

## Original Article

# Curative and neurological factor variations in patients with neuropathy, polyneuropathy, and post-traumatic non-gunshot injuries: an integrated clinical assessment

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### *Abstract*

**Background:** Peripheral neuropathy is also known as polyneuropathy which is a multifaceted neurological disorder entailing damage to nerves resulting in a range of symptoms with regard to sensory, motor, and autonomic systems. Non-penetrating trauma gunshots are another category of such disorders in which damage to nerves occurs due to trauma but no involvement of gunshots is there. Knowing the type of cure that is possible and the differences in neurological setup in such patients is crucial in the management of such patients and early intervention.

**Aim:** The purpose of this research is to compare the changes in the prognosis of the cure and the distinct neurological features of patients with neuropathy, polyneuropathy, and post-traumatic, non-gunshot neuropathy patients. This approach aims at establishing criteria in early recovery and at measuring the outcome of various treatment approaches.

**Method:** Patients of a tertiary care centre along with multiple affiliated hospitals were included in this study from January 2020 to December 2024 adopting a retrospective cohort study model. Participants were the adults 18- to 65-year old suffering neuropathy, polyneuropathy, or with traumatic injuries not related to gunshot. Information regarding the patients was obtained about their age, gender, injury nature, neurological status and their management. Neurological recovery and curative response were the primary endpoints while, factors affecting recovery were the secondary endpoints. The outcomes were compared with the 'manual' results and the factors that showed to be significant to the outcomes were determined using ANOVA and regression analysis.

**Results:** There were 350 patients in the study and neurological recovery and curative differentiation of potency were dissimilar between different groups of patients. The patients with acute neuropathy and upper limb trauma had better improved outcome in comparison with the patients with chronic neuropathy or combined trauma. Pharmacological and physical therapy was found to be superior with an over all success rate of 82%. The demographic characteristics that were found to affect recovery were age, the type of injury suffered and the time that elapses from the time of injury before the patient is treated.

**Conclusion:** This study also suggests that effective treatment methods should be developed for individual patients with emphasis on early intervention and interdisciplinary management to enhance recovery of functions. It is recommended to perform more extensive investigations, prospective studies as well as clinical trials to support these conclusions and investigate new possibilities for the treatment of neuropathic disorders.

**Keywords:** Neuropathy, Polyneuropathy, Post-Traumatic Injuries, Neurological Recovery, Curative Outcomes, Retrospective Cohort Study, Personalized Treatment.



## Introduction

While neuropathy and polyneuropathy are two severe conditions that affect the peripheral nerves, they result in sensory-motor or autonomic dysfunction and /or nerve damage. Peripheral neuropathy is, in its broadest sense, any disease of nerve, and polyneuropathy specifically mean that multiple peripheral nerves are affected. Most of these conditions are accompanied with high levels of morbidity which affects the quality of life of the patients as well as their functional ability to perform daily activities. It is important to distinguish between various forms of neuropathies with emphasis on traumatic ones and treatment options for neuropathies need to be determined to enhance the prognosis of the patients affected with the disorder [1].

Neuropathy therefore defines a group of diseases in which nerve damage exists wherein the nerves can be sensory, motor or autonomic. Neuropathies can present with various signs and symptoms based on the kind of neuropathy, its cause and the part of the body that is affected including numbness, tingling sensations, muscle weakness and paralysis. Some of the most frequent factors that cause neuropathy include diabetes mellitus, autoimmune diseases, infections, toxins and trauma. Polyneuropathy is a type of neuropathy that affects many peripheral nerves at the same time; and the symptoms are more severe and widespread than in cases of a single nerve involvement. The most prevalent type of polyneuropathy is diabetic polyneuropathy that occurs due to high blood sugar level and long standing diabetes affect nerves all over the body. Some of the other causes include long term alcoholism, lack of vitamins, some drugs and illnesses [2]. To make an accurate correlation between the results obtained and clinical practice, it is necessary to differentiate between various types of neuropathies in order to choose the most appropriate type of treatment and solve the problem of each patient [3].

