ISSN- 2394-5125 VOL 09, ISSUE 04, 2022

PREVALENCE OF AXONAL DEGENERATION OF THE SURAL NERVE IN PATIENTS WITH MUSCULAR DYSTROPHY

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ABSTRACT

Muscular dystrophies (MD) are a collection of genetically and clinically diverse neuromuscular illnesses that cause skeletal muscle weakening and disintegration over time. Muscles that are predominantly affected, the degree of weakness, how quickly symptoms progress, and when the first symptom appears to vary across the illnesses. Some categories are linked to issues in other areas. The sural nerve is a specific sensory nerve that runs through the leg's calf (sura) portion. It is composed of tibial and common peroneal nerve branches, the tibial nerve's medial cutaneous branch, and the common peroneal nerve's lateral cutaneous branch.

Aim of the study: To estimate the relationship between muscular dystrophy and the happening of sural nerve axonal degeneration.

Patients and method: 47 patients with proven muscular dystrophy (EMG with raised serum CPK enzyme) were engaged in the study. Sural nerve affection was proved by using NCS. Statistical analysis was done to predict the significance of these two conditions.

Results: 19 patients were having sural nerve degenerative changes (significant relationship)

Keywords: sural nerve, muscular dystrophy, NCS, CPK enzyme, axonal degeneration.

INTRODUCTION

Muscular dystrophies are a collection of more than 30 diseases [(1).] Duchenne muscular dystrophy (DMD) usually affects men starting at age four and accounts for nearly half of all cases [(2).] Becker MD, facioscapulohumeral MD and myotonic MD are other somewhat frequent muscular dystrophies, while the limb-girdle MD and congenital MD are a group of multiple – generally ultra-rare – hereditary illnesses. Mutations in the genes, mainly those involved in the production of muscle proteins, cause muscular dystrophies [(3).]

These mutations might be inherited from one's parents or spontaneously during childhood. Muscular dystrophies can be autosomal recessive, autosomal dominant, or X-linked recessive [(4).] Blood tests and genetic testing are frequently used in the diagnosis process. There is no cure for muscular dystrophy or any other illness in the muscular dystrophy family. Several treatments, including gene therapy and antisense medications, are being developed to target the core problem [(5).]

The steroids for decreasing muscle damage, anticonvulsants for regulation of seizures and some muscular activity, and immune-suppressants for preventing harm to the dying muscle cells are among the other drugs utilized [(6).] Some symptoms may be relieved by physical therapy, braces, or corrective surgery, while individuals with breathing muscle weakness may require assisted ventilation. The type of disease determines the outcome [(7).] Many patients with Duchenne muscular dystrophy will eventually be unable to walk, and the condition is linked to a shorter life expectancy. Charles Bell was the first to characterize muscular dystrophy in the 1830s [(8).] The word dystrophy is derived from the Greek words no or un-nourish". The prognosis

varies depending on the kind of muscular dystrophy. Some dystrophies induce gradual muscular weakening and loss, resulting in physical impairment and life-threatening degeneration of the muscles of breathing or heart. Other MDs have little effect on life expectancy and only cause minor disabilities [(9).]

Traumatic, ischemic, inflammatory, toxic, metabolic, hereditary, and neurodegenerative illnesses affecting the CNS and peripheral nervous system include axonal degeneration as a common hallmark (PNS) [(10).] Wallerian degeneration (WD) is a common example caused by traumatic or ischemic damage that separates the neuronal cell body from the axon's distal section. In addition, inflammatory-demyelinating and neuro-degenerative disorders cause WD-like degeneration, which is characterized by axonal transport disruption and the production of massive axonal swelling or spheroids [(11).]Dying-back refers to axonal degeneration that progresses from distal to proximal due to metabolic, toxic, or degenerative illnesses. Axonal degeneration occurs due to the convergence of three mechanisms: decreased axonal transport, mitochondrial dysfunction, and a rise in intra-axoplasmic calcium (Ca2+) [(12).]

