ELECTROPHYSIOLOGICAL EVALUATION OF FOOT DROP

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ABSTRACT

Foot drop can be a presentation of many causes. Most of them initially present with same signs and symptoms, e.g. foot drop, numbness over lateral aspect of the leg and dorsum of the foot especially peroneal nerve lesions, sciatic nerve lesions, L5 radiculopathy. It poses a lot of diagnostic problems .No study has been published in local literature to highlight this very important subject .Aim and objective of this study is to highlight the importance of electrodiagnostic studies in predicting prognosis, localizing lesions, pathophysiological changes and monitoring recovery.

Cohort and observational study.

This study was carried out at Armed Forces Institute of Rehabilitation Medicine [AFIRM] Rawalpindi from July 2001 to June 2002.

Nerve conduction studies were performed with MS-6 (MEDLEC) using surface electrodes. Concentric needle electromyography was done using Neuropack electromyographic model MEM-7102K. On the basis of electrophysiological studies out of fifty, thirty patients had axonal while 20 patients had demyelinating lesions. Patients were divided into two groups on the basis of axonal and demyelinating lesions.

In group A out of 30, (n=30) there were 14 (46.64%) and group B out of 20, (n=20) 7 patients (35%) of foot drop were due to peroneal nerve lesions, rest of the patients had L5 radiculopathy, Sciatic nerve lesions, Polyneuropathy and other abnormalities. Electrodiagnostic studies serves as an important tool in localizing the lesion and assessing its severity in different causes of foot drop.

Keywords: Foot drop, electrodiagnostic studies, axonal lesions, demyelinating lesions

INTRODUCTION

Foot drop is a common presentation of many focal or systemic disorders involving peripheral or central nervous system. It can also be a result of systemic causes such as Diabetes Mellitus. Some unusual causes like sitting cross legged for a long time can also lead to foot drop [1].

Foot drop means inability to dorsiflex or evert the foot, [2]. Apart from causing gait disturbances it has got lot of cosmetic implications. Sensory deficits predispose to small ulcers, burns etc.

A myriad of causes can present as foot drop some of which are reversible and in these a lot of functional restoration can be achieved through early evaluation and adequate management.

Although it is usually assumed to be result of involvement of common peroneal nerve, actually it is not the case, a large number of conditions can present with foot drop like L5 radiculopathy, Common peroneal nerve, Sciatic nerve injuries, Polyneuropathy, and similar pattern of weakness due to preferential susceptibility of peroneal fibers [3]. Early on, these lesions exactly look like peroneal nerve lesions with foot drop and numbness over lateral aspect of leg and dorsum of foot. It is here that Nerve conduction studies / Electromyography [NCS/EMG] is of great importance in the localization of lesion, pathophysiology, predicting prognosis and monitoring recovery [4].

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PATIENTS AND METHODS

This was a cohort study expanded over one year {Jul 2001 to Jun 2002} conducted at AFIRM Rawalpindi. A total of 50 patients with clinical manifestations of foot drop without any age or sex discrimination were included.

Inclusion Criteria

All patients with clinical manifestations of foot drop like high steppage gait,anaesthesia over outer side of leg and dorsum of feet and wasting of legs referred to AFIRM were included in the study.

Exclusion Criteria

Patients with foot drop due to upper motor neuron lesions like cereberal palsy (in children}, brain tumours were excluded in the study.

NCS/EMG was performed with MS.6 and Neuropack. 2 using surface electrodes and concentric needle electrodes respectively.

In lower limbs common peroneal, tibial and sural nerves were tested. The sensory and motor conduction velocities, latencies and amplitude were noted and compared with normal values. In some cases of severe common peroneal neuropathy, the peroneal nerve sensory potential remains well preserved. A preserved sensory potential should not exclude a common peroneal nerve neuropathy [5].

Electromyography was done with Neuropack. 2 using concentric needle electrodes. Muscles sampled included Gastrocnemius, Tibialis Anterior, Peroneous Longus, Biceps Femoris (Short Head), Glutei and Paraspinals to analyse insertional activity, involuntary activity and Motor Unit Action Potentials[MUAPs] for amplitude, duration and interference pattern.