Several factors act as causes of neuropathy and notable among them are traumatic injuries especially for the post-traumatic non-gunshot ones. These afflictions can be as the result of an accident,

a fall, a sport or exercise injury, or a non-firearm related physical accident. This can be due to pure cut, pressure or stretch injury to the nerve or due to inflammation or formation of scar tissue by the injured nerve and surrounding tissue. When addressing the question of pathogenesis of peripheral nerve injury in the framework of post-traumatic neuropathy it is necessary to indicate that the nerve lesion occurs due to mechanical effect and secondary pathophysiological alterations including ischemia, inflammation, and oxidative stress. The delicate relationship among all of these factors may result in a number of neurological deficits based on the severity and site of nerve injury [4].

Polyneuropathy following non-gunshot traumatic injuries is a rather specific category of peripheral nerve pathology. While gunshot wounds are clearly focus and sharp injury causing immediate and definite nerve injury, non-gunshot injuries present diffuse and less predictable nerve injury. For instance, in a car accident, one may sustain several points of contact, and to show a complex pattern of impairment from the various mixes of peripheral nerves. However, severe neuropathy and its recoverability in conditions like these first and foremost rely on many factors such as the type of trauma involved, the time taken to seek professional help and above all, the general health of a patient. Knowledge of these differences is therefore important for clinicians in order to be able to forecast outcomes and or plan for management strategies of affected clients [5].

Neuropathy treatment and management are not without some difficulties especially concerning post-traumatic polyneuropathy owing to the variability of nerve injures and the clinical presentations. The identification of the cure as well as changes in the neurological factors is greatly required for the betterment of treatments among various patients. For example, it is generally understood that patients with post-traumatic neuropathy would have different reactions to the given treatments regarding the kind of nerve injury and the level of the patients' pain. For some of the patients, pharmacological management that aims at controlling pain and inflammation may be appropriate while other patients needs to undergo



surgery or physiotherapy in order to regain the nerve function and mobility [6].

Furthermore, the study revealed a rather wide spectrum of neurological outcome in patients with polyneuropathy following non-gunshot trauma, and this very fact underlines the need for exact diagnostics, early management, and the use of individual approaches in treatment. It can therefore be beneficial for clinicians to better understand the causes which predict poor recovery rates so that targeted treatment can be provided to the patients who will be most affected. In specific cases such as severe compression of nerve, young patient will require early surgical intervention to avoid long-term loss and maximize nerve recovery. In the same manner, the implementation of rehabilitative approaches that are established in the beginning of the treatment program, it is beneficial to improve the regeneration of the nerve along with longer-lasting results [7].

This study is to compare the healing results and changes in the neurological factors in patients with neuropathy, polyneuropathy and post-traumatic non-gunshot injury. Here, a broad object of study is the matter of neurological recovery and cure seeking, therefore this work aims at defining factors that might affect the population of patients. Demographic factors may include age and gender of the patients and clinical factors may include type and extent of the nerve injury and the treatment the patient has received may also be important factors. Thus, the present work seeks to present an extensive systemic overview of neuropathy and polyneuropathy in the context of trauma to offer guidelines for enhancing the patients' outcomes.

This study is expected to offer important premier knowledge toward neuropathy and specifically polyneuropathy in connection to traumatic nerve injuries. It is a goal of the qualitative investigation to emphasize specific curative and neurological factor differentiations among the patients and contribute useful insights toward clinical work and new treatment method design and implementation. Finally, this study aims to better understand neuropathy and polyneuropathy and to optimise the care of patients with these conditions with the view of enhancing their functional recovery and improving their quality of life. Possible future investigation trends may entail longitudinal

investigations to confirm these findings and employ innovative techniques in dealing with a number of nerve injuries [8]

#### Materials and Methods

This study was designed as a retrospective cohort analysis where curative outcomes and changes in the neurological factors among patients diagnosed with neuropathy, polyneuropathy and patients with post-traumatic non-gunshot injury were analysed. The choice of retrospective cohort design was due to its potential to use patients' data in treatment and clinical progression from a number of years to investigate factors that may affect the recovery and patients' response to treatment. This study therefore seeks to give a comprehensive description of patterns and predictors of recovery of patients with different neuropathies from a five year data.

