SPECTRUM OF DEMYELINATING DISEASES A DEMOGRAPHIC, CLINICAL AND LABORATORY PROFILE

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BONAFIDE CERTIFICATE

This is to certify that the dissertation entitled **"SPECTRUM OF DEMYELINATING DISEASES - A DEMOGRAPHIC, CLINICAL AND LABORATORY PROFILE"** is bonafide record work done by **Dr. M. BIRLA PAVALAM** under my direct supervision and guidance, submitted to the Tamil Nadu Dr. M.G.R. Medical University in partial fulfillment of University regulation for DM, Branch I –Neurology.

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DECLARATION

I **Dr. M. BIRLA PAVALAM** solemnly declare that the dissertation titled **"SPECTRUM OF DEMYELINATING DISEASES - A DEMOGRAPHIC, CLINICAL AND LABORATORY PROFILE"** has been prepared by me. I also declare that this bonafide work or a part of this work was not submitted by me or any other for any award, degree, diploma to any other University board either in India or abroad.

This is submitted to The Tamilnadu Dr. M. G. R. Medical University, Chennai in partial fulfillment of the rules and regulation for the award of D.M. degree Branch – I (Neurology) to be held in August 2009.

Place : Madurai **Dr. M. BIRLA PAVALAM**

Date :

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CONTENTS

INTRODUCTION

Demyelinating diseases form a class of disorders characterized by loss or attenuation of the myelin sheath in the relative absence of neuronal loss and it can occur in both in peripheral and central nervous systems.

The myelin sheath provides a high resistance, low capacitance insulation between the sites of action potential electrogenesis, the node of Raniver. It conducts impulses from one node to another in saltatory manner and therefore its loss is accompanied by significant conduction abnormalities.

The demyelinating diseases have been subdivided by various authors in a variety of ways. One such classification is as follows.

DISEASES OF MYELIN

Autoimmune

Acute disseminated encephalomyelitis

Acute hemorrhagic leukoencephalopathy

Multiple sclerosis

Infectious

Progressive multifocal leukoencephalopahty

Toxic / Metabolic

Carbon monoxide

Vitamin B12 deficiency

Mercuty intoxication (Minamata disease)

Alcohol / tobacco amblyopia

Central pontine myelinolysis

Marchiafava-Bignami syndrome

Hypoxia

Radiation

Vascular

Binswanger's disease

Hereditary Disorders Of Myelin Metabolism (Dysmyelinating)

Adrenoleukodystrophy

Metachromatic leukodystrophy

Krabbe's disease

Alexander's disease

Canavan-Van Bogaert – Bertrand disease

Pelizaeus – Merzbacher disease

Phenylketonuria

REVIEW OF LITERATURE

Multiple sclerosis has been the subject of study by workers all over the world. It is caused by an inflammatory demyelinating process in the CNS. More than 250 prevalence surveys have been carried out serving as the basis for the delineation of geographical risk for MS.

High frequency areas of the world, with the current prevalence of 60 per 100,000 or more, include all of Europe, Southern Canada, the Northern United Status, New Zealand and Southeast Australia.

Medium frequency areas of 5 to 25 per 100,000 comprise most of Australia, the Southern US, the Mediterranean basis and white population of South Africa.

Low risk areas of less than 5 per 100,000 include most of Asia and all of Africa.

One possible conclusion is that MS is a location related illness, with a latitude gradient with some notable exceptions like Japan.

S.No.	***Country***	***Latitude***	***Prevalence***
1.	Iceland	65 N	78.5
2.	UK (Shetlands)	61 N	129
3.	Canada	50 N	30
4.	Yugoslavia	45 N	43.7
5.	Japan	44 N	2.5
6.	France	43 N	39.6

7.	USA	42 N	41
8.	Spain	39 N	17.2
9.	Greece	40 N	38
10.	Algeria	37 N	10
11.	Malta	36 N	4
12.	Asia	36 N	3
13.	Israel	32 N	9.5
14.	Kuwait	30 N	9.5
15.	Hong Kong	23 N	0.8
16.	Bombay	19 N	26

Review of previous Indian literature on MS indicated that MS comprises 0.05 to 1.5% of the total neurologic inpatients. On an average, 1.6 to 5.4 new cases of MS are seen at various centres per year (Jain and Maheswari et al 1985).

However two epidemiological studies among Parsis living in Bombay & Pune found a crude prevalence of 21 cases per 100,000 parsis in Bombay and 58 per 100,000 in Pune (Bharucha et al 1988, Wadia et al 1990).

Previous Indian literature on MS showed male preponderance in most series, the mean age at onset in third and early fourth decade.

When compared to MS in Western countries, the Indian cases show a relatively high incidence of optic nerve involvement both at onset and during the course of disease (Jain & Maheswari et al 1985). Neuromyelitis optica is also seen frequently. Neurological manifestations are protean being determined by varied location and predilection for certain portions of CNS resulting in complexes of signs and symptoms and radiological appearance that can often be recognized as

characteristic of MS (Olliver et al 1824). Cruveitier published gross pathological descriptions of MS together with clinical case descriptions. Pierre Marie was the first to suggest on infectious cause of MS in 1884, a hypothesis that is still debated. Toxins were also considered to be responsible in the early 1900s. A major advance towards understanding of demyelinating disease was discovery of experimental. Allergic Encephalomyelitis (EAM) by Rivers in 1955.

All high and medium risk areas are predominantly white population and MS is the white man's burden. Aside from geography, age, sex and race risk factors for MS include, high socio economic status and urbanization atleast in some series (Kurtzke et al 1991).

Evidence that genetic factors have a substantial effect on susceptibility to MS is unequivocal (John et al 2000). Migrant studies indicate that on the whole, the migrants retain the risk of their birth place. The migration data plus the geographic distribution and clustering serve to define MS as an acquired, exogenous, environmental disease and one that is ordinary acquired in adolescence with a long incubation period before the onset of symptoms. Female to male ratio is 1.5 : 1 in many studies.

MS in India has low prevalence. However recent epidemiological studies indicate that atleast in some parts of India, there is higher prevalence.

No.	*Region*	*Study*	*M.S*	*Devics*	*Autopsy proven*
1.	Bombay	Singhal 1957-86	127	14	2
2.	Chandigarh	Chopra 1968-77	38	5	3
3.	Delhi	Ahuja & roy 1973-79	18	-	1
4.	Vellore	Mathew 1965-70	17	-	-
5.	Bangalore	Gouri devi & Nagaraja 1961-80	42	8	1
6.	Andhra Pradesh	JMK murthy & MVR Reddy 1979-85	26	6	-

Clinically definite MS as a percentage of total neurological admissions to various hospitals has varied from 0.22 in vellore (Mathew), 0.32 in Delhi (Verma), 0.4 in Bombay (Singhal), 0.6 in Chandigarh (JS Chopra), 0.68 in Andhrapradesh (Murthy) 0.35 in Karnataka (Gauri devi & Nagaraja).

