Risk Factors for Focal Neuropathies in Patients Presented to Neuro-Electrophysiology Unit

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Abstract

Objective: To determine and analyze the elements that play a role in contributing to the risk of focal neuropathies in patients who were referred for electrodiagnostic study.

Material and Methods: A descriptive, cross-sectional study was carried out in Neurology department at King Edward Medical University, Lahore. electrodiagnostic tests were performed on 100 consecutive patients with complains of focal neuropathy between June 2023 and January 2024. Patient's history and examination suggestive of polyneuropathy, poly radiculopathy and plexopathy were excluded from the study. NCS and EMG were carried out using standard procedures. The findings were recorded in the preplanned pro forma, together with the historical and demographic information.

Results: Out of 100 patients, fifty were diagnosed with focal neuropathy, males were 38% and 62% were females. Thirty-three patients presented with carpal tunnel syndrome (66%), 10 patients had ulnar neuropathy at elbow (20%), 4 patients had radial neuropathy (8%), and in remaining three patients, 2 were presented with peroneal neuropathy (4%) and 1 had axillary neuropathy (2%). Twenty-five patients were diagnosed with diabetes mellitus (50%). Our study revealed that in patients with carpal tunnel syndrome, 81.8% were females and 75.8% were overweight. Patients with ulnar neuropathy at elbow were 70% males. Three out of Four patients affected with radial neuropathy and two out of three patients with peroneal neuropathy were males.

Conclusion: Focal peripheral neuropathies are not unusual in our setting, and the risk factors are usually overlooked. Common factors which increase the risk are gender, age, abnormal body mass index and diabetes.

Keywords: Ulnar Neuropathy at elbow (UNE), Electro-diagnostics (EDX), Body mass index (BMI), Diabetes mellitus (DM).

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Introduction

Focal neuropathy is a condition in which there is damage to single nerve, most often either in hand, head, torso and leg, resulting in symptoms like tingling, numbness, pain, weakness, and occasionally paralysis in that location. Numerous factors, like inflammation, compression, or underlying diseases like diabetes, can contribute to it. It is characterized as a slowly progressing illness, and the symptoms can differ based on the particular nerve that is impacted.[1]

There are numerous risk factors that can lead to the occurrence of focal neuropathy. Age, body mass index (BMI) and sex are examples of factors that have been shown to have constitutional characteristics; on the other hand, other factors have also been linked to coexisting diseases (such as diabetes, rheumatoid

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arthritis, and cancer), trauma, and infections in addition to occupation, physical activity, surgery, and pregnancy.[2]

Many authors have examined the connection between these factors and focal neuropathies. Carpal tunnel syndrome (CTS) is the most frequently encountered mononeuropathy in the general population, caused by a compression of the median nerve at the carpal tunnel level.[3] There have been a few epidemiological studies conducted to determine the risk factors for CTS, which have shown that obesity, increase body mass index (BMI), age over 30, repetitive motor activity, female gender, and several systemic diseases like diabetes mellitus (DM) are the most consistent risk factors.[4] Ulnar neuropathy at elbow is the second most prevalent type of compression neuropathy seen in the arm. The development of UNE is associated with male gender and BMI, although age is not a significant risk factor.[5] The radial nerve's anatomy makes it vulnerable to entrapment, which can cause a variety of symptoms. Radial nerve-related pain and paresthesia can be relieved by rest, and they can be made worse by frequent pronation and supination. The condition linked to the motor component is wrist drop. Common risk factors for radial nerve injury are trauma, systemic illnesses, and repeated pronation and supination.[6] Shoulder neuropathies are classified as entrapment syndromes. They make up around 2% of cases of shoulder pain connected to sports, thus they are somewhat prevalent. Suprascapular and axillary neuropathies are common in these cases. Stretching is the primary risk factor for the neuropathies surrounding the shoulder that are more prevalent in athletes.[7] Men are more likely to develop peroneal mononeuropathy (PM) than women and 14.5% of participants had weight loss as a risk factor, according to data from a multicenter study that was conducted to assess the predisposing variables and their prevalence.[8] Gaining insight into the risk factors associated with focal neuropathies holds significant importance in enhancing patient care, improving diagnostic accuracy, effective risk management and research progress concerning neurological disorders.

The aim of this study was to determine the extent to which intrinsic and extrinsic factors influence the risk of focal neuropathies in a substantial group of patients referred for Electromyography.

Material and Methods

Analytical cross-sectional study design was conducted in Department of Neurology between June 2023 to January 2024. After taking approval from institutional Review board of at King Edward Medical University, Lahore. After the taken approval from Institutional Ethical Committee Ref No 394/RC/KEMU, Dated 18-09-2023. The study included 100 patients in total through purposive consecutive sampling. Patients of age ≥12 years and of both genders were included. Patients clinically diagnosed with common focal peripheral neuropathies were included. Patients suffering from symptoms of polyneuropathy, plexopathy, myopathy, motor neuron disease, or radiculopathy and traumas were excluded. Patients having cardiac pacemaker in-situ and generalized edema were also excluded from the procedure. Control group: Patients without mono-neuropathy/normal limb were taken as controls but were evaluated for intrinsic (age, gender, height, BMI) and extrinsic (diabetes, occupation) factors.