Diagnosed cases of foot drop due to various causes were divided in to two groups on the basis of axonal or demyelinating lesions on NCS/EMG studies. If the lesions is predominantly demyelinating, only decreased MUAP recruitment will occur and MUAP morphology will remain normal [6]. In demyelinating lesions, focal slowing across the fibular neck or conduction block seen in peroneal motor study can be used to localize the lesion [7]. Studies were repeated after three months and one year trial of conservative management or surgery. Two groups include Group A and Group B. Patients with axonal lesions were placed in Group A and with demyelinating lesions were placed in Group B. Group A included 30 patients while Group B comprised 20 patients.

Criteria for Classifying Axonal or Demyelinating Lesions

Axonal lesions are characterized by speed of more than 75% of upper limit of normal and

distal motor latency less than 130% of normal whereas demyelinating lesions are characterized by speed less than 75%of lower limit of normal and distal motor latency of more than 130%of normal.

RESULTS

Out of 50, (n=50) 30 (60%) patients had axonal lesions and 20 (40%) patients had demyelinating lesions as shown in the fig. 1 and table-1.

In Group A out of 30, (n =30) there were 14 (47%) patients with peroneal nerve lesions, 12 (40%) with L5 radiculopathy and 4 patients (13%) with sciatic nerve lesions as shown in the fig. 2 and table-2.

In Group B out of 20, (n =20) there were 7 patients (35%) with peroneal nerve lesions 6 patients (30%) with L5 radiculopathy, 4 patients (20%) with sciatic nerve lesions and 3 patients (15%) with polyneuropathy. Detailed etiology is given in the fig. 3 and table-3.

Out of 30, patients (n=30) in Group A 16 patients (53.33%) were males while 14 patients (46.66%) were female as shown in the fig. 4 and table-4.

In Group B out of 20 patients, (n=20) 11 were male (55%) while 9 were female patients (45%) as shown in the fig. 5 and table-5.

In Group A out of 30 patients, (n=30) 29 (96.6%) presented with foot drop, 28 (93%) with high steppage gait, 25 (83%) with anaesthesia over outer side of leg and dorsum of feet, wasting of

legs 12 (40%) and trophic changes 6(20%) as shown in the fig. 6 and table-6.

In Group B out of 20 Patients, (n=20) 19 patients (95%) presented with foot drop, 18 (90%) with high steppage gait, 16 (80%) with anaesthesia over outer side of leg and dorsum of foot, 5 (25) with wasting of legs and 4 patients (12%) with trophic changes as shown in the fig. 7 and table-7.

DISCUSSION

Most of the causes of foot drop are usually traced back to peroneal nerve lesions. But sciatic nerve lesions, L5 radiculopathy and number of other conditions may also present with foot drop and numbness over lateral aspect of leg and dorsum of foot drop. It is here that NCS/EMG is of great importance in the localization of lesion, pathophysiology, predicting prognosis and monitoring recovery.

Axonal lesions are characterized by speed of more than 75% of upper limit of normal and distal motor latency less than 130% of normal, whereas demyelinating lesions are characterized by speed less than 75% of low limit of normal and distal motor latency of more than 130% of normal, axonal lesions are characterized by bad prognosis and surgical options are to be considered. A study carried out by Yeap, Singh and Birch suggested fair results of surgical procedure like tendon transfer [8].

This study was carried out to highlight the importance of NCS/EMG in the diagnosis and management of causes of foot drop. A similar study was carried out by Yilmaz, Oge and associates noted that electrophysiological examination of a new born with peripheral neuropathy with foot drop may provide valuable information about the pathophyiological features of nerve lesions.

Causes of foot drop in my study includes in group A which consisted of axonal lesions, out of 30,{n=30}there were 14(47%)patients with peroneal nerve lesions,12(45%)with L5 radiculopathy and 4(13%)patients with sciatic nerve lesions.

In group B out of 20 (n=20)there are 7 patients (35%)with peroneal nerve lesions, 6 patients (30%)with L5 radiculopathy ,4 patients (20%)with sciatic nerve lesions and 3 patients (15%)with polyneuropathy.