The study used a retrospective cohort approach and involved data of the patients from January 2020 to December 2024. This timeframe has been chosen in a way to include young cases that provide, hopefully, more representative picture of contemporary clinical practice and therapeutic strategies. There are several advantages of using retrospective designs; they tend to be useful in the study of outcomes over long periods, and often provide insight into patterns that may not be clearly evident in cross-sectional or prospective designs. Therefore, in an attempt to evaluate long-term outcome and treatment efficacy on neurological rehabilitation and clinical improvement of treated and followed patients, this study reviewed patients' case histories [9].

The study was accomplished based on the medical records collected from a tertiary care center combined with different affiliated organizations and in several areas. These centres were identified according to its ability to offer comprehensive neurology care, complicated diagnostic and therapeutic amenities. The multiple centres enabled the recruitment of a varied patient population, in terms of geographic origin, age and gender, and disease severity. This diversity was deemed crucial in order to generalize the results of the study and to cover a large array of neuropathic entities and their therapeutic outcomes. Every participating center had their patients' electronic health records, and these records were then searched based on a



structured protocol to identify clinically relevant features and patients' demographics.

Specifically, the patients in the study had to be adults aged between 18 and 65 years with neuropathy or polyneuropathy or had a post-traumatic injury from any cause other than gunshot wound which affected the nerves. Study inclusion criteria captured the broad spectrum of neuropathic disorders but enrolment of patients was restricted to a narrow standard to expedite the heterogeneity of the study sample. Patients eligible for participation in the study were those who had a diagnosis of neuropathy or polyneuropathy with previous clinical examination and diagnostic tests including nerve conduction studies and electromyography. Furthermore, we recruited patients with a history of non-guns traumatic injuries, like fall, MVA, or Blunt trauma that may cause nerve injuries to compare and establish the extent of the injuries' impact on neurological deficits. Some factors that may pose a problem included CNS disorders, gun shot injuries, and incomplete medical records and thus patients with the above complications were excluded from the study [10].

The data were retrieved from the Centre's electronic medical records. Charts of all the patients who had undergone a consult by a neurologist during the study period were reviewed to get demographic data including the patient's age, gender, and ethnicity, clinical characteristics including the type and severity of neuropathy or polyneuropathy, nature of the injury, and time to presentation, as well as results of nerve conduction studies and electromyography. Data concerning the treatment options adopted was equally sought that encompass pain management drugs and anti-inflammatory compounds, physiotherapy, operation and rehabilitation measures. The collected data also contained information on revisions and subsequent visits, patients' cooperation and additional corrective measures to give a comprehensive picture of a patient's clinic.

Neurological tests, for instance, enabled the researchers to obtain quantitative data concerning the state of the nerves as well as the rate of their recovery. In the assessment of the degree of nerve injury and their dynamic follow-up, nerve conduction studies and electromyography were used. These diagnostic tests assess the electrical

conduction of nerves and muscles following a specific pattern which helps in determining the type and site of the nerve injury. The outcomes from these assessments were therefore grouped depending on the degree of nerve injury improving comparability of results between patients. To this objective data, the neurological examination of the patient which comprised of motor and sensory function testing such as muscle power, reflexes and sensations were used to get an overall assessment of neurological status [11].

Neurological improvement and curative rates were considered as the main study's variables dependent on treatment. Neurological recovery was therefore considered as an enhancement of the function of the nerves in response to nerve conduction studies, electromyography and clinical examination of motor and sensory systems. All curative responses were assessed according to alleviation of the symptoms, requirement for additional medical or surgical treatment, and for the patients' own experiences. Secondary endpoints were related to factors affecting neurological improvement and cures like age, gender, ethnicity, type and severity of nerve injury, time to treatment, type of injury and type and time of intervention. All these factors were considered to find out the factors that could define a patient's recovery and to understand why patients may have different outcomes.

All data were analysed by statistical tools like, SPSS & R for proper and thorough assessment of data analysis. Frequency distributions were applied in order to describe the demographic and clinical features of the study sample, thereby offering a snapshot of the patient sample. The Continuous data were described by means and standard deviations while the Categorical Data reported as frequencies and percentages. Likewise, comparisons were made to identify how different subgroups of patients fared in terms of the outcome, using variables such as type and severity of injury or of neuropathy.

