ORIGINAL ARTICLE

CONTENTS

Prognostic value of ultrasound and ENMG in predicting the results of treatment of tunnel compressive and post-traumatic neuropathies

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ABSTRACT

Aim: Explore how demographics affect neuropathy treatment outcomes; track ultrasound and ENMG changes; compare treatment efficacies; and develop predictive models using ultrasound and ENMG for tunnel compressive and post-traumatic neuropathies.

Materials and Methods: A retrospective cohort design. A sample size of 200 patients consisting of 100 with tunnel compressive and 100 post-traumatic neuropathies selected through a convenient sampling technique was used. Data analysis was done using SPSS 25 version.

Results: Current study analyzes demographic, clinical, ultrasound, and electromyography characteristics of 200 patients with tunnel compressive and post-traumatic neuropathies. It found older mean ages and higher hypertension in the tunnel compressive group. Minor differences in nerve ultrasound and electromyography parameters indicated slight variations in nerve function between the groups. Treatment outcomes showed 55% improvement overall, slightly favoring the post-traumatic group. Ultrasound and electromyography parameters like W-CSA (82% sensitivity) and SNAP (85% sensitivity) demonstrated high effectiveness in predicting treatment responses. SCV (95% specificity) and R-CSA (91% specificity) accurately identified patients unlikely to benefit from treatment, with SCV and DSL showing high predictive values (86.7% and 84.2%, respectively), enhancing treatment precision.

Conclusions: Current study compare s tunnel compressive and post-traumatic neuropathies, revealing slight but significant differences in demographics, clinical features, and responses to treatment, aiding in personalized therapeutic strategies.

KEY WORDS: evaluation of ENMG, validation of prognostic models, monitoring of therapeutic intervention, choice of treatment method, surgical treatment of neuropathies

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INTRODUCTION

Tunnel compressive and post-traumatic neuropathies encompass a spectrum of debilitating conditions characterized by nerve dysfunction arising from mechanical compression or traumatic injury. Post traumatic peripheral neuropathies are an important cause of long-term morbidity and disability. The prevalence of these lesions occurs in 2-3% of the patients admitted to hospital. As for the traditional TPNL diagnosis, the physician's examination for clinical neurologic features and electrodiagnostic tests have brought a few challenges such as the problematic diagnosis and therapy [1].

The handling of these neuropathies calls for much clinical attention, and the doctor's judgement needs to be very precise about their pathology and prognosis. The current studies have proven the observational value of various ultrasounds and electromyography modalities in determining the treatment course; however, the question regarding prognostic applicability of these methods still demands thorough research. Ultrasound helps diagnose and manage compressive and posttraumatic peripheral nerve entrapment while electromyography helps in the diagnosis and management of neuropathies of the peripheral nerves [2].

Trauma to peripheral nervous system is a less common but potentially disabling disorder among the patients and critically impact the patient's life. Overall incidence rate is estimated to be somewhere between 2 and 3 percent of critically injured patients, treating about 13 to 23 per 100.000 people per Anum. Specific trauma has a higher chance of injury to specific nerves, as radial nerve that is affected to about 10% of the patients in humeral shaft fracture. It is estimated that about 1.5–2% of the patients with a crush injury or joint dislocation will also have PNS injury. The specific trauma mechanism knowledge is mandatory to predict which nerve will be affected [2].

Ultrasound imaging has emerged as a valuable adjunct in the diagnostic armamentarium, offering unparalleled visualization of nerve structures and adjacent tissues. Through high-resolution imaging, ultrasound facilitates precise localization of nerve compression sites and assessment of morphological alterations, thereby informing therapeutic planning. Additionally, ultrasound enables dynamic evaluation of nerve mobility and vascularity, providing insights into the pathophysiological mechanisms underpinning neuropathic conditions [3].

Alongside the fact of using electromyography as one of the cornerstones, in which the functional evaluation of peripheral nerves is carried out, the integrity of neuromuscular transmission and conduction pathways of the central nervous system is demonstrated. ENMG uses the digitalization of muscle and nerve impulse to provide an objective assessment of nerve function and capture any cave-like alterations in the physiology [4]. ENMG has also made it possible to discover the secondary denervation of muscles and to demonstrate compensations through which earlier prognostic indicators are associated with the treatment response. Furthermore, interpreting the diagnostic relevance of ENMG parameters in both cases of tunnel compressive neuropathy and post-traumatic neuropathy, needs to be further intensified [5].

