE or IVIG
Mercury		Peripheral nerve axons CNS	Sensory predominant and ataxia Behavioral changes	Chelation and cessation of exposure
Alcohol		Peripheral nerve	Malnutrition—involves multiple vitamin deficiencies like thiamine and Vit B12, causing sensorimotor peripheral neuropathy Without malnutrition—mild form of distal sensory polyneuropathy	Abstinence improves early symptoms
Pyridoxine excess		DRG/axons	Sensory axonopathy or neuronopathy	
Organophosphorus compounds		Motor > sensory axons	Distal motor weakness, foot drop, cramps, and mild sensory disturbances	Symptomatic management

Table 7: Entrapment neuropathies of upper and lower limbs

Nerve entrapped	*Anatomical site of compression*	*Clinical presentation*	*Treatment*
Upper limbs			
Long thoracic nerve (C5–C7)	• Middle scalene • Middle and posterior scalene • Second rib and clavicle	Medial winging of the scapula	Thoracic/supraclavicular decompression or combined—within 6–12 months for better results[85]
Spinal accessory nerve (C1–C6)	At the jugular foramen—due to tumor In the posterior triangle—due to lymph nodes/intervention	Lateral winging of scapula	Medical management for pain Surgical decompression—resection of fascia[86]
Axillary nerve (C5–C6)	Quadrilateral space by posterior humeral circumflex artery	Paresthesias, posterior shoulder pain, weakness of deltoid, and teres minor	Medical management for pain and paresthesias Surgical intervention within 6–12 months of onset[87]
Median nerve (C6–T1)	AIN entrapment—pronator teres heads Carpel tunnel syndrome—flexor retinaculum at wrist	AIN—weakness of muscles in deep anterior compartment CTS—dull aching pain at wrist, worsened in night, with paresthesias in later 3.5 fingers	Severe sensorimotor weakness—surgical intervention such as decompression of flexor retinaculum relieves maximum symptoms Mild-moderate weakness—medical management with gabapentin, pregabalin, etc.[88]
Ulnar nerve (C8–T1)	Medial epicondyle and olecranon—cubital tunnel syndrome Guyon canal syndrome—palmar carpel ligament	Pain in medial elbow with intermittent numbness in ring finger and little finger with weakness of small muscles of hands	*In situ* decompression, medial epicondylectomy, anterior subcutaneous transposition, intramuscular transposition, and submuscular transposition[89]
Radial nerve (C5–T1)	Arcade of Frohse Deep head of supinator muscle	Lateral elbow pain and wrist drop	Decompression surgery—relieving the nerve from arcade of Frohse—good prognosis[90]
Lower limbs			
Sciatic nerve (L4–S3)	• Between piriformis and obturator internus muscle • Ischiofemoral impingement syndrome—compression by quadratus femoris • Proximal hamstring syndrome, compression by hamstring muscles	Posterior thigh and hip pain, ± radicular in nature. Buttock pain aggravated by sitting—compression by piriformis muscle	Most cases—resolve spontaneously Bed rest Analgesics/NSAIDs, physical and behavioral therapy Interventions like chemonucleolysis for refractory leg pain may be tried[91]
Lateral femoral cutaneous nerve of thigh (L1–L3)	Most common compression at exit from pelvis	Unilateral pain, paresthesia, and numbness in the lateral or anterolateral thigh, relieved after sitting[92]	Conservative treatment focuses on reduction of the factors that cause or intensify nerve compression, for example avoidance of tight clothing and constrictive belts around the waist Surgical intervention-decompression of nerve at inguinal ligament[92]
Peroneal nerve	• Most common compression at fibular head • At exit of lateral leg • At tight tunnel formed by external retinaculum	Foot drop, pain, and numbness of the lateral lower leg and foot dorsum, aggravated by plantar flexion and foot inversion	Timely surgical decompression can treat peroneal entrapment neuropathy, positive correlation between decreased time of surgery, and better outcomes[93]

nerve, being a part of the central nervous system myelin, is affected by demyelinating diseases such as multiple sclerosis and neuromyelitis optica, and toxic and deficiency diseases such as the B12 deficiency. Toxic amblyopia and methanol toxicity are some common examples in clinical practice.