Male preponderance was noted in majority of the series from India (Chopra et al 1980, Gourie Devi & Verma). However female preponderance was noted in one series from Bombay (Singhal et al 1987). Opticospinal and optico spino brain stem forms were the forms seen in India and other Asian countries (Chopra, Gouri, Singhal, Stibastic 1985).

The precise cause of MS is still not known. We also don't know the reasons for the rare occurrence of MS in India and other oriental countries.

The explanation may lie in genetic or environmental features or both. Milton Alter et al 1977 has suggested that in countries with low prevalence of MS, viral and bacterial infection are more frequent and people are more exposed to these at early age which provide them with effective immunity that reduces their risks of acquisition of MS from a latent infection.

S. Bansil, B.S. Singhal et al 1996 studied the various aspects of M.S. and compare it with US patients.

Region involved	***Parameter***	***India***	***US***	***P value***
Cerebral	MRI	58/66	92/99	NS
Spinal	MRI	17/38	19/34	NS
	Clinical	71/81	96/06	NS
Optic	VEP	60/72	34/56	< 0.005
	Clinical	68/71	62/106	< 0.0002
Brain stem	MRI	22/66	34/98	NS
	BERA	11/64	10/47	NS
	Clinical	44/81	71/100	NS
Cerebellum	MRI	11/66	20/98	NS
	Clinical	37/81	54/106	NS

This implied visual symptoms both by VEP and clinical criteria was more frequent in Indian patients. NMO variant was more reported to be more common in Indian patients as well as oriental Asian population. (Shibusaki et al 1978).

Diagnostic Criteria :`

Jean – Martin charcot, in 1868, first proposed nystagmus, intention tremor

and scanning speech and Otto Marburg, in 1936 proposed Ulthoff sign, negative abdominal reflexes and pyramidal signs as diagnostic criteria which are now obsolete.

The criteria by Sydney Allison and Harold Millar et al in 1954, Schumacher et al in 1965 and Mc Aplane et al in 1972 are also not in use now.

Poser et al in 1983, proposed a criteria as follows.

Category	***Attack***	***Clinical evidence***		***Para clinical***	***CSF OCB / IgG***
Clinically Definite MS					
CDMS A1	2	2			
CDMS A2	2	1	and	1	
Lab supported MS					
LSMS B1	2	1	or	1	+
LSMS B2	1	2	and	-	+
LSMS B3	1	1	and	1	+
Category	***Attack***	***Clinical evidence***		***Para clinical***	***CSF OCB / IgG***
Clinically Probable MS					
CPMS C1	2	1			
CPMS C2	1	2			
CPMS C3	1	1	and	1	
Lab supported probable MS					
LSPMS	2				+

Revised McDonald et al (2005) diagnostic criteria for multiple sclerosis is as

follows.

Clinical (attacks)	*Objective*	*Additional requirement*
2 or more	2 or more	None
2 or more	1	Disemination in space by MRI or 2 or more MRI lesion consistent with MS plus positive CSF or await further clinical attack implicating other size
1	2 or more	Dissemination in time by MRI or second attack
1	1	Dissemination in space by MRI or 2 or more MRI lesions consistent with MS plus positive CSF and Dissemination in time by MRI or second attack
0 (Progression from onset)	1 or more	Disease progression for 1 year and 2 out of 3 of the following 1)Positive brain MRI (9T2 lesions or 4 or more T2 lesions with positive VEP) 2) Positive spinal cord MRI (2 or more focal T2 lesions) 3) Positive CSF

Clinical features :

Posner et al (1995) proposed definitive symptoms lasting for atleast 24 hours

and possible symptoms which must be followed by definite symptoms within 2 years in order to be onset of markers. Clinical features suggestive of MS are, onset between ages 15 and 50, involvement of multiple areas of CNS, optic neuritis, Lhermitte's sign, inter nuclear ophthalmoplegia, fatigue and worsening with elevated body temperature. Onset before 10 and after 60, involvement of PNS, hemianopsias, rigidity and sustained dystonia, cortical deficits such as aphasia, apraxia and neglect, deficit developing within mints and early dementia are clinical features not suggestive of MS. Initial symptoms by Weinshenker et al (1989) in their study of 1096 cases included optic neuritis 17.2%, sensory 45.4% motor 20.1%, Diplopia 0.9% and cerebral 13.2%.

Pathology :

John et al (2000) found that MRI and MRS may be helpful in characterizing the underlying pathological process in MS. Changes in number and volume of lesions in T2 MRI are sensitive but nor specific markers of disease activity and response to treatment, Miller et al 1998. The pathological hall mark of MS is the cerebral or spinal plaque which often have a hard or rubbery consistency and small size (1 to 2 cm) but confluent plaque can also occur. Histological examination reveals perivascular infiltration of lymphocytes, especially T cells and macrophages with occasional plasma cells. The fate of oligodendroglia in MS lesions is disputed, Consensus opinion is that it is reduced at plaque centre and

preserved or increased at periphery. Pathologically types I & II appear to be mostly inflammatory with retention of active oligodendrocytes in comparable to types III & IV which are mainly necrotic. Recent pathological studies demonstrate that the extent of remyelination can be quite extensive, even in patients with progressive disease. (Patrikios et al 2006).

Course :

Relapsing remitting, secondary progressive, primary progressive and progressive relapsing are four clinical patterns of MS. Reenmaker and Anderson et al 1993 found that 66% at onset had relapsing and remitting, 15% relapsing and progressive and 19% progressive at onset and in follow up for 25 years, 80% become progressive and 15% died.

Investigations :

Palace et al 2001, proposed that MRI, Evoked Potentials and CSF Oligo Clonal Bands are 3 main investigations. The white matter lesion seen on the imaging correlate well with macroscopic plaque pathologically Ormeod et al 1987.

Gadolinium enhancement is seen with new early active lesions due to Blood Brain Barrier disruption and it usually lasts for 4-6 weeks. T1 black holes correlate with tissue destruction including loss of axons, Van walderveen et al, 1997.

Patey et al 1977, proposed 3 or more T2 hyperintense lesions with one

bordering lateral ventricle to diagnose MS. A positive MRI in revised criteria by Mc Donald et al 2005, include three out of four of the following.

1. One Gd-enhancing brain or cord lesion or nine non Gd-enhancing brain or cord lesion in T2 MRI
2. One or more brain infratentorial or cord lesions
3. One or more juxtacortical lesions
4. Three or more periventricular lesions.