Axonal lesions are characterized by immediate clinical weakness and numbness. Wallerian degeneration takes 4 to 7 days to develop, up to this time distal NCS remains normal. After wallerian degeneration amplitude

Table-1: Type of lesion

Axonal Lesions	60%
Demyelinating Lesions	40%

Table-2: Etiology pf foot drop (Group A)

	Axonal Lesions	30 Patients (60%)
1.	Peroneal Nerve Lesions	14 (47%)
2.	L5 Radiculopathy	12 (40%)
3.	Sciatic Nerve Lesions	4 (13%)

Table-3: Etiology of foot drop (Group B)

	Demyelinating Lesions	20 Patients (40%)
1	Peroneal Nerve Lesions	7 (35%)
2	L5 Radiculopathy	6 (30%)
3	Sciatic Nerve Lesions	4 (20%)
4	Polyneuropathy	3 (15%)

Table-4: Sex distribution (Group A) (30 Patients)

Male	16 Patients (53.33%)
Female	14 (46.66%)

Table-5: Sex distribution (Group B) (20 Patients)

Male	11 Patients (55%)
Female	9 (45%)

Table-6: Clinical presentation (Group A) (30 Patients)

Foot drop	29 patients (96.6%)
High Steppage Gait	28 (93%)
Anaesthesia Over Outer Side of Leg and Dorsum of the Foot	25 (83%)
Wasting of Legs	12 (40%)
Trophic Changes	6 (20%)

Table-7: Clinical presentation (Group B) (20 Patients)

Foot Drop	19 patients (95%)
High Steppage Gait	18 (90%)
Anaesthesia Over Outer Side of Leg and Dorsum of the Foot	16 (80%)
Wasting of Legs	5 (25%)
Trophic Changes	4 (20%)

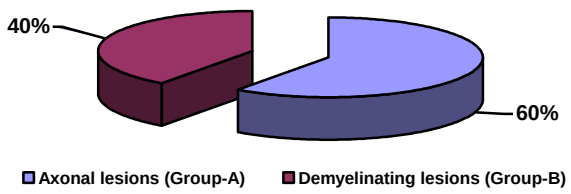

Fig. 1: Type of Lesion

decreases with relative preservation of conduction velocities and distal latencies, but never in the demyelinating range i.e. conduction velocity less than 75% of normal and distal latency 130% of upper limit of normal.

In this study Group A which included patients due to various causes of foot drop, weakness, numbness and high steppage gait persisted after several weeks in 24(80%) of patients. Same was concluded with NCS/EMG findings with decreased MUAP recruitment, abnormal spontaneous activity like positive sharp waves and fibrillations and reinnervated MUAP morphology and surgical management was considered. In a similar study conducted by Scelsa, Berger and colleagues showed that a significantly greater patients with low peroneal Compound Muscle Action Potentials (CMAP) amplitudes had weakness of L5 (P = 0.025) and S1 innervated muscles (P = 0.038). The association of low CMAP amplitude with weakness of at least three muscles was considered in the analysis of L5 (P=0.0001) and S1 (P=0.014).

In a study carried out by Vastamaki 24 patients were reviewed after decompression for peroneal neuropathy. 15(62.5%) were males and 9 (37.5%) females. Mean age was 44 years. Etiology was operation around the knee (50%), a tibial fracture 12 (50%), compression 1 (0.04%) ankle sprain 2 (0.08%), sitting in a cross legged position 4 (16%) and in 4 cases (16%) no reason was found. Immediate relief was obtained in 14 cases (58.33%), slow relief in 10 cases (41.66%) and in 3 cases (12.5%) no recovery.

In a study conducted by Weber and Albert it was concluded that diagnostic sensitivity for needle electrode examination was 90% in cases of L5 radiculopathy [9].