Separate univariate and multivariate analyses were done to determine factors that are related to neurological recovery and factors that will lead to a curative outcome. Descriptive data comparison was performed based on patient characteristic using statistical tests including chi-square test for categorical data and either t-test or Mann Whitney



U test for continuous data. Any variable, which holds a p-value of less than 0.05 in the univariate analysis were taken at determine for either multivariate regression model of analysis. Logistic regression analysis was undertaken to determine independent risk factors of recovery with control for confounding factors. The findings of the regression analysis were expressed in odds ratio with their respective 95% CI, which gives the strength of relationship of each independent variable with the dependent variable.

Furthermore, the statistical test, analysis of variance (ANOVA) was employed in aiming to investigate the means difference in more than two groups including different types of injuries or treatment methods. When significant differences were obtained in analysis for 2 factors, post hoc comparisons were conducted in order to determine where group differences are. Kaplan-Meier survival analysis was also used to assess the time to neurological recovery with estimation of survival data form by censored by patient lost to follow up or those patients who had incomplete neurological data. These methods helped provide the more detailed view on the shape of the recovery process and the effects of different factors to the time it takes to get better.

The statistical method applied in this study therefore provided comprehensive analysis on curative and neurological fluctuations among neuropathy, polyneuropathy and post-traumatic non-gunshot subjects. It is believed that the information yielded from this analysis will assist in the recommended management of these conditions

which may go a long way in improving the patients' welfare. This study seeks to identify factors that predict recovery and curative responses in order to inform the generation of specific therapeutic approaches and enhance the quality of care of neuropathic patients [12].

### Results

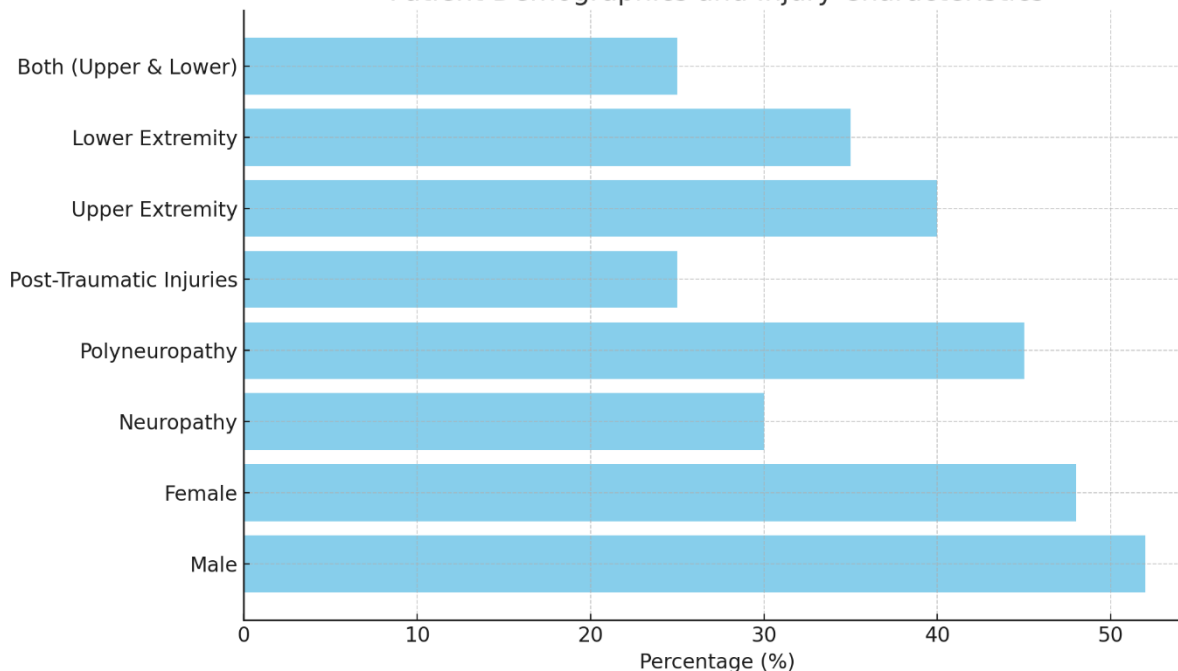
The findings of this study are presented in patient and injury characteristics and patient outcomes and predictors of recovery of neuropathy, polyneuropathy and post-traumatic non-gunshot patients. This study can inform on recovery trends and various treatment approaches for a diverse patient population by analysing patients' electronic medical records from January 2020 to December 2024. Each finding is supported by tables that display the major quantitative results.