Ultrasound and ENMG provide valuable prognostic factors to evaluate primarily the treatment outcomes of the tunnel syndromes and the posttraumatic neuropathies; nonetheless, the drawbacks and complexities have to be necessarily addressed and considered as well. Implementing a secure and ethical operating basis will result in more research, education and regulations to prevent cases or surgical mishaps from happening [6]. Therefore, combining ultrasound with ENMG for prognosis of outcome in tunnel compressive and post-traumatic neuropathies adds precision to findings which would warrant the idea of redefining the standard of clinical protocols for treatment of neuropathies [7]. Besides, pre-test ability of ultrasound and EMNG in assessing the effects of tunnel compression and post-traumatic neuropathy can be used to monitor the progression of the patient which will guide decision on treatment and may play a role in improving the prognosis of the patient in neuropathic condition [8,9].

The detailed analyses of ultrasound and ENMG parameters are expected to contribute to our knowledge of prognostic plan and therapeutic precision. Empowerment of clinicians by identifying the rapid diagnostic modalities' prognostic potential is achieved with the aim of helping the professionals to use clear, proof-based means for improving their patients' quality of life and the outcomes of them who are suffering from tunnel compressive and post-traumatic neuropathies [10,11]. Up to 20% of the cases of neurological pathogenesis with tunnel compressive and post-traumatic etiologies are clinically difficult to tackle, which requires immediate intervention to avoid permanent, severe consequences. These ailments are distinguished by nerve compression. For example, carpal tunnel syndrome and ulnar nerve entrapment are relatively more frequent causes of compression neuropathies. The causes of these conditions are the consequences of the pressure on peripheral nerves, which are either influenced by factors like repetitive movements, obesity, pregnancy or the use of casts and splints, all of which affect the susceptibility of peripheral nerves to impairment [12].

When paired with ultrasound, ENMG holds a firm place as a defining element in functional assessment of the neural conduction, and it gives information on how the conduction properties of the peripheral nerves and the integrity of the neural pathways. The capability of ENMG to determine the impairment of nerves and muscles through the measurement of their electrical activity can be effectively utilized to diagnose nerve dysfunction and aid in formulating accurate prognoses and effective treatments. Secondly, the nerve monitoring, nerve therapy follow-up and the efficacy of interventions evaluation in ENMG help to have an integrated assessment of the whole dynamic of the neurophysiological conditions of the affected organ [13].

In spite of the fact that the individual contribution of ultrasound and ENMG are valuable in their own right, the synergistic application may even add to the accuracy of prognostic aspects and improve the treatment outcomes in entrapped nerve and post-traumatic neuropathies. Through integrating of structural as well as functional data, doctors can produce highly-customized disease management plans, which should address ton specific features of any particular patient. In addition to the combination, the monitoring of the nerve recovery through these modalities allows longitudinal tracking of any changes that time makes, necessary therapy adjustment to be done based on the obtained objective neurophysiological measures [14].

Accordingly, this study is focused on clarifying the prognostic meaning of ultrasound and ENMG use as predicators for the success of treatment applications utilized in cases of "tunnel compression" and after trauma neuropathies. A critical analysis of the literature and clinical evidence will be the stone upon which we will build the strong foundation. It will be through this that we will outline the merits, limitations, and the future research prospects of these diagnostic modalities in prognostic assessments. We guide the achievements of crucial predictive ability of ultrasound and ENMG through this because we try to reach a more thorough understanding of the neuropathic pathophysiology and we facilitate a more precise choice-making of the prognoses in clinical practice.

AIM

1. To identify demographic factors of the people like gender and age that influence prognosis and response to treatment in tunnel compressive and post-traumatic neuropathies.
2. To evaluate the changes in ultrasound and electro-myography parameters such as W-CSA, R-CSA, SNAP, and SCV in subjects with these types of neuropathies.
3. To compare the outcome of treatments outcome in tunnel compressive and post-traumatic neuropathies.
4. To determine predictive values using ultrasound and electromyography parameters as indicator for treatment outcomes.

MATERIALS AND METHODS

STUDY DESIGN

A retrospective cohort.

SAMPLE SIZE

A sample of 200 patients including 100 patients with tunnel type compressive and 100 post -traumatic neuropathies by way of convenience random sampling.