Entrapment Neuropathies

Entrapment neuropathies are treatable disorders that are caused by compression of peripheral nerves secondary to passage through narrow anatomical spaces. They are characterized by pain and/or sensorimotor loss. The common pathomechanisms of entrapment neuropathies are as follows[84]:

- Extra- and intraneural ischemia.
- Demyelination and axonal degeneration.
- Neuroinflammation.

These compression neuropathies can be divided based on gradings of peripheral nerve injuries such as neuropraxia (nerve sheath intact but nerve function is temporarily impaired), axonotmesis (nerve fibers are interrupted but connective tissue remains intact), and neurotmesis (most severe type of nerve injury where the nerve fibers and connective tissue are severed). A few of the common entrapment neuropathies are described in Table 7.

Autonomic Neuropathy

Autonomic neuropathies are a complex group of disorders targeting mainly the autonomic

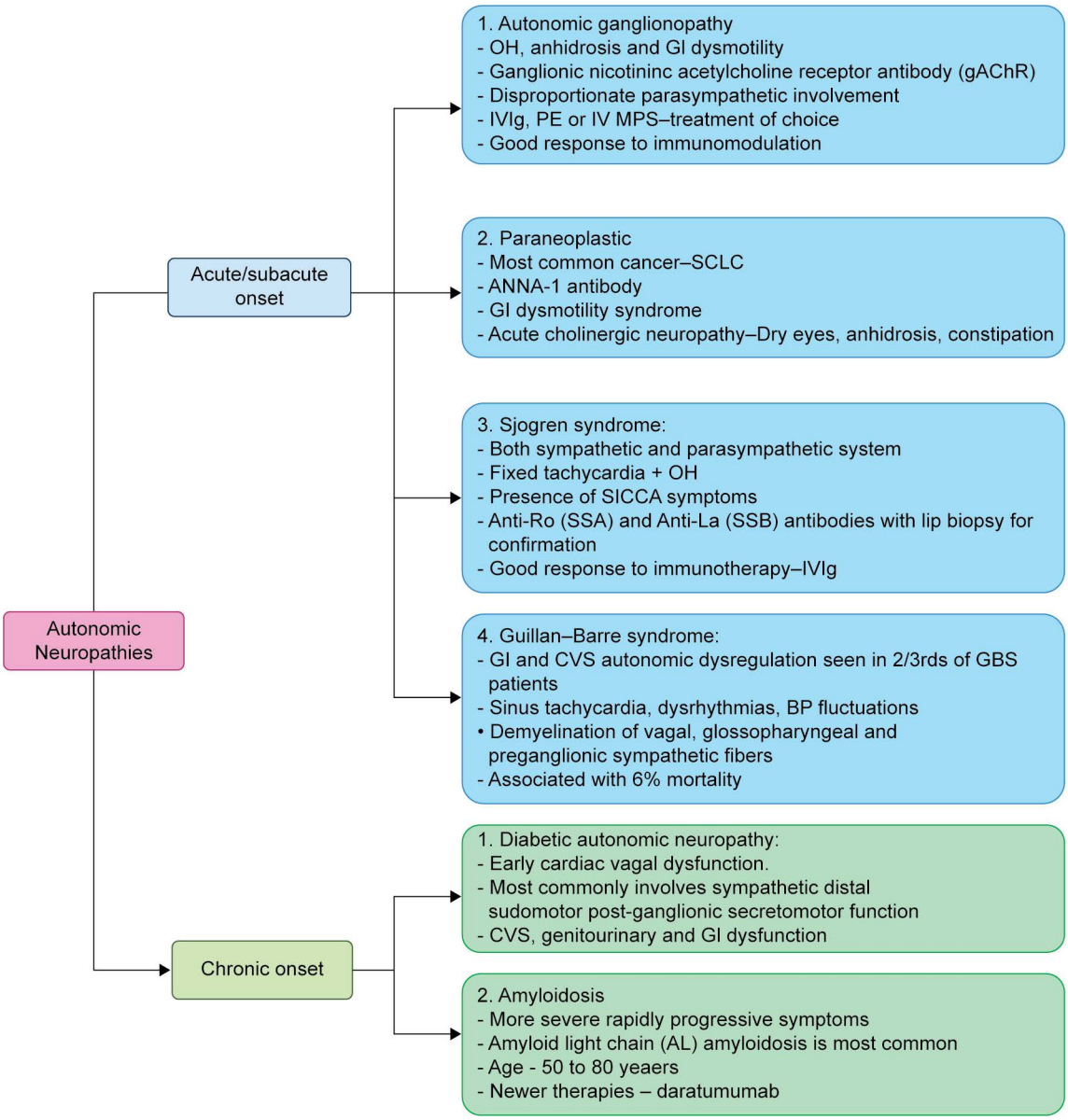


Fig. 4: Autonomic neuropathies

fibers, including the parasympathetic and sympathetic systems. They are classified according to temporal course/disease onset (acute/subacute/chronic), etiology (hereditary/acquired), and as per the involvement of the fibers (parasympathetic/sympathetic/generalized).[94] Pertaining to the current article, a few of the most important treatable entities are described briefly in Figure 4.

Conclusion

