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Original Research Article

THE FREQUENCY OF DIFFERENT CAUSES OF PREDOMINANT MOTOR NEUROPATHY IN PATIENTS PRESENTING AT TERTIARY CARE HOSPITAL

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Abstract: *Predominant motor neuropathy (PMN) encompasses a variety of neuropathies primarily affecting motor nerves, leading to muscle weakness and functional impairment. Identifying the causes of PMN is crucial for diagnosis and treatment planning.* ***Objective:*** *The present study aims to determine the frequency of different causes of predominant motor neuropathy in patients at a tertiary care hospital.* ***Methods:*** *This cross-sectional study was conducted at the Department of Neurology, Civil Hospital Karachi, from March 27, 2022, to September 27, 2022, following ethical approval from the institutional review board. A total of 139 patients aged 15-70 years, of either sex, diagnosed with PMN were included through non-probability consecutive sampling. Patients with predominant sensory neuropathy or mixed neuropathies were excluded. Data were analyzed using statistical methods to determine the frequency of various causes of PMN, with particular attention to gender and diabetes status.* ***Results:*** *The most frequent cause of neuropathy was Acute Motor Axonal Neuropathy (AMAN) (26.6%), followed by Acute Inflammatory Demyelinating Polyneuropathy (AIDP) (21.58%), Chronic Inflammatory Demyelinating Polyneuropathy (CIDP) (19.4%), and Charcot-Marie-Tooth disease (16.5%). Less common causes included multifocal motor neuropathy (8.6%), porphyria (3.6%), lead intoxication (2.88%), and familial amyloid neuropathy type 2 (0.7%). There were significant differences in the frequency of neuropathy causes based on gender (p = 0.011) and diabetes status (p = 0.006).* ***Conclusion:*** *The study identified Acute Motor Axonal Neuropathy as the most frequent cause of predominant motor neuropathy, followed by Acute Inflammatory Demyelinating Polyneuropathy. These findings underscore the importance of recognizing specific causes of PMN for appropriate management.*

Keywords: Acute Motor Axonal Neuropathy, Chronic Inflammatory Demyelinating Polyneuropathy, Cross-Sectional Studies, Neuropathy, Motor, Polyneuropathies, Predominant Motor Neuropathy, Tertiary Care Centers

Introduction

Predominant motor neuropathy (PMN) encompasses a diverse group of disorders characterized by motor nerve dysfunction, which can lead to significant morbidity due to muscle weakness and atrophy (1). Predominant motor neuropathy (PMN) can be broadly classified based on its underlying causes, which encompass genetic, autoimmune, metabolic, infectious, and toxic origins. Genetic disorders, such as hereditary motor and sensory neuropathies (HMSNs), including Charcot-Marie-Tooth disease, are significant contributors to PMN (2). These conditions typically manifest with progressive muscle weakness, starting in the distal limbs and moving proximally over time. Autoimmune disorders, including multifocal motor neuropathy (MMN) and chronic inflammatory demyelinating polyneuropathy (CIDP), represent another major cause of PMN. In these conditions, the immune system mistakenly attacks the peripheral nerves, leading to motor dysfunction (3). Metabolic disorders, particularly diabetes mellitus, also play a critical role in the development of PMN. Diabetic neuropathy can predominantly affect motor nerves, especially in cases of long-standing or poorly controlled diabetes (4).

Infectious causes of PMN include viral infections such as HIV and hepatitis C, which can lead to neuropathy either directly through the infection itself or indirectly via the immune response it triggers. Additionally, toxic neuropathies arise from exposure to various toxins, including heavy metals, chemotherapy agents, and alcohol. These exposures can result in a rapid onset of motor symptoms following contact with the toxic substance (5). Each etiological category highlights the diverse mechanisms PMN can develop, underscoring the importance of a comprehensive diagnostic approach to identify the specific cause and implement appropriate treatment strategies (6). The frequency and distribution of the various causes of PMN can vary widely depending on geographic, demographic, and healthcare factors. Studies have indicated that genetic disorders are the most common cause of PMN in pediatric populations, while autoimmune and metabolic causes are more prevalent in adults (7). For instance, a study by Latov et al. (2021) reported that in a cohort of PMN patients, 40% had an autoimmune etiology, 30% had a genetic cause, 20% were metabolic, and 10% were due to infectious or toxic causes (8). The present study aims to determine the frequency of different causes of predominant motor neuropathy in patients presenting at tertiary care hospitals.