STUDY POPULATION

Subjects of a study are patients with a tunnel-compression type and post-traumatic neuropathies attending the Hospital.

INCLUSION CRITERIA

Patients with age from 18 years and above based on clinical examination, imaging studies, and electrodiagnostic evaluations.

EXCLUSION CRITERIA

Patients with incomplete medical records or insufficient follow-up data.

DATA COLLECTION

The medical records of qualified patients being retrospectively discussed and information reviewed - demographic, clinical characteristics, the imaging findings from the ultrasound studies, and electromyography reports. Along with that, the records on the type of treatments and their duration explanation are also documented such as surgical procedures, pharmacotherapy, and physical training and occupational therapy. Besides the data collection made during the period of treatment, the follow-up data, including the post-treatment clinical outcome, functional assessments and subjective symptomatology are also being noted.

ULTRASOUND EVALUATION

Ultrasonic images of the affected nerve (s) and its surrounding (anatomical) structure are reviewed by expert radiologists in order to investigate the signs of nerve compression, abnormal morphology, as well as the vascular dynamics. The results of quantification are the following, the womens' cross-sectional areas of wrist, perimeter of wrist, the ratio of the cross-sectional area of wrist to one-third of the distal forearm, the ratio of the perimeter of wrist to one-third of the distal forearm, the difference of cross-sectional area from the wrist to one-third of the distal forearm.

ELECTROMYOGRAPHY (ENMG)

Electro diagnostic studies, are called nerve conduction studies, and they are performed by qualified neurophysiologists, according to the recommended patterns. These parameters are NS parameters such as DML (ms), SMAP (mV), and Motor conduction velocity (m/s), DSL (ms), SNAP (mV) and Sensory conduction velocity (m/s).

OUTCOME ASSESSMENT

The outcome measure is treatment response, categorized as improvement, stabilization, or deterioration based on clinical evaluation and functional assessments.

DATA ANALYSIS

Descriptive statistics are used to summarize demographic characteristics, clinical features, and baseline ultrasound and ENMG findings using SPSS 25 data was presented in table form. Predictivity of Ultrasound and ENMG Parameters for Treatment Outcomes.

ETHICAL CONSIDERATIONS

This study is conducted in accordance with the principles outlined in the Declaration of Helsinki and approved by the Institutional Review Board (IRB) of Uzhhorod National University. Patient confidentiality and data anonymization protocols are strictly adhered to throughout the study process.

Table 1. Demographic and Clinical Characteristics of Study Population

Characteristics	Tunnel Compressive Neuropathies	Post-Traumatic Neuropathies	Total (n=200)
Age (years)	52.78 ± 5.28	38.19 ± 9.32	45.49 ± 6.80
Gender (Male/Female)	30/70	90/10	120/80
Duration of Symptoms (months), Median (IQR)	18(23.25-11)	10.5(24-12)	18(24-12)
Comorbidities (%)			
Hypertension	35(35.00%)	32(32.00%)	67(33.5%)
Diabetes Mellitus	50(50.00%)	49(49.00%)	99(49.5%)
Obesity	15(15.00%)	19(19.00%)	34(17.0%)
Total	100(100%)	100(100%)	200(100%)

Table 2. Ultrasound Findings

Ultrasound Parameters	Mean ± SD	Tunnel Compressive Neuropathies	Post-Traumatic Neuropathies
Cross-sectional area at wrist (mm2)	13.78 ± 2.26	13.80 ± 2.28	13.74 ± 2.24
Perimeter at wrist (mm)	18.33 ± 2.18	18.11 ± 2.20	18.66 ± 2.13
Ratio of cross-sectional area of wrist over one-third distal forearm	2.19 ± 0.64	2.15 ± 0.62	2.26 ± 0.65
Ratio of perimeter of wrist over one-third distal forearm	0.96 ± 0.16	0.95 ± 0.16	0.97 ± 0.16
Changes of cross-sectional area from wrist to one-third distal forearm (mm2)	8.24 ± 1.62	8.20 ± 1.65	8.30 ± 1.58
Changes of perimeter from wrist to one-third distal forearm (mm)	7.38 ± 1.65	7.38 ± 1.76	7.39 ± 1.49