As can be surmised from the above discussion, a variety of neuropathic processes have the potential of reversibility, and these need to be rapidly identified and treated for best outcomes. Evaluation of clinical features, coupled with investigations, helps the process of segregation and reaching the diagnosis. Inflammatory, infective, toxic, metabolic, and deficiency neuropathies form the main categories of reversible neuropathies and should be actively looked for for best outcomes.

Acknowledgment

Photo courtesy to Dr Varsha Patil—Consultant Neurologist at Bombay Hospital Institute of Medical Sciences, Mumbai.

Author Contributions

SVK: concept, design, and review.

JM: literature review and writing the manuscript.

HH: design, manuscript preparation, and review.

RR: concept and review.

References

1. Alport AR, Sander HW. Clinical approach to peripheral neuropathy: anatomic localization and diagnostic testing. Continuum 2012;18(1):13–38.
2. Nemni R, Bottacchi E, Fazio R, et al. Polyneuropathy in hypothyroidism: clinical, electrophysiological and morphological findings in four case. J Neurol Neurosurg Psychiatry 1987;50(11):1454–1460.
3. Rao SN, Katiyar BC, Nair KR, et al. Neuromuscular status in hypothyroidism. Acta Neurol Scand 1980;61:167–177.
4. Moorthi RN, Doshi S, Fried LF, et al. Chronic kidney disease and peripheral nerve function in the health, aging and body composition study. Nephrol Dial Transplant 2019;34:625–632.
5. Bolton CF, Baltzan MA, Baltzan RB. Effects of renal transplantation on uremic neuropathy. A clinical and electrophysiologic study. N Engl J Med 1971;284:1170–1175.
6. Hermans G, De Jonghe B, Bruyninckx F, et al. Clinical review: critical illness polyneuropathy and myopathy. Crit Care 2008;12:238.
7. Jericho H, Sansotta N, Guandalini S. Extraintestinal manifestations of celiac disease: effectiveness of