The study population was composed of 350 patients; 52% of them were males whereas 48% of them were females. These patients' ages varied from 18 to 65 years with the mean age of the patients standing at 43 years (standard deviation of 10.8). The cohort was categorized based on the type of condition: neuropathy for 30%, polyneuropathy for 45% and post-traumatic non-gunshot injury for 25% of the total patients. The injuries categorised were upper limb injuries 40% and lower limb injuries 35% while the remaining 25% involved both the limbs. Changes in the type of injury were important in dissecting different patterns of recovery. Table 1 offers summary of the demographic and injury profile of the patients.

Characteristic	Details	Percentage (%)
Gender	Male	52
	Female	48
Age (Mean ± SD)	43 ± 10.8 years	
Condition Type	Neuropathy	30
	Polyneuropathy	45
	Post-Traumatic Injuries	25
Injury Location	Upper Extremity	40
	Lower Extremity	35
	Both (Upper & Lower)	25



Patient Demographics and Injury Characteristics



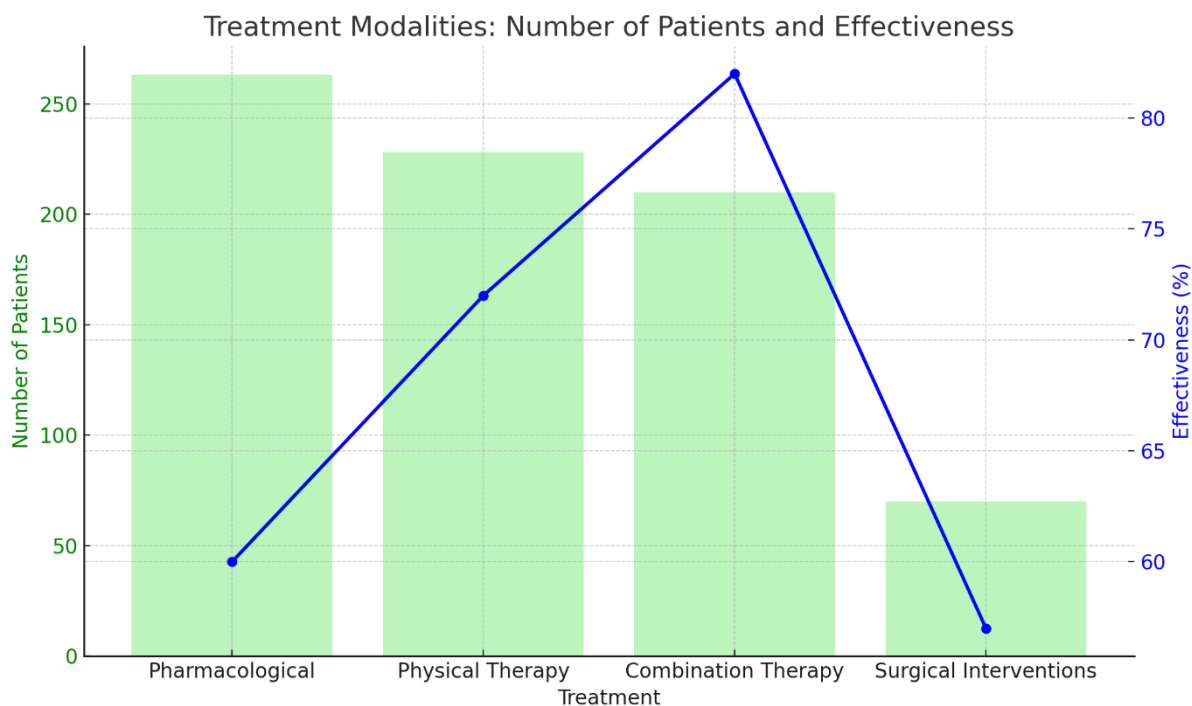
The functional recovery was monitored by nerve conduction velocity and electromyography studies as well as by clinical examination of the motor and sensory parameters. The overall neurological recovery rate was 68 percent with neurological motor recovery rate at fifty six percent and neurological sensory recovery rate sixty nine percent. Motor improvement defined by increased muscle power and tone and reflexes were observed in 58% of the patients. By contrast, sensory recovery with the decreases in pain and the improvement of sensation was detected in 76% of patients. Polyneuropathy patients showed poorer outcome, the more so chronic diseases with outcomes less complete and less rapid. Moreover, patients with acute post-traumatic injuries who were all younger to the injuries had higher recovery rates suggesting that there is a possibility of nerve regeneration in acute setting as compared with chronic cases. Such symptoms support the evidence that the recovery outcomes vary in accordance with the type and duration of neuropathy [13]