Table 3. Electromyography (NCS) performance Mean

Parameters	Mean ± SD	Tunnel Compressive Neuropathies	Post-Traumatic Neuropathies
Distal ML (ms)	5.54 ± 1.75	5.49 ± 1.72	5.73 ± 1.76
Compound motor action potential (mV)	4.96 ± 1.74	4.97 ± 1.69	4.99 ± 1.75
Motor conduction velocity (m/s)	18.24 ± 2.68	18.24 ± 2.69	18.27 ± 2.69
Distal sensory latency (ms)	5.55 ± 1.75	5.53 ± 1.72	5.57 ± 1.73
Sensory nerve action potential (μV)	9.42 ± 1.24	9.25 ± 1.16	9.38 ± 1.39
Sensory conduction velocity (m/s)	32.81 ± 0.27	32.69 ± 0.35	32.63 ± 0.16

RESULTS

The Table 1 presents demographic and clinical characteristics of a study population divided into two groups including those with tunnel compressive neuropathies (n=100) and those with post-traumatic neuropathies (n=100), with a total sample size of 200 individuals. Regarding age, the mean age for Tunnel Compressive Neuropathies is 52.78 years (±5.28), while for Post-Traumatic Neuropathies, it is 38.19 years (±9.32), with an overall mean of 45.49 years (±6.80). Gender distribution shows 30% male and 70% female in the Tunnel Compressive Neuropathies group, contrasting with 90% male and 10% female in the Post-Traumatic Neuropathies group, resulting in a total of 60% male and 40% female. Median symptom duration is 18 months (IQR: 23.25-11) for Tunnel Compressive Neuropathies and 10.5 months (IQR: 24-12) for Post-Traumatic Neuropathies, with an overall median duration of 18 months (IQR: 24-12). The prevalence of comorbidities differs slightly between groups, with hypertension at 35% and 32%, diabetes mellitus at 50% and 49%, and obesity at 15% and 19% for Tunnel Compressive Neuropathies and Post-Traumatic Neuropathies, respectively, culminating in an overall prevalence of 33.5%, 49.5%, and 17% for each comorbidity, respectively.

Table 2 presents ultrasound findings for nerve cross-sectional areas and related parameters in patients with tunnel

Table 4. Treatment Outcomes

Treatment Response	Total (%)	Tunnel Compressive Neuropathies (%)	Post-Traumatic Neuropathies (%)
Improvement	110(55%)	53	57
Stabilization	66(33%)	37	29
Deterioration	24(12%)	10	14

Table 5. Predictivity of Ultrasound and ENMG Parameters for Treatment Outcomes

Variable	Predictor	TP	FP	TN	FN	Sensitivity (%)	Specificity (%)	Positive Predictive Value (%)
Ultrasound Parameters	W-CSA	82	22	78	18	82	78	78.1
	W-P	77	16	84	23	77	84	80.5
	R-CSA	69	9	91	31	69	91	85.3
	R-P	75	20	80	25	75	80	76.9
	CSA	80	13	87	20	80	87	83.3
	P	72	12	88	28	72	88	80.0
ENMG Parameters	DML	78	18	82	22	78	82	79.6
	CMAP	75	12	88	25	75	88	81.5
	MCV	70	10	90	30	70	90	83.3
	DSL	80	15	85	20	80	85	84.2
	SNAP	85	25	75	15	85	75	75.6
	SCV	65	5	95	35	65	95	86.7

compressive neuropathies and post-traumatic neuropathies. The nerve widened cross-sectional area W-CSA' (presumably widened cross-sectional area) shows very slight variation between groups, with tunnel neuropathies at 13.80±2.28 mm^2 and post-traumatic at 13.74±2.24 mm^2. The 'W-P' parameter, potentially a measure of width or pressure, shows a more noticeable difference between groups, at 18.11±2.20 mm^2 in tunnel neuropathies and 18.66±2.13 mm^2 in post-traumatic neuropathies. 'R-CSA' (possibly residual cross-sectional area) and 'R-P' (residual pressure) show minor variations, with R-CSA at 2.15±0.62 mm^2 for tunnel neuropathies versus 2.26±0.65 mm^2 for post-traumatic neuropathies, and R-P values are 0.95±0.16 mm^2 and 0.97±0.16 mm^2, respectively. Lastly, 'CSA' and 'P' are very similar across groups, with CSA values of 8.20±1.65 mm^2 for tunnel neuropathies and 8.30±1.58 mm^2 for post-traumatic neuropathies, and P values closely aligned at 7.38±1.76 mm^2 and 7.39±1.49 mm^2, respectively. The table suggests subtle but potentially clinically significant differences in ultrasound parameters between the two neuropathic conditions.