the gluten-free diet. J Pediatr Gastroenterol Nutr 2017;65(1):75–79.
8. Collins MP, Hadden RD. The nonsystemic vasculitic neuropathies. Nat Rev Neurol 2017;13:302–316.
9. Anders HJ, Goebel FD. Neurological manifestations of cytomegalovirus infection in the acquired immunodeficiency syndrome. Int J STD AIDS 1999;10(3):151–159.
10. Jones MR, Urits I, Wolf J, et al. Drug-induced peripheral neuropathy: a narrative review. Curr Clin Pharmacol 2020;15(1):38–48.
11. Martin CL, Albers JW, Pop-Busui R, et al. Neuropathy and related findings in the diabetes control and complications trial/epidemiology of diabetes interventions and complications study. Diabetes Care 2014;37(1):31–38.
12. Feldman EL, Callaghan BC, Pop-Busui R, et al. Diabetic neuropathy. Nat Rev Dis Primers 2019;5(1):41.
13. Tesfaye S, Chaturvedi N, Eaton SE, et al. Vascular risk factors and diabetic neuropathy. N Engl J Med 2005;352:341–350.
14. Callaghan BC, Xia R, Reynolds E, et al. Association between metabolic syndrome components and polyneuropathy in an obese population. JAMA Neurol 2016;73:1468–1476.
15. Ziegler D, Rathmann W, Dickhaus T, et al. Neuropathic pain in diabetes, prediabetes and normal glucose tolerance: the MONICA/KORA Augsburg Surveys S2 and S3. Pain Med 2009;10:393–400.
16. Laughlin RS, Dyck PJB. Diabetic radiculoplexus neuropathies. Handb Clin Neurol 2014;126:45–52.
17. Freeman R. Diabetic autonomic neuropathy. Handb Clin Neurol 2014;126:63–79.
18. Vinik AI, Maser RE, Mitchell BD, et al. Diabetic autonomic neuropathy. Diabetes Care 2003;26(5):1553–1579.
19. Kazamel M, Stino AM, Smith AG. Metabolic syndrome and peripheral neuropathy. Muscle Nerve 2021;63:285–293.
20. Stino AM, Smith AG. Peripheral neuropathy in prediabetes and the metabolic syndrome. J Diabetes Investig 2017;8(5):646–655.
21. American Diabetes Association. Standards of Medical Care in Diabetes—2022 Abridged for Primary Care Providers. Clin Diabetes 2022;40(1):10–38.
22. Lunn MP, Hughes RA, Wiffen PJ. Duloxetine for treating painful neuropathy, chronic pain or fibromyalgia Cochrane Database Syst Rev 2014;2014(1):CD007115.
23. Derry S, Bell RF, Straube S, et al. Pregabalin for neuropathic pain in adults. Cochrane Database Syst Rev 2019;1:CD007076.
24. Tesfaye S, Vileikyte L, Rayman G, et al. Painful diabetic peripheral neuropathy: consensus recommendations on diagnosis, assessment and management. Diabetes Metab Res Rev 2011;27:629–638.
25. Çakici N, Fakkel TM, van Neck JW, et al. Systematic review of treatments for diabetic peripheral neuropathy. Diabet Med 2016;33:1466–1476.
26. Hughes RA, Swan AV, van Doorn PA. Intravenous immunoglobulin for Guillain–Barré syndrome. Cochrane Database Syst Rev 2014;2014(9):CD002063.
27. Raphaël JC, Chevret S, Hughes RAC, et al. Plasma exchange for Guillain–Barré syndrome. Cochrane Database Syst Rev 2012:CD001798.
28. Nomura T, et al. A randomized controlled trial comparing intravenous immunoglobulin and plasmapheresis in Guillain–Barré syndrome. Neurol Ther 2001;18:69–81.
29. Raphael JC, Chevret S, Harboun M, et al. Intravenous immune globulins in patients with Guillain–Barre syndrome and contraindications to plasma exchange: 3 days versus 6 days. J Neurol Neurosurg Psychiatry 2001;71(2):235–238.
30. Walgaard C, Jacobs BC, Lingsma HF, et al. Second IVIg course in Guillain–Barré syndrome patients with poor prognosis (SID-GBS trial): protocol for a double-blind randomized, placebo-controlled clinical trial. J Peripher Nerv Syst 2018;23(4):210–215.
31. Ruts L, Drenthen J, Jacobs BC, et al. Distinguishing acute-onset CIDP from fluctuating Guillain–Barré syndrome: a prospective study. Neurology 2010;74(21):1680–1686.