In our study out of 20 patients of demyelinating lesions of group B 15 (75%) patients had good recovery when reevaluated clinically and electrophysiologically at 3 months and 1 year with improvement in gait, weakness, muscle power, anaesthesia over outer side of leg and improvement in conduction velocity and reduction in amplitude with conservative treatment. However 5 cases (25%) had bad recovery and were considered for surgical treatment. Early decompression for compressed nerve root is recommended especially in older

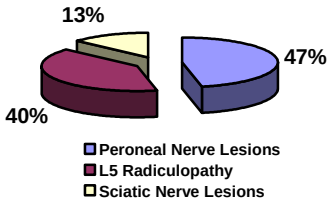

Fig 2: Etiology of Foot Drop (Group A)

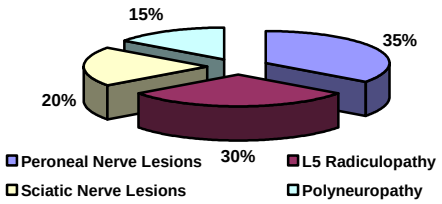

Fig 3: Etiology of Foot drop (Group - B)

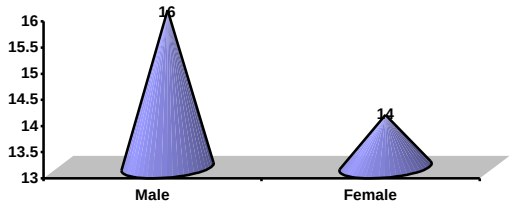

Fig 4: Sex distribution (Group A)

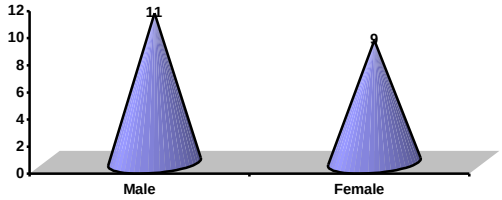

Fig 5: Sex Distribution (Group-B)

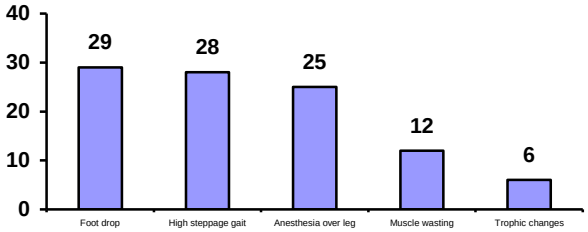

Fig 6: Clinical Presentation (Group-A)

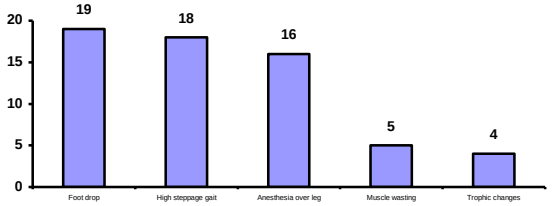

Fig 7: Clinical Presentation (Group B)

patients with severe motor weakness presenting with negative straight leg raising test [10].

Purely relying on NCS/EMG it is difficult to differentiate between axontemesis and neurotemesis, but combining the results of clinical evaluation, radiographic investigations and repeated electrophysiological studies, patients can be managed properly and prognosis ascertained. In a study carried out by Nagel, Greenbaum, and McCann recommended that MRI is highly accurate in diagnosing unusual cases of peroneal neuropathy [11].

The results of the study cannot be generalized since we concentrated on specific group of population i.e. Armed Forces Personnel and their families. Moreover it is very important to realize while utilizing NCS/EMG to understand its physiological limitations, drawbacks and shortcomings.

Foot drop is a very important subject and has devastating consequences upon the patient and results in major disability. Patients who are referred to Rehabilitation Medicine and under went thorough assessment and NCS/EMG studies, their diagnosis and prognosis was much clearer and it was easier to make a rehabilitation plan. A lot of unanswered questions still remain and lot of work still needs to be done before we can grasp the real nature of this important disability.

Nerve conduction studies and electromyography play a central and pivotal role in the evaluation and diagnosis of neurogenic disorders. Electrophysiological studies are an extension of clinical examination and play a key role in the localization of lesion. These studies provide valuable information about the underlying pathology and help to narrow down the differential diagnosis. It can help in planning the management i.e. conservative or surgical. A fair correlation exists between electrophysiological findings and clinical features. In Pakistan introduction and application of this technique is still in developing stage. This can be well gauged from the very little local medical literature available on this subject. More extensive research is needed in this rapidly expanding field to realize its full potential. Electrodiagnostic studies must be carried out in all the patients presenting with foot drop, numbness over the outer aspect of leg and dorsum of foot and high steppage gait to localize a lesion and to devise appropriate management strategies.

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