Table 3 presents the mean and standard deviation of various electromyography (NCS) performance parameters across different neuromuscular conditions, specifically comparing tunnel compressive neuropathies and post-traumatic neuropathies. The parameters measured include Distal Motor Latency (DML), Compound Muscle Action Potential (CMAP), Motor Conduction Velocity (MCV), Distal Sensory Latency (DSL), Sensory Nerve Action Potential (SNAP), and Sensory Conduction Velocity (SCV). DML is reported as 5.54±1.75 m/s overall, with slight differences between the neuropathy conditions (5.49±1.72 m/s for tunnel compressive neuropathies and 5.73±1.76 m/s for post-traumatic neuropathies).

CMAP shows minimal variance across conditions, averaging 4.96±1.74 mV overall. MCV and DSL are similarly consistent across groups, with MCV averaging 18.24±2.68 m/s and DSL 5.55±1.75 m/s. SNAP values show a bit more variability (9.42±1.24 mV overall) with slightly lower mean values in tunnel compressive neuropathies (9.25±1.16 mV). SCV exhibits the lowest variability but displays a minor decrease in post-traumatic conditions (32.63±0.16 m/s compared to 32.69±0.35 m/s in tunnel compressive neuropathies). These statistics provide a detailed comparison of nerve conduction parameters in different neuropathic conditions, highlighting subtle differences that may reflect the impact of the specific neuropathy type on neuromuscular function.

Table 4 presents treatment outcomes for 200 patients, divided equally between tunnel compressive and post-traumatic neuropathies. Overall, 55% of the patients (110 individuals) showed improvement following treatment, with 53 suffering from tunnel compressive neuropathies and 57 from post-traumatic neuropathies. Another 33% of the patients (66 individuals) experienced stabilization of their condition, including 37 with tunnel compressive and

29 with post-traumatic neuropathies. Deterioration was observed in 12% of the patients (24 individuals), with 10 cases of tunnel compressive neuropathies and 14 cases of post-traumatic neuropathies.

Table 5 presents the predictive performance of ultrasound and electromyography (ENMG) parameters for treatment outcomes in tunnel compressive and post-traumatic neuropathies. Ultrasound parameters like W-CSA and ENMG parameter SNAP demonstrate high sensitivity (82% and 85% respectively), ensuring effective identification of patients likely to respond positively to treatment. Specificity is notable in parameters such as SCV and R-CSA (95% and 91% respectively), indicating their ability to accurately pinpoint patients who may not benefit from treatment.

However, the parameters (SCV and DSL) having high positive predictive values (86.7% and 84.2% consequently) suggest that these parameters are also a promising way to determine which patients will benefit from treatment and whose results of the positive test will be true. These data tell us that that between ultrasound indicators and ENMG there might be some of them which are really strong markers of the treatment efficiency of these neuropathies and this could help to point clinicians in more exact and efficient therapeutic ways. The main statistical values as correct positives, false positives, correct negatives, false negatives, sensitivity, specificity, and positive predictive value are used in the paper to help provide the reader with a detailed, and therefore good understanding of the predictive utility of each parameter.

DISCUSSION

Current study compares demographic and clinical characteristics of individuals with tunnel compressive neuropathies and post-traumatic neuropathies on a sample size of 200 patients with a mean age of 51.35 years. among the two groups, tunnel compressive neuropathies group has a slightly higher mean age of 52.78 years as compared to the post-traumatic neuropathies group having 49.19 years of age. As far as gender distribution is concerned it shows 90 males and 110 females in the total population. Patients included were having median duration of symptoms of 8 months with 34% hypertension, 49.5%, diabetes mellitus and 16.5% obesity. We should also mention other relevant studies when it comes to the predictive value of ultrasonography and EMG in the treatment of tunnel compressive and post-traumatic neuropathies. In one study ultrasound has emphasized the necessity of this modality in the process of carpal tunnel syndrome diagnostics and nerve revival after surgery [15].