EVOKED POTENTIALS

VEP

Delayed but well preserved wave form is positive VEP. Of 744 patients, reported to have no history or clinical findings of optic neuritis, 51% had pattern shift VEP abnormalities ranging from a high of 93% (Halliday et al 1973) to a low of 34% (Purves et al 1981.)

Chiappa in 1997 showed BAEP abnormalities in 67%, 41% and 30% patients of definite, probable and possible MS patients and SEP in 77%, 67% and 49% patients respectively.

CSF

The frequency of abnormal Oligo Clonal Bands in definite MS was 90%, in isolated MS was 50%, in transverse myelitis was 30% and in normal control was 2% - Andersen et al 1994.

Acute Disseminated Encephalo Myelitis (ADEM)

It is a demyelinating syndrome that occurs in association with an immunization or vaccination. The clinical presentation more common in children include, simultaneous bilateral optic neuritis, loss of consciousness, loss of Deep Tendon Reflexes and retained abdominal reflexes in presence of babinski's sign, central body temperature of greater than 100^{o} F and severe shooting limb pains.

A feature of ADEM is that majority of the T2 lesions show enhancement suggesting they are of recent onset, consistent with a monophasic illness. Hurst, first postulated the immune response invoked by neural tissues in brain. In 1935, Rivers and Schwantker inoculated monkeys with normal brain tissue and produce Experimental Allergic Encephalitis which is the prototype experimental autoimmune disease. In recurrent ADEM, stereotyped features follows the partial or complete recovery. In multiphasic ADEM, differing symptoms occur and serial MRI is needed to distinguish this. Lesions of ADEM tend to resolve during follow up, complete resolution in one thirds and partial in others (Hynson and Dale et al)

A comparison of 3 major case series of ADEM is as follows

Factor	***Hynson (2001)***	***Dale (2000)***	***Schwartz (2000)***
Age	2 – 16	3 – 15	19 – 61
Prior inf %	77	74	76
Prior vaccine	2/31	2/28	-
Disease evolution	1-42 days	0-31 days	0-14 days
Headache %	45	58	Not given
Fever %	52	43	15
Meningism %	26	31	15
Altered sensorium%	68	69	19
Optic neuritis%	13	29	Not given
Cranial nr palsies%	45	51	Not given
Pyramidal signs %	23	71	77
Sensory deficits %	3	17	65
Ataxia %	65	49	38
Aphasia %	26	0	8
Seizures %	13	0	4
Extrapyramidal %	0	2	0
CSF pleocytosis %	62	64	81
OCB%	3	29	58
MRI white matter %	90	91	
MRI periventricular %	29	44	54
Thalamus %	32	41	15
Basal ganglia %	39	28	Not given
Brain stem %	42	56	57
Spinal cord %	16	28	Not given
Corpus collosum %	29	Not given	23
Gd enhancement %	90	11	71
Follow up MRI	25% Normal 75% decrease in size of lesion	37% normal 53% partially improved 10% unchanged	26% Normal 55% partially resolved 15% new lesions

In NIMHANS study, during the period Jan 1997 – 2003, mean age of presentation was 22 years and 50% were less than 15 years old. Non specific

infection was the commonest antecedent event. Gray matter involvement was common (89%). Mortality was 16% and causes of death were bronchopneumonia, sepsis and autonomic dysfunction and children had better prognosis than adults.

GUILLIAN-BARR`E SYNDROME

The term GBS defines a recognizable clinical entity that is characterized by rapidly evolving symmetrical limb weakness, loss of tendon reflexes, mild or absent sensory signs and variable autonomic dysfunctions. It has become the leading cause of acute flaccid paralysis after the eradication of poliomyelitis from many countries.

In 1859, Jean Baptiste Octave Landry described this entity as acute ascending paralysis.

In 1916, Guillain, Barre and Strohl emphasized the main clinical features of GBS as motor weakness, areflexis, paresthesia and minor sensory loss and albumino cytological dissociation in CSF. In 1956, Fisher's syndrome was described. Young et al in 1975, described acquired dysautonomic features in GBS. In 1990 Asbury and Cornblath proposed a laboratory and clinical criteria for GBS.

Incidence was 4 per lakh population as per Kaplan et al. In 1992, Ropper et al (Massachusether General Hospital study) reported the mean age of occurrence of GBS was 39 years with bimodal peak in 16-25 years and 45-60 years, Dowling

et al in their study found no seasonal cluster.

Antecedent illness was found in two thirds of cases which were preceded by average of 11 days in MGH study.

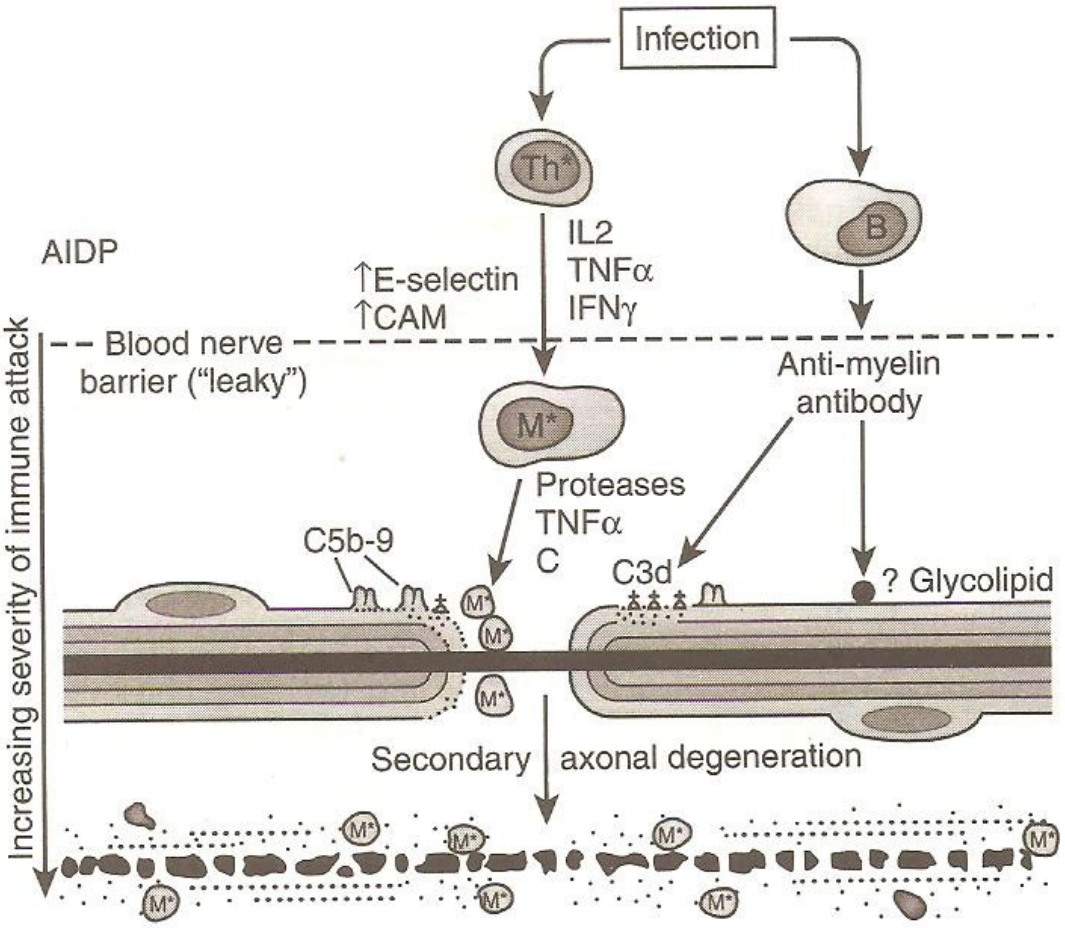
Rabies, BCG, T.T, influenza, measles, mumps, rubella hepatitis B and polio was found to be antecedent illness by Applebaum et al 1953, 1994. Serological evidence of campylobacter was found in 38% to 0% as per Kalder and Spend et al 1984 study.