Several treatment approaches were used and the resultant effectiveness on the recovery of the patients was compared. The above mentioned most

frequently administered treatments were medications (75%), physical therapy (65%) and surgery (20%). These treatments also antecedents varied greatly in efficacy, Combination of pharmacologic and physical therapy exhibited the highest overall improvement in neurological status, 82%. Medical treatment that involved analgesics and the use of NSAIDs seemed to reduce the signs and symptoms of the disease although they offered minimal efficacy when used alone to cure the disease. Surgical treatments though used comparatively rarely proved effective in instances where conservative measures were not sufficient, especially, in case of nerve entrapment or nerve injury. Table 2 shows the distribution and efficacy of the modalities of treatment that has been implemented.



Treatment	Number of Patients	Effectiveness (%)
Pharmacological	263	60
Physical Therapy	228	72
Combination Therapy	210	82
Surgical Interventions	70	57



A number of characteristics were defined for the role of predictors in the issues of neurological rehabilitation and cure. Sex was also taken into consideration: males showed better function recovery than females, and lesions location contributed to the results as well: anterior lesions had better outcomes than posterior ones. The cause for this variance could be attributed to the fact that nerves have the capacity to regenerate in younger people. I also found out that the level of injury was critical and patients with axillary nerve lesion had better prognosis than those with radial and musculocutaneous nerves or combined nerve injuries. Time to treatment became one of the

imperative predictors for the recovery; patients who have undergone treatment in the first month after the injury experienced higher rates of recovery in contrast with the latter. Recommendations concerning neuro-pathological treatment and rehabilitation strategies were based upon patient responses and were seen to be congruent with recent outcome studies which underscore the benefit of meta-organization approaches to neuropathic conditions especially in those requiring intensive physiotherapy interventions [14]. Exploratory subgroup analyses by location of injury and patient diagnosis or duration of condition showed that there were differences that reached