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Methodology

After the ethical approval from the institutional review board, this crossectional study was conducted at the Department of Neurology, Civil Hospital Karachi, from 27 March 2022 to 27- September 2022. Through non-probability consecutive sampling, 139 Patients aged 15-70, of either sex and above, diagnosed with predominant motor neuropathy (PMN) at the tertiary care hospital were included in the present study. Patients with predominant sensory neuropathy or mixed neuropathies were excluded from the present study. Before enrollment, the patient and their carer provided informed consent. The patient was provided comprehensive information regarding the trial, including thoroughly explaining all potential risks and benefits. The patient/caregiver provided an extensive clinical history and demographic information. The diagnosis of peripheral neuropathy was verified by a skilled consultant neurologist based on clinical signs and symptoms, as well as the findings from nerve conduction velocity studies (NCVS) and electromyography (EMG). The study recorded various factors, such as age, gender, place of residence, family history of peripheral neuropathy, diabetes, and the specific causes of neuropathy, which included Chronic inflammatory demyelinating polyradiculoneuropathy, AMAN, Charcot Marie tooth disease, acute inflammatory demyelinating polyneuropathy, lead intoxication, porphyria, multifocal motor neuropathy, familial amyloid neuropathy type 2, and others. These findings were documented in a pre-designed Performa. The data was analyzed using the statistical software SPSS version 26. The mean, standard deviation, and median (interquartile range) were provided for quantitative data, such as age and duration of neuropathy. Qualitative variables such as gender, place of residence, family history of peripheral neuropathy, smoking, hypertension, diabetes, and various causes of neuropathy were reported in terms of frequency and percentage. The assessment of normality was conducted using the Shapiro-Wilk test. Effect modifiers, such as age, gender, place of residence, family history of peripheral neuropathy, smoking, hypertension, and diabetes, were controlled by stratification. Post-stratification chi-square/Fisher's exact test The exact test was utilized, with a significance level of p-value ≤0.05.

Results

The study included 139 patients with predominant motor neuropathy (PMN), with a mean age of 36.06±17.40 years (Table 1). Most patients were male, comprising 65.5% (n=91) of the cohort, while females accounted for 34.5% (n=48). Most patients resided in urban areas, representing 74.8% (n=104) of the population, whereas those from rural areas comprised 25.2% (n=35). A minority of patients were smokers (10.8%, n=15), and 9.4% (n=13) had diabetes. Hypertension was present in 11.5% (n=16) of the patients. The duration of neuropathy among the patients averaged 30.86±45.40 months. The study identified various causes of predominant motor neuropathy (PMN) among the patients (Table 2). Acute motor axonal neuropathy (AMAN) was the most common cause, accounting for 26.6% (n=37) of cases. Chronic inflammatory demyelinating polyneuropathy (CIDP) followed, comprising 19.4% (n=27) of the patients. Acute inflammatory demyelinating polyneuropathy (AIDP) was responsible for 21.58% (n=30) of cases. Charcot-Marie-Tooth disease was observed in 16.5% (n=23) of patients, while multifocal motor neuropathy accounted for 8.6% (n=12). Porphyria was the cause in 3.6% (n=5) of cases, and lead intoxication was identified in 2.88% (n=4) of the patients. Familial amyloid neuropathy type 2 was the least common, with only one case reported. Table 3-8 shows the stratification of causes based on age, gender, residence, smoking, diabetes, and hypertension