Pathogenesis :

The bulk of experimental and clinical evidence suggests that GBS is an organ-specific, immune-mediated disorder caused by a synergistic interaction of cell mediated and humoral immune response to still incompletely characterized peripheral nerve antigens (Kieseier et al, 2006).

At the onset of disease, activated T cells play a major role in opening the blood nerve barrier to allow circulating antibodies to gain access to peripheral nerve antigens. T-cell activation markers (interleukin-6, interleukin-2, soluble interleukin-2 receptor, and interferon) and TNF- α, a proinflammatory cytokine released by T cells and macrophages, particularly IL-23 (Hu et al 2006), are increased in patient serum.

Diagram showing Mechanism of immune injury to nerve fibres in AIDP



Several observation indicate that humoral factors also participate in the autoimmune attack on peripheral nerve myelin, axons, and nerve terminals : 1) immunoglobulins and complement can be demonstrated on myelinated fibers of affected patients by immunostaining ; 2) MFS and AMAN are strongly associated with specific antiganglioside antibodies ; 3) Serum from MFS and AMAN patients contain IgG antibodies that block neuromuscular transmission in a mouse nerve-muscle preparation ; 4) complement C1-fixing antiperipheral nerve myelin

antibody can be detected in the serum of patients during the acute phase of GBS ; 5) Intraneural injection of GBS serum into rat sciatic nerve results in secondary T cell infiltration of the injection site at the time of the appearance of the hind limb weakness, and 6) Plasmapheresis or immunoglobulin infusions result in clinical improvement.

Certain C. jejuni strains associated with axonal GBS and MFS variants contain GM like epitopes in their polysaccharide coats. Anti GM and GQ1b antibodies that cross react to these lipopolyaccharide epitopes are found in a high proportion of patients with AMAN and MFS and some patients with GBS.

The antiganglioside antibodies obtained from AMAN and MFS patients block neuromuscular transmission in an in vitro nerve muscle preparation. The blocking activity of these IgG antibodies can be neutralized by intravenous immuno globulin (Buchwald et al 2002). Furthermore, rabbits immunized with GM, develop AMAN, thereby fulfilling the postulates for confirming an autoimmune pathogenesis (Sheikh and Griffin, 2001).

Clinical features :

In typical GBS, Ropper et al 1992 found weakness in 60%, paresthesia in 80%, both in 30%, areflexis in 70%, hyporeflexis in 30% of patients.

The pattern of weakness noted by Ropper et al 1992 was ascending in 54%, descending in 14% and equal in 32%.

Anderson et al in 1982 noted ascending pattern in 43%, descending pattern in 5% and equal in 28% and in Ravn et al 1967 study it was ascending in 37% and descending in 4%.

The reflex loss by MGH series was 62% at the time of admission, 98% with absent ankle jerk and 80% with absent knee jerk.

Winer et al in 1988 noted that maximum deficit was reached by 34 percent within 7 days, 70% within 14 days and 84 % within 21 days. Deteroriation stopped by one month in 92% patients, 4% progressed further upto 44 days.

Dysautonomia was more frequent in patients with severe motor deficits. Sustained sinus tachycardia and vagal mediated arrhythmia are among the most common cardiac complications. Davis Dingle et al, in 1972 found hypertension in 5-61%, hypotension in 5-57%. They also noted quadriplegia, respiratory failure and involvement of cranial nerves IX and X were associated with orthostatic hypotension.

Diagnostic criteria for GBS

Diagnostic criteria for GBS modified from AK Asbury, DR Comblath is as follows.

Required :

1. Progressive weakness of 2 or more limbs due to neuropathy
2. Areflexia

3. Disease course < 4 weeks
4. Exclusion of other causes (eg. Vasculitis (PAN, SLE), toxins (Organophosphates, lead), botulism, diphtheria, prophyria, localized spinal cord or cauda equine syndrome.

Supportive :

1. Relative symmetrical weakness
2. Mild sensory involvement
3. Facial nerve or other cranial nerve involvement
4. Absence of fever
5. Typical CSF profile (acellular, increase in protein level)
6. Electrophysiological evidence of demyelinations

Variants of GBS :

The connections between these syndromes and GBS is based on i) a close resemblance to portions of typical GBS ii) overlap between typical GBS and variant syndromes. iii) laboratory findings that confirm the diagnosis of GBS particularly raised CSF protein and electrophysiological abnormalities. iv) exclusion of other more common causes of variants. Variants have been described based on topography of deficits, clinical course, fiber type involved, pathology and electrophysiological criteria as follows.

Topographic variants :

Miller Fisher Syndrome (MFS)

Pharyngo cervico brachial weakness

Paraparetic form

Unusual forms

Fiber type variants

Pure motor

Pure sensory

Dysautonomia

Clinical course variants

Recurrent GBS

Subacute Inflammatory Demyclinating polyneuropathy

Pathological variant

Axonal

Immunological variants of GBS

Miller Fisher Syndrome – Anti GQ lb Ab

AMAN - Anti GM 1, anti GM 1b, anti GD 1a

ASAN - Anti GD 1b

NINCDS criteria for variants of GBS include

1. Fever at the onset of neuritic symptoms
2. Severe sensory loss with pain

3. Progression beyond four weeks
4. Sphincter involvement
5. CNS involvement
6. Sensory level
7. Very poor recovery

Miller Fisher Syndrome :

It constitute 5% of all cases of GBS and C-Jejuni is the most common trigger. Diplopia is the most common initial symptom and ataxia occurs on day 3 to 4 and hyporeflexia or areflexia usually occurs at end of first week. MFS pathophysiology is a subject of debate, peripheral hypothesis was put forward by Ropper et al in 1983 and central hypothesis by Aldin et al in 1982.