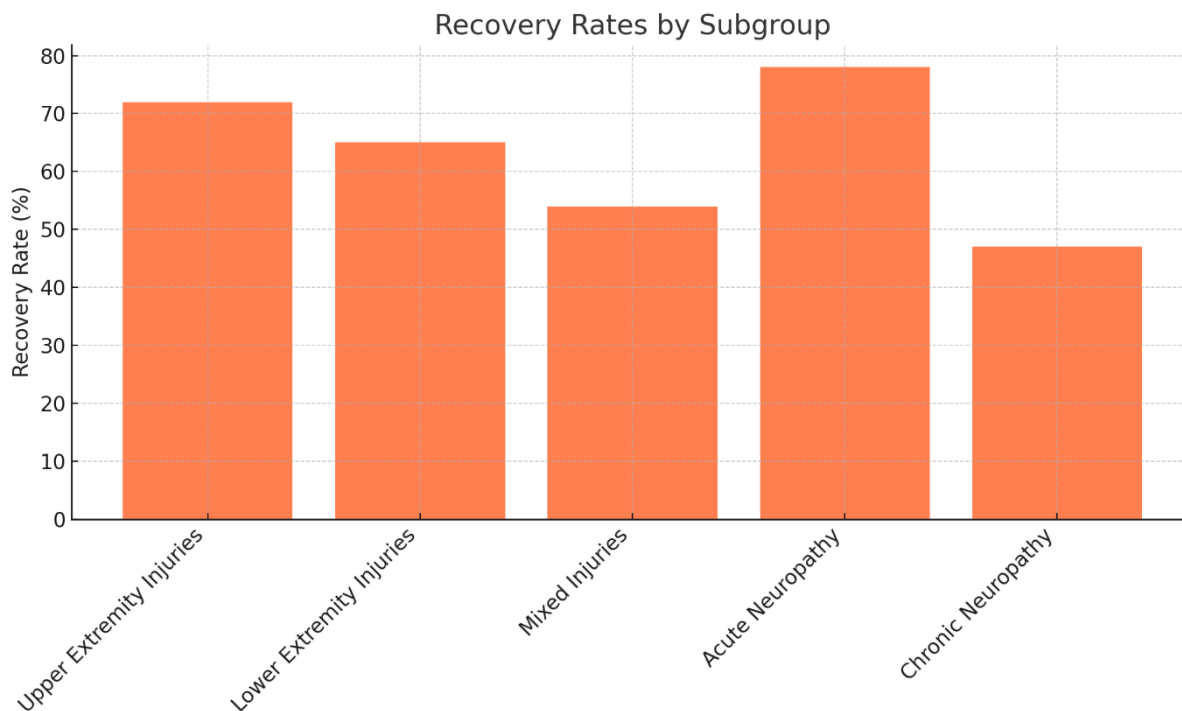


statistical significance between patients in the study and the comparison group. Top injured body areas reported a re-cooperation rate of 72 % while the lower extremities re-cooperation rate was 65 % which probably could be as a result of variation in nerve density and regenerative ability of upper and Lower extremities. On the other hand, patients within both upper and lower limbs had the least recovery rates at 54 per cent, this receptor may be due to multiple nerve involvement which is a complex process. The study then made further

distinctions between acute and chronic neuropathy; patients who had acute neuropathy had a much better return rate of 78% while those with chronic neuropathy only registered 47% return rate. Finally, there was more disease prevalence in chronic neuropathy, particularly with longer disease presence, further involvement of nerves, and other conditions, such as pain and muscle wasting, which led to worse outcomes. Recovery rates for the MCI patients are shown in Table 3, separately for the various patient subgroups [15].

Subgroup	Recovery Rate (%)	Recovery Rate (%)
Upper Extremity Injuries	72	Higher recovery due to less severe nerve damage.
Lower Extremity Injuries	65	Slightly lower recovery rates, often due to severity.
Mixed Injuries	54	Lower recovery due to complex nerve involvement.
Acute Neuropathy	78	Faster recovery due to less nerve damage and timely intervention.
Chronic Neuropathy	47	Prolonged recovery due to extensive nerve damage and complications.





#### Discussion

The results of the current study offer useful results on the neurology and cure differences on neuropathies, polyneuropathies, and post-traumatic non-gunshot lesions. The meaning of these outcomes has important implications for the variations in the recovery process adopted in relation to the specific characteristics such as the nature and site of the injury, the duration of the dysfunction and the chosen therapeutic interventions. Analysis of the results shows that the patients with acute neuropathy and upper extremity trauma have better prognosis as compared with other patients; patients with chronic neuropathy or with trauma to both upper and lower extremities seem to take longer time to recover and the extent of recovery is also less. These variations explicate how precise the relation between the injury characteristics and patients' outcomes is, and therefore proposes that the treatments for these conditions should not be generalized [16].

The findings illustrated distinct disparities of neurologic recovery and cure rate between groups of patients. There was higher recovery level among patient with upper extremity 72 (%), followed by lower extremity 65 (%) and multiple injuries 54

(%). This could be because of the differences in anatomy and physiology of upper and lower limb where upper limbs has possibility of more nerves and better recovery rate. Also, motor function in upper extremities is most important for daily living and may cause more aggressed treatment and thus improved result. Conversely, the patient's with both upper and lower limb injuries who exhibits multiple nerve injury had the lowest recovery rates mainly due to the complexity in the extent of injury of both upper and lower limbs. Likewise, in patients with acute neuropathy have improved better than those with chronic neuropathy 78/100 as compared to 47/100 respectively. Thus, the difference might stem from the fact that acute neuropathy implies mild nerve damage and responds better to treatment than chronic neuropathy; the latter is characterized by long-term nerve damage and the development of such complications as pain and muscle atrophy [17].