All patients 12 years or older referred for EMG with clinical diagnosed of focal peripheral neuropathies during 08 months at Department of Neurology, Mayo hospital, Lahore were included in the study. The case group included patients diagnosed with a certain type of focal neuropathy. The control group included patients with or without symptoms, but with normal BMI and sugar levels. The demographic characteristics of the patients were recorded after taking their informed consent for the study.

NCS/EMG were performed by routine conventional methods. EDX findings along with history and demographic characteristics were noted on a preplanned pro forma.

EDX procedure was done according to the protocol for individual mononeuropathies.[9] Sensory NCS were performed antidromically. Surface electrodes were used. Median ulnar and radial nerve compound motor action potential (CMAP) were recorded from abductor pollicis brevis, abductor digiti minimi & extensor indicis proprius muscles respectively. Musculocutaneous and axillary nerve CMAPs were taken from Biceps brachii and deltoid muscles respectively. Peroneal & tibial nerve CMAPs were taken from extensor digitorum brevis & abductor

hallucis muscles respectively. All the values were compared with reference values.[9] In the analysis, CMAP or SNAP amplitudes were considered abnormal if they were less than 75% of the reference values.[9] The muscles innervated by the affected nerve were sampled during needle EMG. In needle EMG, MUAPs were analyzed in respect of recruitment, amplitude, duration and polyphasia. When there was a decrease in the recruitment pattern, MUAP was classified as neurogenic.[9] BMI was calculated as (BMI = weight/height^2). For the calculation of Body mass index WHO cut-off points were used[11]. Patients with BMI <18.5 kg/m^2 were considered underweight, BMI = 18.5–24.9 kg/m^2 were considered normal, BMI ≥25.0 kg/ m^2 were considered overweight, and BMI ≥30.0 kg/m^2 were considered obese.

For the evaluation of diabetes normal values of American Diabetes Association (ADA) were used. Patients with blood sugar random (BSR) ≥200 mg/dl were labelled diabetic.

Data analysis was done by using the Statistical Package for the Social Sciences (SPSS) version 25.0. For all quantitative variables such as age and BMI, mean and standard deviation were computed. Meanwhile, for qualitative variables like gender, percentage and frequency were determined. An unpaired student t test was used to compare groups for continuous variables, such as BMI, age and height.

Results

In our study, 100 subjects were included with a mean age of 54.5±9.0. Table 1 presents demographics and outcomes for the entire study group, groups with normal and abnormal EMG findings, and risk factor-based diagnostic subgroups. NCS/EMG was normal in 50 patients (60% women); 50 patients had abnormal EMG findings (64% women). In comparison to individuals with normal EMG findings, patients of both genders had higher BMIs and were older (Table 1).

CTS is most frequently encountered mono-neuropathy (33%). In comparison to the group with normal results, both genders with CTS had higher BMIs (Table 1). Table 2 shows that excessively high BMI was present in the majority of CTS patients, with 13 being overweight, 10 being obese, and 02 having morbid obesity. CTS was more prevalent in women (81.8%). Additionally, the CTS patients were older than the control group (Table 1). The association between diabetes and pregnancy with CTS was also investigated. Twenty patients (60.6%) had diabetes (Table 4), and five of the twenty-seven females (15.2%) were pregnant. The study found that UNE was the second most common neuropathy (20%). Of these, three patients (30%) were female and seven patients (70%) were male. The UNE group's mean age (45.9±10.9) and BMI (23.2±3.70) were not significantly different from those of the control group (Table 1). Only male gender has been linked to an increased risk of UNE. Table 3 shows 20% of UNE patients were diabetic. Repetitive and vigorous motions, as well as consistent posture, were reported by 60% of the patients. It was discovered that radial neuropathy was not associated with gender, age, or BMI (Table 1). Table 1 shows that men were somewhat more likely to have peroneal neuropathy and have high mean BMI (26.6±2.88) than normal subjects, and that age is not a risk factor. Out of three patients one was diabetic (Table 4).

Table 1: *Demographic data for patients with normal and abnormal EMG findings*

Data	Number of subjects	Gender	Age (Years)		Height (cm)	BMI (kg/m^2)
		%	Mean	P value	Mean P value	Mean P value
CASES	50	Males 34.0 Females 66.0	53.9±8.9 P<0.01	171.0±9.9	P<0.01	26.2±4.1 P<0.01
CONTROLS	50	Males 40.0 Females 60.0	50.7±9.7 P<0.01	162.1±9.9	P<0.01	22.9±3.5 P<0.01

Table 2: *Relationship of BMI with different focal neuropathies*

Neuropathy	Total cases	Normal (N=54) Number (%)	Underweight (N=10) Number (%)	Overweight (N=20) Number (%)	Obese (N=16) Number (%)
Carpal Tunnel Syndrome	33	07 (21.2%)	01 (3.0%)	13 (39.4%)	12 (36.4%)
Ulnar Neuropathy at Elbow	10	06 (60.0%)	03 (30.0%)	01 (10.0%)	0
Radial Neuropathy	4	02 (50.0%)	0	01 (25.0%)	01 (25.0%)
Peroneal Neuropathy	3	0	0	02 (66.6%)	01 (33.3%)