Pharyngeal Cervical Brachial Variant :

It is characterized by areflexia and abnormal electrophysiological findings confined to upper limbs with normal power and reflexes in legs and antibodies against gangliosides GT 1a and GD 1a.

Paraparetic Variant :

Areflexia and electrophysiological abnormalities are confined to lower limbs and CSF analysis shows albumino cytological dissociation.

Unusual topographic variants :

This includes, purely facial or oculomotor form, facial diplegia with distal

limb paresthesia, abducent nerve palsy with distal paresthesia and severe ptosis without opthalmoplegia.

Axonal form :

It has fulminant onset, severe paralysis and poor recovery with characteristic electrophysiology.

Acute Motor Axonal Neuropathy :

Mckhann et al in 1991 described this entity in 90 patients from Northern China, as Chinese paralytic syndrome. Extensive wallerian like degeneration of motor nerve roots and motor fibers of peripheral nerves with extensive abnormalities of anterior horn cells in spinal cord characterize this. Diagnostic criteria include, symmetric motor weakness in all four limbs, absence of paresthesia or sensory loss, areflexia by one week, progression of weakness by one day to three weeks, normal SNAP and albumino cytological dissociation in CSF.

Acute Sensory Axonal Neuropathy :

Severe early paresthesia of feet and hands with absence of weakness characteristic this. Autopsy reveals inflammation and degeneration of dorsal root ganglion, dorsal roots and posterior column in spinal cord. Antibodies are directed to Ganglioside GD lb & GD3.

Pure dysantonomia :

Young and associates, in 1975 described this as a entily due to involvement

of myelinated portions of ANS, sympathetic white rami communicans, vagus nerves and splanchnic nerves. It is characterized by hypertension, orthostatic hypotension, vomiting, diarrhea or constipation, paralytic ileus, sweating disturbance and cardiac arrthymias, areflexia or hyporeflexia occurs by one week. Nerve conduction study will be normal but CSF shows albuminocytological dissociation. Some autonomic dysfunction improves by 2-4 months.

Electro physiological profile :

Eisen et al in 1974 performed NCS at the peak of neurological deficit and found 58% of patients had prolonged distal latency and 63% had conduction velocity abnormalities and in 58% SNAP were absent.

Hadden et al in 1998 studied 360 patients and divided the results into 5 groups – 69% demyelinating, 3% axonal, 3% inexcitable, 2% normal and 23% equirocal. Different criteria have been used to detect demyelination by various authors like Albers et al 1985, Albers and Kelly 1989, Cornblath et al 1990 and Ho et al 1995 and as such as universally acceptable criteria. An ad hoc committee of the AAN included mandatory electrophysiological features as the presence of three of the following four criteria for demyelination : partial motor nerve conduction block, reduced motor nerve conduction velocity, prolonged distal motor latencies, and prolonged F-wave latencies.

According to the American Academy of Neurology (AAN) criteria, a partial

conduction block is a drop of 20% or more in negative peak area or peak to peak amplitude and a change of less than 15% in duration between proximal and distal sites of stimulation. A possible conduction block or temporal dispersion is a drop of 20% or more in negative peak area or peak to peak amplitude and a change of more than 15% in duration between proximal and distal site stimulation. A reduced conduction velocity is defined as a velocity of less than 80% of the lower limit of the normal range if the amplitude of the CMAP is more than 80% of the lower limit of the normal range or less than 70% of the lower limit, if the CMAP amplitude is less than 80% of the lower limit. Prolonged distal latency is defined as being more than 12% of the upper limit of the normal range if the CMAP amplitude is more than 80% of the lower limit of the normal range or more than 150% of the upper limit if the CMAP amplitude is less than 80% of the lower limit. An absent F wave or F wave latency is defined as being more than125% of the upper limit (Inflammatory Neuropathy Cause and Treatment criteria, more than 120%) if the CMAP amplitude is more than 80% of the lower limit or latency is more than 150% of the upper limit if the CMAP amplitude is less than 80% of the lower limit. The AAN Electro diagnostic Criteria requires presence of three of the following four conditions. 1. Partial conduction block of >1 motor nerve, 2) Reduced conduction velocity of > 2 motor nerves, and 3) Prolonged distal latency of > 2 motor nerves, or (4) Prolonged F-wave latencies of > 2 motor nerves or the

absence of F waves.

Albers JW, Kelly JJ et al, 1989 proposed a electrophysiologic criteria for Acute Demylinating poly-neuropathy as follows.

Demonstrate at least three of the following in motor nerves.

1. Prolonged Distal Latency

(two or more nerves not at entrapment sites)

DL > 115% ULN (for normal CMAP amplitudes)

DL > 125% ULN (for CMAP amplitude < LLN)

2. Conduction velocity slowing

(two or more nerves not across entrapment sites)

CV < 90% LLN (for CMAP amplitudes > 50% LLN)

CV < 80% LLN (for CMAP amplitudes < 50% LLN)

3. Prolonged F and H responses (one or more nerves)
   > 125% ULN

4. Conduction block or temporal dispersion (one or more nerves)
   Unequivocal conduction block : Proximal / distal CMAP area ratio < 0.5
   Possible conduction block : Proximal / distal amplitude ratio < 0.7
   Temporal dispersion : Proximal / distal CMAP duration ratio > 1.15.

Electrophysiological studies are carried out to support the diagnosis, to classify the diseases and to prognosticate the GB syndrome. Decrease in motor

conduction velocity was proved to be an adverse prognostic marker in early studies by Eisen et al 1974 and Pleasure et al 1968 but the study by Raman and Taori et al 1976 didn't find it so. Ropper et al 1991 reported 22 of 24 patients with early proximal block had quicker recovery with reversibility of block while those with inexcitable one or low CMAP on distal stimulation had poor outcome. Winer et al, in 1988 noted that 71 percent of patients with absent or small CMAP (< 1 MV) from Abductor Polliscis Brevis by median nerve stimulation had delayed or poor recovery compared with 18 percent of patients those with large CMAP.

AIMS AND OBJECTIVES

- To study the spectrum of patients with demyelinating illness admitted in Govt. Rajaji Hospital, Madurai during the period of June 2007 to April 2009.
- To study the demographic profile of the patients with various demyelinating illness.
- To analyse the antecedent events, clinical profile and etiological factors among them.

- To evaluate the imaging, CSF and electrophysiological profile and short term outcome among them.

SUBJECTS AND METHODS

The study design was prospective one involving patients admitted in Medicine, Obstetrics and Gynaecology, Neuromedicine and all other wards for demyelinating illness.