32. Kesici S, Tanyıldız M, Yetimakman F, et al. A novel treatment strategy for severe Guillain–Barré syndrome: zipper method. J Child Neurol 2019;34(5):277–283.
33. Nikolaus M, Kühne F, Tietze A, et al. Modified zipper method, a promising treatment option in severe pediatric immune-mediated neurologic disorders. J Child Neurol 2022;37(6):505–516.
34. Misawa S, Kuwabara S, Sato Y, et al. Safety and efficacy of eculizumab in Guillain–Barré syndrome: a multicentre, double-blind, randomised phase 2 trial. Lancet Neurol 2018;17(6):519–529.
35. Davidson AI, Halstead SK, Goodfellow JA, et al. Inhibition of complement in Guillain–Barré syndrome: the ICA-GBS study. J Peripher Nerv Syst 2017;22(1):4–12.
36. Pritchard J, Gray IA, Idrissova ZR, et al. A randomized controlled trial of recombinant interferon-beta 1a in Guillain–Barré syndrome. Neurology 2003;61(9):1282–1284.
37. Kiefer R, Kieseier BC, Stoll G, et al. The role of macrophages in immune-mediated damage to the peripheral nervous system. Prog Neurobiol 2001;64:109–127.
38. Lim JP, Devaux J, Yuki N. Peripheral nerve proteins as potential autoantigens in acute and chronic inflammatory demyelinating polyneuropathies. Autoimmun Rev 2014;13:1070–1078.
39. Vallat JM, Yuki N, Sekiguchi K, et al. Paranodal lesions in chronic inflammatory demyelinating polyneuropathy associated with anti-Neurofascin 155 antibodies. Neuromuscul Disord 2017;27(3):290–293.
40. Watkins JM, Dimachkie MM, Riley P, et al. Subcutaneous immunoglobulin therapy for chronic inflammatory demyelinating polyneuropathy: a nursing perspective. J Neurosci Nurs 2019;51(4):198–203.
41. Hahn AF, Bolton CF, Pillay N, et al. Plasma-exchange therapy in chronic inflammatory demyelinating polyneuropathy. A double-blind, sham-controlled, cross-over study. Brain 1996;119(4):1055–1066.
42. Mehndiratta MM, Hughes RAC, Pritchard J. Plasma exchange for chronic inflammatory demyelinating polyradiculoneuropathy. Cochrane Database Syst Rev 2015;2015:CD003906.
43. Eftimov F, Liesdek MH, Verhamme C, et al. Deterioration after corticosteroids in CIDP may be associated with pure focal demyelination pattern. BMC Neurol 2014;14:72.
44. Hughes RAC, Gorson KC, Cros D, et al. Intramuscular interferon beta-1a in chronic inflammatory demyelinating polyradiculoneuropathy. Neurology 2010;74(8):651–657.
45. RMC Trial Group. Randomised controlled trial of methotrexate for chronic inflammatory demyelinating polyradiculoneuropathy (RMC trial): a pilot, multicentre study. Lancet Neurol 2009;8(2):158–164.
46. Gorson KC, Amato AA, Ropper AH. Efficacy of mycophenolate mofetil in patients with chronic immune demyelinating polyneuropathy. Neurology 2004;63(4):715–717.
47. Chaganti S, Hannaford A, Vucic S. Rituximab in chronic immune mediated neuropathies: a systematic review. Neuromuscul Disord 2022;32(8):621–627.
48. Vrancken AFJE, Said G. Vasculitic neuropathy. Handb Clin Neurol 2013;115:463–483.
49. Khadilkar SV, Yadav RS, Patel BA. Neuromuscular Disorders. Singapore: Springer; 2018.
50. Collins MP, Dyck PJB, Gronseth GS, et al. Peripheral Nerve Society Guideline on the classification, diagnosis, investigation, and immunosuppressive therapy of non-systemic vasculitic neuropathy: executive summary. J Peripher Nerv Syst 2010;15(3):176–184.
51. Grimaud J, Vallat JM. Neurological manifestations of leprosy. Rev Neurol (Paris) 2003;159(11):979–995.
52. Nascimento OJM. Leprosy neuropathy: clinical presentations. Arq Neuropsiquiatr 2013;71:661–666.
53. Marahatta S, Bhattarai S, Paudel BH. Electrophysiological profiles of leprosy neuropathy. Lepr Rev 2017;88:373–380.
54. van Brakel WH, Nicholls PG, Wilder-Smith EP, et al. Early diagnosis of neuropathy in leprosy—comparing diagnostic tests in a large prospective study (the INFIR cohort study). PLoS Negl Trop Dis 2008;2(4):e212.