Table 3: *Association of age with focal neuropathies*

Neuropathy	Total cases	Age (Years) 18-25	26-35 >45		36-45
		Number (%)	Number (%) Number (%)		Number (%)
Carpal Tunnel Syndrome	33	01 (3.0%)	04 (12.1%)	18 (54.5%)	10 (30.3%)
Ulnar Neuropathy at Elbow	10	03 (30.0%)	03 (30.0%)	02 (20.0%)	02 (20.0%)
Radial Neuropathy	4	01 (25.0%)	02 (50.0%)	01 (25.0%)	0
Peroneal Neuropathy	3	0	01 (33.3%)	01 (33.3%)	01 (33.3%)

Table 4: *Association of diabetes with focal neuropathies*

Diabetes	Carpal tunnel syndrome (N=33)	Ulnar neuropathy at elbow (N=10)	Radial neuropathy (N=04)	Peroneal neuropathy (N=03)
	Number (%)	Number (%)	Number (%)	Number (%)
Yes	20 (60.6%)	02 (20.0%)	01 (25.0%)	01 (33.3%)
No	13 (39.4%)	08 (80.0%)	03 (75.0%)	02 (66.6%)

Discussion

Our study demonstrates that age, gender, and BMI are associated with a large number of focal neuropathies in patients presented for EDX evaluation. Patients having abnormal EMG findings were typically older and had a greater BMI as compared with control. However, there were some notable exceptions. Young men were more likely to have radial and peroneal neuropathies, which are typically brought on by constant posture. Radial neuropathy is unrelated to BMI.

Patients who were obese or overweight had a higher chance of developing CTS. Consistent with some earlier research, BMI was important intrinsic risk factor for CTS in both gender, not just women as many earlier researches had suggested. Obesity is linked to CTS due to adipose tissue accumulation or increased hydrostatic pressure, which compresses the median nerve. The chance of developing CTS increases after the age of 30. This study confirms that CTS is uncommon in individuals under the age of 20, as previously documented by other researchers, as well as age 41-60 as an independent risk factor.[10] Diabetic female patients were more strongly related with CTS. It occurs three times more commonly among diabetics than in the general population. CTS has high prevalence during pregnancy.[11] Hormonal changes, fluid retention, and weight gain may further aggravate or trigger hand and wrist disorders during pregnancy.[12] Diabetes may be the highest risk factor for CTS, also linked with high BMI, which is a known risk factor.[13]

UNE is considered as the second most common occupational upper-limb nerve entrapment, following carpal tunnel syndrome.[14] Our research revealed a relationship between UNE and age, male gender, diabetes which is consistent with finding in a study done by Ashworth NL et al, in 2020.[15] Previous studies revealed that both gender with UNE were older as compared with control but in our study there was no difference in the BMI and Age of UNE patients and control group. Some studies found no association between UNE and age, while others found one in men but not in women. Men were more likely to experience ulnar neuropathies, consistent with previous studies.[16] Men were more likely to have radial and Peroneal neuropathy. Radial neuropathy is typically a 'Saturday night palsy' induced by brief compression while sleeping. Previous research demonstrate that this is an uncommon (0.6%) peripheral neuropathy, caused due to diabetes.[17] our research shows no association of radial nerve entrapment with age, BMI and diabetes. The most common entrapment syndrome in the lower limbs is Peroneal nerve entrapment occurring at the fibula head level. Peroneal neuropathy can result from prolonged squatting or sitting with crossed legs. Previous study indicated one possible risk factor for Peroneal mononeuropathies is weight reduction.[18] But our study is unable to identify any connection between BMI and Peroneal neuropathy.

Conclusion

Focal peripheral neuropathies are not uncommon in our setup but the risk factors often remain under-reported. Common factors which increase the risk are gender, age, abnormal BMI and diabetes. For the purpose of treating and managing different focal neuropathies, it is critical for the physician to comprehend the constitutional risk factors associated with mononeuropathies. While UNE in an elderly patients is unusual, CTS is more likely in woman with higher BMI who complains of pain/tinigling or numbness in the hand. It is crucial to recognize BMI as a key predictive factor for a number of common peripheral neuropathies, not just for diagnosis but also for therapy and prevention. Losing weight may be a reasonable treatment for certain neuropathies, like CTS. If the underlying cause is eradicated, the majority of neuropathies that arise from

biomechanical stress, poor posture, or repetitive performing tasks can be cured.

Conflict of Interest *None*

Funding Source *None*

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Authors Contribution

SB, AN: Conceptualization of Project
ESF, SB: Data Collection
AH, ESF, SB: Literature Search
ESF, SB, AH: Statistical Analysis
ESF, SB, AH, AN: Drafting, Revision
ESF, SB: Writing of Manuscript