Inclusion Criteria :

Patients admitted for neurological symptoms and signs suggestive of demyelinating illness and investigations compatible with them were included in study group.

Exclusion Criteria

Patients with equivocal diagnosis or inadequate clinical details or investigations not compatible with demyelinating illness were excluded from study group.

Methodology :

Patients general information antecedent events, symptoms were recorded in a predesigned proforma one allotted for each patient.

Detailed clinical examination finings, pattern of weakness respiratory muscle weakness, requirement of ventilatory assistance were documented in that proforma.

CSF analysis results, neuro imaging findings, electro physiological profile including motor nerve conduction of standard limb nerves, F wave responses and Sensory Nerve Action Potential results were all recorded in the proforma.

Statistical analysis was done on these data and Chi-Square Test, Student ‘t’ test and p values were applied wherever possible.

RESULTS

Total cases with demylinating illness

included in our study - 75.

Diagram -1

Pie Diagram showing the spectrum of distribution of demyelinating illnesses.

	No.of cases	Percentage
GBS	66	88
ADEM	7	9
MS	2	3

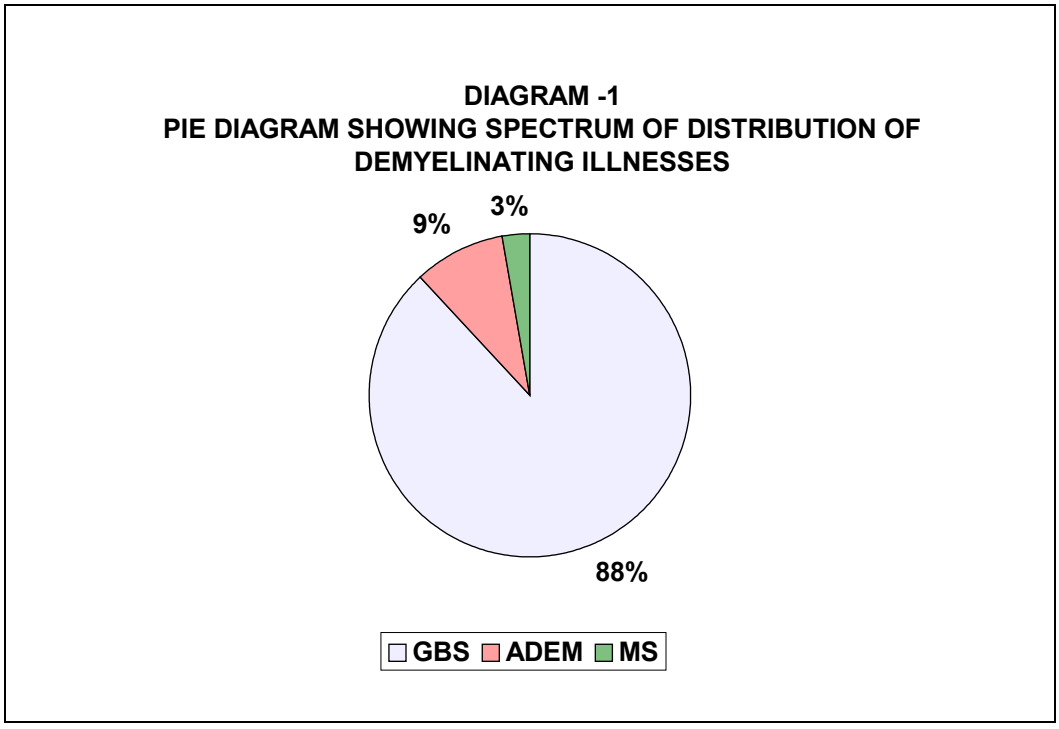


Table – 1

Clinical and MRI profile of two cases of M.S.

S. No	Parameter	Case 1	Case 2
1.	Age and Sex	20 F	31 F
2.	Antecedent event	Nil	Nil
3.	1st attack	Rt hemiparesis	Paraparesis
4.	2nd attack	Lt hemiparesis depression	Quadriparesis
5.	Course	Relapsing remitting	Relapsing remitting
6.	Estimated site	Cerebral	Spinal cord
7.	MRI brain	1 Gd enhancing br lesion 3 periventricular lesions	Normal
8.	MRI spinal cord	Normal	One lumbar healed other cervical contrast enhancing demyelinating plaque

Table – 2

Age & Sex Distribution of patients with ADEM

Age Interval	***Male***	***Female***	***Total***	***Percentage***
10 – 19	2	2	4	57%
20 – 29	1	1	2	29%
30 – 40	1	-	1	14%
Total	4	3	7	

Males with ADEM - 4 (57%)

Females with ADEM - 3 (43%)

Table -3

Antecent events of patients with ADEM

S. No.	*Antecent event*	No.of patients	Percentage
1.	Exanthematous fever	2	29%
2,	Post vaccinial	2	28%
3.	Non specific infections	3	43%

Table – 4

Clinical and imaging profile of patients with ADEM

S. No.	Parameter	No.of patients	Percentage
1.	Head ache	4	57
2.	Fever	3	43
3.	Meningismus	4	57
4.	Altered sensorium	2	29
5.	Optic neuritis	1	14
6.	Cranial nerve palsies	2	29
7.	Pyramidal signs	6	86
8.	Sensory deficits	2	29
9	Ataxia	2	29
10	Aphasia	1	14
11	Seizures	2	29
12	MRI, periventricular lesions	1	14
13	Thalamic lesions	2	29
14	Basal ganglia lesions	2	29
15	Spinal cord lesions	3	43
16	Contract enhancement	6	86
17	CSF pleocytosis	4	57

Table – 5

Age and Sex distribution of patients with GBS

Age interval	Male	Female	Total	Percentage
10 -19	10	5	15	23
20 – 29	10	10	20	30
30 – 39	5	2	7	11

40 – 49	10	2	12	18
50 – 59	3	3	6	9
> 60	3	3	6	9

Males with GBS - 41 (62%)

Females with GBS – 25 (38%)

Table – 6

Residential distribution of GBS cases

Residence	No.of patients	Percentage
Madurai District	54	82
Other Districts of Tamilnadu	11	16
Other State	1	2

Table – 7

Antecent events preceeding GBS

S. No.	Antecedent event	No.of patients	%	't' test	'p' value
1.	Respiratory illness	16	24	1.49	0.1413
2.	Gastrointestinal illness	6	9	2.43	0.0204
3.	Malignancy	1	2	2.58	0.0153
4.	Pregnancy	3	5	2.58	0.0149
5.	Post viral	2	3	2.78	0.0093

6.	Non specific	8	12	2.25	0.0343

Patients with GBS without any antecedent event - 30 (45%)