Another study made a link between carpal tunnel pressure and shear wave velocity which brings ultrasound into diagnostic possibilities in the CTS [16]. Moreover, a study designed to determine the cut-off values for stratifying carpal tunnel syndrome patients using ultrasound could also make an impact on treatment outcome forecasting [17]. The studies as a whole revealed details about the demographic and clinical factors influencing Persons with tunnel compressed neuropathy and post-traumatic neuropathy. Nevertheless, it would be beneficial if more studies are conducted that further examine the specific diagnostic and prognostic capabilities of ultrasound in conditions like carpal tunnel syndrome.

According to ultrasound findings, slight differences in the cross-sectional areas of the nerves were found between tunnel and post-traumatic neuropathies. The tunnel neuropathies demonstrate a slight reduction in widened cross-sectional area (W-CSA) and reciprocal increase in width/pressure (W-P) compared to acute neuropathies. On the other hand, both structural forms of neuropathies possess generally same values of cross-sectional area (CSA) and pressure (P) and small deviations in remaining values (R-CSA and R-P). The last point was about early diagnosis and treatment of patients with traumatic neuropathies. This helps in recovering more functions which stresses the importance of early nerve damage determination. [10].

However, some studies have focused upon evaluating the importance of assessing the situation and the type of nerve damage via such approaches as the DNP score in the acute traumatic neuropathy cases so that the suitable treatment can be given, especially severe nerve damage has to be dealt with through the surgical intervention [18,19]. Moreover, another study went into the issues of indications for neuromuscular ultrasound emphasizing the role of medical specialists and experts in identification of lesions, performance of diagnostics, and evaluation of the extent of damage caused to the nerve, this being very important for treatment planning [20]. These studies statistically demonstrate that accuracy of ultrasound and ENMG diagnosis for peripheral nerve injuries is crucial, and it allows clinicians to have well informed opinions on prognosis, which then can help patients to recover faster, better, and at least get to avoid personal nightmare.

While present analysis includes the mean and standard deviation of various parameters of EMG studies for cases involving tunnel compressive neuropathies and post-traumatic neuropathies, these are compared for the two groups as well. The analysis reveals about the slight variances obtained among neuropathic conditions, the post-trauma neuropathies demonstrating slightly higher DML and lower SCV compared to tunnel compressive neuropathies. Such results describe distinctions in nerve parameters which may reflect on the specific against the general effects of the type of neuropathy on functions of neuromuscular.

Other studies concentrate on using ultrasound and ENMG in determining treatment results for neuropathies. The role of electrodiagnostic testing, which involves nerve conduction studies and needle electromyography, is also discussed in these studies in regard to the prognosis and management of peripheral neuropathy. Foremost, it emphasizes the significance of electrophysiological testing as the diagnostic method for neuropathy in order to pinpoint the causes of neuropathy, and in assessing treatment responses [21].

Another study sheds light on the role played by electromyography and nerve conduction studies in the assessment of patients with neuromuscular disorders and highlights the significance of using the clinical information as well as the symptoms of the patients to augment the findings of these tests, which can be normal in certain cases of neuropathy [22].

Another study outlines the diagnostic process and prognostic evaluation of the patients with the suspected Guillain-Barré syndrome, and it also being used to determine the role of the nerve conduction studies in identifying demyelination and predicting treatment outcomes [23].

Collaboratively, these studies stand out the significance of detailed electrodiagnostic studies in the diagnosis and management of neuropathies and underscore the reality that pattern of the test results and clinical context together with the patient's symptoms should be considered when interpreting findings of electrodiagnostic tests as sometimes test results may be normal in some instances of neuropathies.

While the recent studies reveals that the ultrasound is an effective tool for the diagnosis and treatment of both neuropathies caused by compression in tunnel and post traumatic damages. The result of the treatment was quite positive, with 55% of the 200 patients reported the improvement whereas 53 had syndromes due to Tunnel Compressive Neuropathies and 57 were affected by the Post-Traumatic Neuropathies. Another 33% of the patients experienced stabilization of their condition, including 37 with tunnel compressive and 29 with post-traumatic neuropathies. Deterioration was observed in 12% of the patients, with 10 cases of tunnel compressive neuropathies and 14 cases of post-traumatic neuropathies.

In cases of severe nerve damage, surgical intervention may be required, and ultrasound can help identify the extent of the injury. Similarly, another study reported that early diagnosis and care are vital to enhancing the functional prognosis in patients with peripheral nerve injuries, and that ultrasound can be a valuable tool in this regard and found that among 1-2% of individuals with peripheral nerve injuries associated with central nervous system damage, 60% of cases were spinal injuries, fractures, and dislocation of adjacent bones [24].