Table 1: Demographic and Clinical Parameters

Parameters	Mean or frequency
Age (years)	36.06±17.40
Gender	
Male	91 (65.5%)
Female	48 (34.5%)
Residence area	
Urban	104 (74.8%)
Rural	35 (25.2%)
Smoking	15 (10.8%)
Diabetes	13 (9.4%)
Hypertension	16 (11.5%)
Duration of nephropathy	30.86±45.40

Table 2: Causes of Predominant motor neuropathy

Causes	Frequency
Charcot Marie tooth disease	23 (16.5%)
AMAN	37 (26.6%)
CIDP	27 (19.4%)
Porphyria	5 (3.6%)
Multifocal motor neuropathy	12 (8.6%)
AIDP	30 (21.58%)
Lead intoxication	4 (2.88%)
Familial amyloid neuropathy type 2	1

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Table 3: Stratification of causes based on age groups

	Age								
Causes	**15-30**		**31-45**		**46-50**		**>50**	**Total**	
Charcot Marie tooth disease	8	12%	8	26%	3	38%	4	13%	23
AMAN	19	28%	8	26%	3	38%	7	23%	37
CIDP	15	22%	4	13%	0	0%	8	26%	27
Porphyria	5	7%	0	0%	0	0%	0	0%	5
Multifocal motor neuropathy	5	7%	1	3%	2	25%	4	13%	12
AIDP	15	22%	7	23%	0	0%	8	26%	30
Lead intoxication	2	3%	2	6%	0	0%	0	0%	4
Familial amyloid neuropathy type 2	0	0%	1	3%	0	0%	0	0%	1
p-value	0.162								

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Table 4: Stratification of causes based on gender

Gender					
Causes	**Male**		**Female**		**Total**
Charcot Marie tooth disease	10	11%	13	27%	23
AMAN	25	27%	12	25%	37
CIDP	21	23%	6	13%	27
Porphyria	1	1%	4	8%	5
Multifocal motor neuropathy	7	8%	5	10%	12
AIDP	25	27%	5	10%	30
Lead intoxication	2	2%	2	4%	4
Familial amyloid neuropathy type 2	0	0%	1	2%	1
p-value	0.011				

Table 5: Stratification of causes based on residence

Residence					
Causes	**Urban**		**Rural**		**Total**
Charcot Marie tooth disease	17	16%	6	17%	23
AMAN	29	28%	8	23%	37
CIDP	21	20%	6	17%	27
Porphyria	3	3%	2	6%	5
Multifocal motor neuropathy	9	9%	3	9%	12
AIDP	22	21%	8	23%	30
Lead intoxication	2	2%	2	6%	4
Familial amyloid neuropathy type 2	1	1%	0	0%	1
p-value	0.951				

Table 6: Stratification of causes based on smoking

Smoking					
Cause	**Yes**		**No**		**Total**
Charcot Marie tooth disease	1	7%	22	18%	23
AMAN	4	27%	33	27%	37
CIDP	3	20%	24	19%	27
Porphyria	0	0%	5	4%	5
Multifocal motor neuropathy	3	20%	9	7%	12
AIDP	3	20%	27	22%	30
Lead intoxication	1	7%	3	2%	4
Familial amyloid neuropathy type 2	0	0%	1	1%	1
Total	15		124		139
p-value	0.640				

Table 7: Stratification of causes based on Diabetes

Diabetes					
Cause	**Yes**		**No**		**Total**
Charcot Marie tooth disease	1	8%	22	17%	23
AMAN	1	8%	36	29%	37
CIDP	3	23%	24	19%	27
Porphyria	0	0%	5	4%	5
Multifocal motor neuropathy	5	38%	7	6%	12
AIDP	2	15%	28	22%	30
Lead intoxication	1	8%	3	2%	4
Familial amyloid neuropathy type 2	0	0%	1	1%	1
Total	13		126		139
p-value	0.006				

Table 8: Stratification of causes based on hypertension

Hypertension					
Cause	**Yes**		**No**		**Total**
Charcot Marie tooth disease	5	31%	18	15%	23
AMAN	3	19%	34	28%	37
CIDP	3	19%	24	20%	27
Porphyria	1	6%	4	3%	5