Table – 8

Internal between onset and peak symptoms of patients with GBS

S.No.	Onset in days	No.of patients	Percentage
1.	< 7	7	10
2.	8 – 15	44	67
3.	> 16	15	23

Table - 9

Signs and symptoms profile of patients with GBS

S.No.	Parameter	No.of patients	Percentage
1	UL weakness	60	91
2	LL weakness	62	94
3	Ophthalmoparesis	10	15
4	Facial palsy	34	51
5	Bulbar palsy	26	39
6	Sensory symptoms	48	72
7	Dysautonomia	36	54
8	Respiratory failure	26	39
9	Ventilatory assistance	23	34

Number of patients died - 3 (5%)

Table – 10

Ventilator days of patients with GBS

Days	Cases	Percentage
0 – 4	8	35
4 – 8	7	30
8 – 12	6	26
> 12	2	9

Table – 11

GBS variants of this study

Variant	No.of Patients	Percentage
MFS	2	3
Recurrent GBS	1	1.5
Pharyngofacial	1	1.5
Bifacial	1	1.5

Table – 12

GBS patients subjected to NCS & CSF study

S.No.	Investigation	No.of patients	Percentage
1	CSF	24	36
2	NCS	25	38

Table – 13

CSF analysis report of patients with GBS

S.No.	Parameter	Normal	Abnormal
1	Cells	24	0
2	Sugar	24	0
3	Protein	21 *	3
4	Globulin	24 **	0

* elevated (88%)

** negative

Table – 14

Electrophysiological abnormalities of patients with GBS

.	Nerve	F	%	DL	%	CV	%	CB/ Td	%	SNAP	%	CMAP	%
	Right Median	17	68	4	16	2	8	1	4	16	64	10	4
	Left Median	18	72	5	20	3	12	1	4	17	68	11	4
	Right Ulnar	18	72	4	16	2	8	2	8	15	60	14	5
	Left Ulnar	19	76	5	20	5	20	2	8	16	64	15	6
	Right Peroneal	21	84	10	40	8	32	1	4	NA	NA	12	4
	Left Peroneal	21	84	8	32	7	28	1	4	NA	NA	10	4
	Right Tibial	19	76	8	32	10	40	3	12	NA	NA	13	5
	Left Tibial	19	76	11	44	10	40	4	16	NA	NA	12	4
	Right Sural	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	N
	Left Sural	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	N

NA – Not applicable

Patients with totally not stimulatable nerves - 4 (16%)

See Master chart -2 for abbreviations

Table – 15

Electro physiological abnormal patterns of patients with GBS

S.No.	Abnormal Pattern	No.of patients	Percentage
1.	Demyelinating	12	48
2.	Axonal	4	16
3	Mixed	9	36

Table – 16

Ventilator days and outcome of GBS cases at the end of one month

Ventilator days	Total	Good recovery	%	Mild – Moderate deficit	%	Severe deficit	%
0 - 4	8	6	75	2	25	0	0
4 - 8	7	4	57	2	29	1	14
8 – 12	6	1	17	3	50	2	33
>12	2	0		1	50	1	50

Chi-Square value - 4.3105 ; 'p' value = 0.635

Table – 17

Electrophysiological abnormality pattern and outcome of GBS cases at the end of one month

S.No.	Abnormal Pattern	Total	Good recovery	%	Mild – Moderate deficit	%	Severe deficit	%
1	Demyelinating	12	10	83	2	17	0	0
2	Axonal	4	0	0	1	25	3	75
3	Mixed	9	4	44	3	33	2	23

Chi square value - 0.8005 'p' value = 0.9273

DISCUSSION

Madurai on the banks of the Vaigai is one of the Districts in South Tamilnadu and it spans about 3242 sq.km and it has a population of 28,54,303 (2007). The health services from Govt. Sector are rendered by hierarchical system of Primary Health Centres, Taluk Hospitals, ESI hospitals and one Medical College Hospital namely Govt. Rajaji Hospital, Madurai. (See Annexure).

Hence, GRH, Madurai is a tertiary referral care hospital to which cases not only from Madurai but also from nearby other districts of Tamilnadu are referred. The cases admitted in all the departments crosses seventy thousand per year. The cases that presents with acute spectrum of demyelinating illnesses which are managed with neurologists constitute 0.04 percent of admissions (2008).

In our 23 months of prospective study 75 cases were admitted for demylinating disorders among which 66 had GBS, 7 had ADEM and 2 had multiple sclerosis.

MULTIPLE SCLEROSIS

The two multiple sclerosis were females with onset in third decade and presented with relapsing and remitting form but one was localized to intracranial

and other to spinal cord (Table-1). Both had motor features and first case had additional psychiatric feature, depression and second had sensory and sphincter problem which were comparable to Singhal et al, and Gowrie et al studies as follows.

Parameters	Singhal	Chopra	Gourie devi	Murthy
Motor weakness	92.4	77.7	95.2	76.9
Sensory deficit	56	46	69	34.6
Visual loss	69	65	76.2	73
Ataxias	30	30	50	38
Sphincter dis	56	47	57	23
Occular	-	11	23.8	23

ACUTE DEMYELINATING ENCEPHALO MYELITIS

Of the seven cases of ADEM, four belonged to adolescent age group and constituted 57 percent (Table-2).

Non specific infections contributed to 43% of antecedent events of ADEM, post viral and post vaccinal respectively to 29 and 14 percent (Table-3).

Pyramidal signs were noted in 86% of cases of our study which has comparable to Scharwatz et al study 2002 (Table-4).

Meningismus was present in 57% cases of our study which was present in Hynson, Dale and Schwartz et al studies as 26, 31 and 15% respectively.

Spinal cord was affected in 43% cases of our study in contrast to 16% and 28% in Hynson and Dale et al studies.

Gadolinium enhancing lesions, indicating active lesion were present in 86% patients of our study in comparable to 90% in Hynson and Dale and 71% is Schwartz study.

GULLIAN BARRE SYNDROME

Demography Profile :

82% of patients with GBS were residing at Madurai district and 16% came from nearby district like Virudhunagar, Theni, Dindigul and Karur and one case was from Iduki, Kerala (Table-6).

No month wise seasonal variation was noted in 23 months study. But the trend of GBS cases in 2009 seems to be increasing which needs further follow up in this current year (Diagram-6).

Age & Sex

Gupta et al 1994, in their study showed the peak age group of occurrence of GBS in third decade, Alter et al 1990, showed the peak at fifth decade. Dowling et al 1977, showed bimodal distribution. In our study, 30% of cases occurred in third decade followed by 23% in second decade.

Male predominance was shown in Das et al 1995 as 2.7 : 1 and Kaplan et al 1985 as 2.1 : 1 and Alexander et al 1985 as 1.5 : 1.