The sural nerve is a sensory nerve that runs through the calf portion of the leg [(13).] It consists of tibial and peroneal nerve branches, the tibial nerve's medial cutaneous branch and the common peroneal nerve's lateral cutaneous branch [(14).] The sural nerve goes down the mid-portion of the calf to the ankle, along the skin that extends from the mid popliteal fossa to just beyond the lateral malleolus, then under the malleolus lastly forward along the lateral face of the foot once formed [(15).] The lateral foot and lower ankle skin are supplied with feeling by the sural nerve.

PATIENTS AND METHOD

this study was conducted during the period between February 2018 till August 2018. A total of 47 patients with a range of 15-21 years old were included in this study. They were non-diabetic, with an average weight of 29.8 kg, with no history of previous CNS insults. They were firmly diagnosed with muscular dystrophy using a nerve conduction study and needle EMG with confirmation of concomitant raised serum creatine phosphokinase (CPK) enzyme specific for muscular injury. In addition, MRI was done on all of them to exclude any lumbosacral spine problems.

A Nerve conduction study was done for upper and lower limb sensory and motor fibres to exclude peripheral polyneuropathy. Sural nerve axonal degeneration was a definite diagnosis for 19 patients with muscular dystrophy. Statistical analysis using Q-square analysis using the SPSS program was used to calculate whether there is a significant association between muscle dystrophy and sural nerve degeneration.

RESULTS

This study demonstrates that there was a highly significant concomitant occurrence of myopathic disorder with sural nerve axonal degeneration, in a particular respect, as shown in table (1):

Table (1): show the significance of correlation between myopathy and sural nerve degeneration.

	Sural degeneration	**No sural degeneration**	***P*-value**
Myopathy	19	28	< 0.00001

The chi-square statistic is 160.7083. The *p*-value is < 0.00001. Significant at $p<0.05$ confirming close association, whatever the underlying cause between these 2 entities of diseases.

ISSN- 2394-5125 VOL 09, ISSUE 04, 2022

DISCUSSION

DMD is a deadly neuromuscular illness caused by mutations in the DMD gene, which codes for dystrophin protein [16]. The pathological hallmarks of DMD are muscle weakening and eventual muscle degeneration because of the depletion of dystrophin [17]. Despite accumulating evidence of neurological problems caused by dystrophin depletion, the neuropathology of this disease remains understudied [18]. A characterized axonal degeneration in the phrenic and the hypoglossal (XII) nerves using a quantitative morphological analysis of the nerve sections was investigated thoroughly [19]. The most common cause of death in DMD is respiratory failure. Such findings emphasize the significance of further elucidating the neuropathology of DMD.

Furthermore, these findings emphasize the importance of treating both nervous system dysfunction and skeletal muscle impairments to alleviate this disease. A reduction in the levels of the survival motor neuron (SMN) protein will cause spinal muscular atrophy (SMA), a motor neuron disorder [20]. SMN has been linked to the assembly, splicing, transcription, and RNA localization of uridine-rich small nuclear ribonucleoprotein particles (U snRNPs) in previous research [21]. The cells that showed lowering SMN to the levels seen in SMA patients inhibit U snRNP formation. In Xenopus laevis or zebrafish, enforced suppression of SMN expression prevented embryonic growth. Despite progressing through development under less severe knock-down circumstances, zebrafish embryos showed substantial SMA-like motor axon degeneration [22]. Simultaneously, silencing two other key components in the U snRNP assembly pathway, including Gemin2 and pICln, resulted in the same result. Importantly, injecting pure U snRNPs into Xenopus and zebrafish embryos defective in either SMN or Gemin2 can avoid developmental cessation and motor neuron degenerative changes, respectively [23].

Ethical clearance- Taken

Source of funding- Self

Conflict of Interest – No conflict of interest is associated with this work.

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