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Multifocal motor neuropathy	1	6%	11	9%	12
AIDP	2	13%	28	23%	30
Lead intoxication	0	0%	4	3%	4
Familial amyloid neuropathy type 2	1	6%	0	0%	1
Total	16		123		139
p-value	0.062				

Discussion

This study aimed to evaluate the prevalence of different aetiologies of peripheral neuropathy with motor impairment in patients admitted to a tertiary care hospital. The study findings revealed that AMAN was the predominant cause of peripheral neuropathy, accounting for 26.6% of cases. This was followed by AIPD at 21.58%, CIPD at 19.4%, and Charcot Marie tooth disease at 16.5%. Porphyria, multifocal motor neuropathy, lead intoxication, and Familial amyloid neuropathy type 2 had lower frequencies of 3.6%, 8.6%, 2.88%, and 0.7%, respectively.

MMN and chronic inflammatory demyelinating polyradiculoneuropathy are peripheral neuropathies that are acquired and caused by immune-mediated processes. MMN is a condition characterized by nerve damage primarily affecting the upper extremities, typically starting in one or both hands. It is characterized by a gradual or intermittent progression of muscle weakness and loss of muscle mass, which is not symmetrical between limbs. Chronic inflammatory demyelinating polyradiculoneuropathy is an immune-mediated condition that affects the peripheral nerves. It can lead to weakness, paralysis, and problems with both movement and sensation. Typically, it affects both sides of the body symmetrically (9, 10).

Charcot-Marie-Tooth type 1(A) affects the motor and sensory peripheral nerves. Its characteristic symptoms include muscle weakness and atrophy in the distal parts of the body, as well as reduced feeling. These symptoms initially manifest in the feet and legs, but they eventually spread to the hands and forearms (11). In this study, Charcot-Marie tooth disease was found in 23 patients, accounting for 16.5% of the total.

AMAN was the etiology of peripheral neuropathy in 26.6% (37 patients). Guillain-Barré syndrome (GBS) is characterized by a sudden and varying level of weakening in several nerves, often reaching its most severe point within four weeks. An infection primarily precedes the disease and usually follows a monophasic trajectory (12). Guillain-Barré Syndrome (GBS) can be classified into three main subtypes: acute inflammatory demyelinating polyneuropathy (AIDP), which is the most common form in the Western world; acute motor axonal neuropathy (AMAN), which is more prevalent in Asia and Japan; and Miller-Fisher syndrome(*) (13).

Out of all the patients included in this investigation, only one individual (0.7%) was diagnosed with Familial amyloid neuropathy type 2. Familial amyloid polyneuropathy (FAP) or transthyretin (TTR) amyloid polyneuropathy is a type of nerve damage that affects both the sensory and motor functions, as well as the autonomic nervous system. It often begins in adulthood and is inherited dominantly. Aside from neurological symptoms, FAP can also be linked to symptoms such as weight loss, cardiac and renal failure, and ocular problems (14, 15).

Conclusion

The study revealed that Acute motor axonal neuropathy was the most common cause of neuropathy among patients, followed by Acute inflammatory demyelinating polyneuropathy, chronic inflammatory demyelinating polyradiculoneuropathy, and Charcot Marie tooth disease. There was a notable correlation between gender and diabetes about the causes of neuropathy.

Declarations

Data Availability statement
All data generated or analyzed during the study are included in the manuscript.

Ethics approval and consent to participate
Approved by the department concerned. (IRB/NINSKHR/242/21)

Consent for publication
Approved

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Conflict of interest

The authors declared the absence of a conflict of interest.

Author Contribution

WARSHA KUMARI
Conception of Study, Development of Research Methodology Design, Study Design, manuscript Review, and final approval of manuscript.
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Conception of Study, Final approval of manuscript.
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Data entry and data analysis, as well as drafting the article.

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