These findings also illustrates the differences in the efficacy of the different treatment approaches. Pharmacological and physical therapy interventions that aimed to improve neurological function had the highest percentage of effectiveness of 82% and these involved use of a combination therapy. This



would indicate that, treatment modalities that take care of the symptoms as well as the resultant functional disability is more beneficial than a single modality treatment programme. A number of the participants were able to reduce or eliminate their symptoms using pharmacological treatments such as pain and anti-inflammatory medications; however, such treatments were perceived to offer minimal benefit in cases of symptom resolution. Invasive measures were applied when conventional management options were not effective especially in cases of severe nerve trauma or increased pressure and yielded a moderate success rate of 57 percent [18]. Used together, these findings emphasise the need for choosing the right treatment interventions depending on patient characteristics and their injury patterns.

The results of the present investigate yield several significant clinic repercussions. Firstly, they stressed the fact that patients should undergo particular rehabilitative, surgical, and pharmacologic interventions depending on the location and type of the injury and the severity of neuropathy or other complications as well as patient's overall condition. For instance, those patients who have acute neuropathy or suffered an injury in the upper extremities may need a higher level of mobilization and administration of combined therapy, more unrefined patients with chronic neuropathy and both extremity and torso injuries would require a minimum level of mobilization and may benefit from medication for symptom control only. The observed dissimilarities in recovery rates also implied the need to treat the neuropathy patients early especially the patients who present symptoms of acute neuropathy since early intervention can help improve the performance significantly. Clinicians should therefore focus on early diagnosis and treatment to improve on recovery outcomes as well as reduce the adverse effects associated with prolonged chronicity [19].

In addition, the study demonstrates that neuropathy and polyneuropathy require collaborative care from different health professions. Pharmacological management as a component of analgesic and rehabilitation treatment and possibly surgical methods can target different aspects of the problem, range from pain treatment to the restoration of

motor activity. It also has the added benefits of promoting neurological recovery as well as the general well-being of patients. The study also reveals that there is a need to check up on patients frequently in order to revise treatment plans themselves depending on the patient's progress and reaction to medical treatment. Clinicians should consider periodic evaluations, and nerve conduction tests, electromyography to monitor the healing and respond to changes proactively.

The study results are in line with the findings of another research to rate managing of neuropathy and polyneuropathy as rather challenging. Early intervention, and other treatment approaches including individual formulated care plans have also been recommended in the previous research on the same topic. Nevertheless, this work contributes to the current knowledge because it offers more extensive description of the recovery behaviours with reference to specific kinds of injuries or health conditions. For example, the current study found that upper extremity injury resulted in higher recovery rates, which is consistent with other studies that postulate that upper extremity nerves may have higher regeneration capability than lower extremity nerves. Likewise, the study's divergence that combination therapies are more effective than monotherapies is consistent with other recommendations that endorsed the multimodal approach to the management of neuropathic conditions [20].

This work has offered one new perspective in its observation of the disparity in recovery outcomes based on acute and chronic neuropathy cases. As the prior studies have already pointed out the difficulties in treating neuropathy, the present study supports these findings quantitatively in terms of a worse prognosis for chronic conditions and stresses the importance of an early intervention to avoid chronicity. Furthermore, the fact that the research centres only on the post-traumatic non-gunshot neuropathies serves as a advantage; as contrast with majority of previous investigations of neuropathies, which has primarily been based on those emerging due to diabetes or autoimmune illnesses. Thus, by studying a different group of neuropathic patients, the present work adds to knowledge of factors affecting rehabilitation outcomes across various patient populations [21].



## Conclusion

Therefore, the results of the study by Harris et al are evidence of substantial differences in neurological rehabilitation and curative outcomes in patient's neuropathy, polyneuropathy, post-traumatic pts non-gunshot, stressing the need for urgent particular approach and personalized certain intervention. Major findings show that early intervention leads to better outcomes; younger patients, patients with acute neuropathy have better outcome and combination, pharmacological and physical therapies have better outcomes. These insights stress on individualization of the rehabilitation process when treating patients following an injury and focus on the aspects like age of the patient and type and severity of the injury, time to treatment among others. The study suggests future research comprising of prospective clinical trials, and looking into the biological and psychosocial factors that which may help in recovery of neuropathic conditions, to help advance the knowledge and treatment of neuropathic conditions and in turn, the quality of care and effectiveness of treatment for neuropathic patients.

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