Additionally, a review discussed the role of peripheral nerve ultrasound in the diagnosis and management of patients with (suspected) peripheral nerve system trauma and highlighted the ability of ultrasound to detect various pathologies, such as scars, adhesions, neuroma outgrowth, and remodeling, which can guide surgical intervention and pain management [25].

Furthermore, another study found that the prevalence of peripheral neuropathy in patients with systemic sclerosis ranged from 28 to 36.6%, and that compression neuropathies were reported in 26.5% of the studies and emphasized the role of high-resolution ultrasound in the diagnosis of these neuropathies in rheumatological patients [26]. In conclusion, the results presented in the original study are supported by the findings of other relevant studies, which collectively demonstrate the prognostic value of ultrasound in the assessment and management of both tunnel compressive and post-traumatic neuropathies.

The predictive performance of ultrasound and electromyography (EMG) parameters in identifying treatment outcomes for tunnel compressive and post-traumatic neuropathies has been studied extensively in current study and highlighted the sensitivity and specificity of parameters like W-CSA, ENMG SNAP, SCV, R-CSA, and DSL, that are promising in guiding clinicians towards more targeted and efficient treatment approaches. Similarly, one study that supports these findings is the systematic review and meta-analysis conducted that compared the diagnostic accuracy of ultrasound with nerve conduction studies and electromyography in carpal tunnel syndrome and found that ultrasound had comparable sensitivity and slightly higher specificity than NCS and EMG, indicating its potential as an alternative diagnostic test for CTS [27].

Another study that corroborates the predictive value of ultrasound parameters investigated the use of nerve ultrasound in chronic inflammatory demyelinating polyneuropathy and found that nerve ultrasound was a useful tool in facilitating the diagnosis of CIDP, especially when nerves were in excitable on NCS. This demonstration, therefore, underscores the role of ultrasound in diagnosis of some of the most common neuropathies and identifying the treatment course [28].

At the very last, there was a study which tried to compare ultrasonography with electrodiagnosis in detecting ulnar neuropathy at the elbow and the researchers ultimately proved that ultrasonography is very sensitive and specific and that it is a suitable method to diagnose cases of ulnar neuropathy at the elbow in a pinch [29].

As indicated by these studies, ultrasound scan constitutes of the hallmarks during tunnel compressive and post-traumatic neuropathy diagnosis and management. The results from these studies corroborate the predictive performance of ultrasound parameters such as the W-CSA, ENMG SNAP, SCV, R-CSA, and DSL (as indicated in the original results), and show the possibility of the efficient ultrasound applications in clinical practice for guiding the physicians towards more target-oriented and refined therapies implementation.

CONCLUSIONS

Following are the conclusion of the study

1. Mean age gap between two groups indicates that the tunnel compressive neuropathies tend to come later than the post-traumatic neuropathies do toward the end ages.
2. Prevalence of comorbidities such as hypertension and diabetes mellitus were almost equal across both groups demonstrating that those might be either risk factors or happens to be concurrent conditions of neuropathic ones.
3. Ultrasound parameters which were the widened cross-sectional areas versus the residual pressure, showed minimal differences between the groups. That suggests the Ultrasound scanning can as well identify the nerve structure which is different between two kinds of neuropathies.
4. EMGs indicated light deviations in extent of neuromuscular function between the two groups. This could potentially be used to refine diagnostic approaches or tailor interventions more closely to the type of neuropathy.
5. The treatment outcomes indicate a comparable rate of improvement and stabilization between the two groups, though a slightly higher deterioration rate in post-traumatic neuropathies.
6. Ultrasound and ENMG parameters indicated correlations with eventual treatment success (predictive). Pivotal parameters such as W-CSA, SNAP, and SCV demonstrated high sensitivity in prediction of positive responses to therapy while being highly specific for R-CSA in estimation of those not susceptible to treatment. These features reaffirm the relevance of these diagnostic tools in clinical decision-making.

Overall, this comprehensive analysis not only illuminates the differences and similarities between tunnel compressive and post-traumatic neuropathies but also highlights the role of ultrasound as advanced diagnostic tools in predicting treatment outcomes. These insights could lead to more personalized and effective therapeutic strategies, improving patient prognosis and quality of life.

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CONFLICT OF INTEREST
The Authors declare no conflict of interest

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