55. Khadilkar SV, Benny R, Kasegaonkar PS. Proprioceptive loss in leprous neuropathy: a study of 19 patients. Neurol India 2008;56:450–455.
56. Carod-Artal FJ. Infectious diseases causing autonomic dysfunction. Clin Auton Res 2018;28(1):67–81.
57. Shah PK, Malhotra YK, Lakhotia M, et al. Cardiovascular dysautonomia in patients with lepromatous leprosy. Indian J Lepr 1990;62(1):91–97.
58. Kumar S, Alexander M, Gnanamuthu C. Cranial nerve involvement in patients with leprous neuropathy. Neurol India 2006;54(3):283–285.
59. Khadilkar SV, Patil SB, Shetty VP. Neuropathies of leprosy. J Neurol Sci 2021;420:117288.
60. World Health Organization. Leprosy; 2025.
61. Ebenezer GJ, Scollard DM. Treatment and evaluation advances in leprosy neuropathy. Neurotherapeutics 2021;18:2337–2350.
62. Schütz SG, Robinson-Papp J. HIV-related neuropathy: current perspectives. HIV AIDS 2013;5:243–251.
63. Ghosh S, Chandran A, Jansen JP. Epidemiology of HIV-related neuropathy: a systematic literature review. AIDS Res Hum Retroviruses 2012;28(1):36–48.
64. Centner CM, Little F, Van Der Watt JJ, et al. Evolution of sensory neuropathy after initiation of antiretroviral therapy. Muscle Nerve 2018;57(3):371–379.
65. Haanpää M, Treede RD. Capsaicin for neuropathic pain: linking traditional medicine and molecular biology. Eur Neurol 2012;68(5):264–275.
66. Dorfman D, George MC, Schnur J, et al. Hypnosis for treatment of HIV neuropathic pain: a preliminary report. Pain Med 2013;14(7):1048–1056.
67. Carson CA. Tart cherry juice as a treatment for peripheral neuropathy. Integr Med (Encinitas) 2015;14(1):48–49.
68. Bakare AO, Owoyele BV. Bromelain reduced pro-inflammatory mediators as a common pathway that mediate antinociceptive and anti-anxiety effects in sciatic nerve ligated Wistar rats. Sci Rep 2021;11(1):289.
69. Albany C, Dockter T, Wolfe E, et al. Cisplatin-associated neuropathy characteristics compared with those associated with other neurotoxic chemotherapy agents (Alliance A151724). Support Care Cancer 2021;29(2):833–840.
70. Pachman DR, Qin R, Seisler DK, et al. Clinical course of patients with oxaliplin-associated neuropathy: N08CB (Alliance). J Clin Oncol 2014;32:5s.
71. Karam C, Dyck PJB. Toxic neuropathies. Semin Neurol 2015;35(4):448–457.
72. Li GZ, Hu YH, Li DY, et al. Vincristine-induced peripheral neuropathy: a mini-review. Neurotoxicology 2020;81:161–171.
73. Singh M, Thomas VM, Mulay S. Bortezomib-induced motor neuropathy: a case report. J Oncol Pharm Pract 2020;26(6):1549–1552.
74. Quickfall D, Daneman N, Dmytriw AA, et al. Metronidazole-induced neurotoxicity. CMAJ 2021;193(42):E1630.
75. Mandel W. Pyridoxine and the isoniazid-induced neuropathy. Dis Chest 1959;36(3):293–296.
76. Snider DE Jr. Pyridoxine supplementation during isoniazid therapy. Tubercle 1980;61(4):191–196.
77. Koller WC, Gehlmann LK, Malkinson FD, et al. Dapsone-induced peripheral neuropathy. Arch Neurol 1977;34(10):644–646.
78. Arné-Bès MC. Neurotoxic effects of medications: an update. Rev Med Liege 2004;59(Suppl 1):118–123.
79. Aladawi M, Shelly S, Dyck PJB, et al. Nitrofurantoin and minocycline-associated vasculitic neuropathy: case reports and literature review. J Clin Neuromuscul Dis 2022;24(2):85–94.
80. Bressler AM, Zimmer SM, Gilmore JL, et al. Peripheral neuropathy associated with prolonged use of linezolid. Lancet Infect Dis 2004;4(8):528–531.
81. Kishor K, Dhasmana N, Kamble SS, et al. Linezolid induced adverse drug reactions–an update. Curr Drug Metab 2015;16(7):553–559.
82. Thomson RM, Parry GJ. Neuropathies associated with excessive exposure to lead. Muscle Nerve 2006;33(6):732–741.
83. Beritić T, Feldman RG. Lead neuropathy. CRC Crit Rev Toxicol 1984;12(2):149–213.

84. Pham K, Gupta R. Understanding the mechanisms of entrapment neuropathies. Review article. Neurosurg Focus 2009;26(2):E7.
85. Wu F, Ng CY. Long thoracic nerve palsy: when is decompression indicated. J Hand Surg Glob Online 2023;5:519–524.
86. Nystrom NA, Champagne LP, Freeman M, et al. Surgical fasciectomy of the trapezius muscle combined with neurolysis of the spinal accessory nerve; results and long-term follow-up in 30 consecutive cases of refractory chronic whiplash syndrome. J Brachial Plex Peripher Nerve Inj 2010;5:7.
87. Mangi MD, Zadow S, Lim W. Nerve entrapment syndromes of the upper limb: a pictorial review. Insights Imaging 2022;13(1):166.
88. Joshi A, Patel K, Mohamed A, et al. Carpal tunnel syndrome: pathophysiology and comprehensive guidelines for clinical evaluation and treatment. Cureus 2022;14:e27053.
89. Vij N, Traube B, Bisht R, et al. An update on treatment modalities for ulnar nerve entrapment: a literature review. Anesth Pain Med 2020;10(6):e112070.
90. Schmid AB, Fundaun J, Tampin B. Entrapment neuropathies: a contemporary approach to pathophysiology, clinical assessment, and management. Pain Rep 2020;5(4):e829.
91. Koes BW, van Tulder MW, Peul WC. Diagnosis and treatment of sciatica. BMJ 2007;334(7607):1313–1317.
92. Scholz C, Hohenhaus M, Pedro MT, et al. Meralgia paresthetica: relevance, diagnosis, and treatment. Dtsch Arztebl Int 2023;120:655–661.
93. Fortier LM, Markel M, Thomas BG, et al. An update on peroneal nerve entrapment and neuropathy. Orthop Rev (Pavia) 2021;13(2):24937.
94. Kaur D, Tiwana H, Stino A, et al. Autonomic neuropathies. Muscle Nerve 2021;63:10–21.