In our study 62% belonged to male group and 38% female group and male female ratio is 1.63 : 1 (Table-5).

Antecedent Illness

Various studies from India showed that 30 percent to 80 percent of GBS had antecedent illness. Our study showed 55 percent of patients had antecedent illnesses which with comparison to other studies was as follows.

Antecedent event (%)	Present series	MGH	Wiener 1988	Italian
Respiratory illness	24	36	68	41
Gastro intestinal illness	9	8	17	8
Malignancy	2	6	-	-
Pregnancy	5	12	16	4
Post viral	3	-	6	2
Non specific	12	-	-	3

The 'p' values for Gastro intestinal illness, malignancy, pregnancy, post viral and non specific infections were significant (Table-7).

Clinical profile :

The highly variable sensory symptoms, 28 to 83 percent was due to varied criteria used for diagnosis also the incidence of autonomic dysfunction varied from 11 to73 percent reflecting the intensity of search.

The comparison of various signs and symptoms of our study (Table-9) with other studies was as follows.

No.	Symptoms & signs	Current series (%)	MGH (%)	Gibbils (%)	Sedano (%)	Capro (%)
1.	UL weakness	91	-	89	90	NA
2.	LL weakness	94	98	100	97	96
3.	Ophthalmoparesis	15	15	6	NA	18
4.	Facial palsy	51	50	47	50	46
5.	Bulbar palsy	39	40	30	26	NA
6.	Sensory	72	72	79	77	46
7.	Dysautonomia	54	65	73	48	13
8.	Respiratory failure	39	34	28	13	13
9.	Ventilatory assistance	34	5	20	13	13

Of the 23 cases that needed ventilator assistance, 8 weaned in less than 4 days, 7 between four and eight days, 6 between eight and twelve days and 2 above twelve days (Table-10).

In 0-4 days group, 75% had good recovery and 25% had mild to moderate deficit and none had severe deficit

In 4-8 days group, 57% had good recovery, 29% had mild to moderate deficit and 14 percent had severe deficit

In 8-12 days group, 17% had good recovery, 50% had mild to moderate deficit and 33 percent had severe deficit and

In more than 12 days group, 50% had mild to moderate deficit and remaining 50% had severe deficit (Table-16).

Over all mortality was attributed to the type of presentation and quality of intensive care and comorbid medical conditions and it varied from 2 percent to 20 percent in Lotter et al 1977 and Gibbel et al 1992 studies respectively. In our study the mortality was 5% and all those cases were died within 24 hours of admission due to respiratory failure.

Variants of GBS

The comparison of occurrence of GBS variants of our study with those of other studies was as follows (Table-11).

Variant (%)	Current study	MGH	Beghl	Sedano
MFS	3	5	5	0.03
Recurrent GBS	1.5	0	0	0.04
Pharyngo facial	1.5	3	0	0
Bifacial	1.5	1	0	0

CSF Analysis

Of the total admissions of patients with GBS, 36% of cases were subjected for CSF analysis and among them 88% showed albumino cytological dissociation

(Table-12&13).

Electrophysiological Study

38% of patients admitted with GBS were subjected for nerve conduction studies which may be related to general condition and availability of electrophysiological lab services. From the nerve conduction study demyelinating pattern was made out in 48% and axonal pattern is 16% and remaining mixed pattern (Table-15).

Motor nerve study of right and left median showed abnormalities of 40 and 44 percents respectively in our study (Table-14) which was in comparison to Eisen et al studies which showed 25% abnormalities, Kaur et al studies which showed 56 percent abnormalities and Taly et al which showed 100% abnormalities.

Motor nerve studies of ulnar showed 25%, 56%, and 47% abnormalities is tiesen, Kaur and Taly et al studies respectively but in our studies it was 56% in right ulnar, 60% in left ulnar.

Motor nerve studies of common peroneal showed 25%, 56% and 100% abnormalities in Eiesen, Kaur and Taly series respectively but in our studies it was 48% in right peroneal and 40% in left peroneal respectively.

Right tibial and left tibial showed respectively 52% and 48% abnormalities.

F wave abnormalities were noted in 70% of median nerve studies, 74% of ulnar nerve studies, 84% of peroneal nerve studies, 76% of tibial nerve studies in

our series.

Conduction block or temporal dispersion was noted in 4% of Median, 8% of ulnar, 4% of peroneal and 14% of tibial nerve studies in our series.

SNAP abnormalities as per Taly et al studies were 100% in median, 53% in ulnar and 100% in Sural stimulation. But our studies had showed 66% in median, 62% in ulnar, and 24 % in sural stimulation.

A short term outcome at the end of one month was analysed (Table-17). Of the patients with demyelinating abnormal pattern, 83% had good recovery and 17% had mild to moderate deficits. 75% of axonal pattern had severe deficits and 25% had mild to moderate deficit. Among mixed pattern 44% had good recovery, 33% had mild to moderate deficit and 23 percent had severe deficits.

SUMMARY AND CONCLUSIONS

- The spectrum of patients with demyelinating illness admitted comprised of 88% GBS, followed by 9.3% ADEM and 2.7% multiple sclerosis.
- All cases of ADEM belonged to 10 to 40 year age group and 57% fell into adolescent age group.
- Non specific infections antedates 43% of ADEM and post viral and post vaccinal shared 29% and 28% respectively.
- 43% of ADEM were of meningitic form and remaining encephalitic form and CSF pleocytosis was noted in 57% of cases
- 82% of GBS cases were from Madurai locality. No significant variations between months of occurrence of GBS was made out but trend is of increasing pattern from this current year.
- The age group of patients with GBS varied from 10 to above 60 and 30% fell into third decade. Males : Female ratio is 1.63 : 1.

- Antecedent events occurred in 55% of patients with GBS of which gastro intestinal illnesses constituted 9%, non specific fever 12%, pregnancy 5% and post viral 3% which were statistically significant.
- Lower limb onset was noted in 94% of cases and ventilator assistance was needed for about 34% of cases. 50% of patients in ventilator for more than 12 days had severe deficits which was 33% and 14% for those who were on ventilator for days between 8 and 12 and 4 and 8 respectively.
- Of variants, MFS occurred in 3% recurrent GBS, pharygofacial and bifacial occurred 1.5% each.
- 36% of GBS cases were subjected to CSF study and albumino cytological dissociation was noted in 88%.
- Of the 38% posted for nerve conduction studies, demyelinating pattern was noted in 48% and axonal in 16%. 83% of patients with demyelinating pattern showed good recovery, whereas 75% of axonal pattern showed severe deficit at the end of 1 month.

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PROFORMA

Name :	***Age :***	***Sex :***	***Hosp.No.***
Residence :			***DOE :***

1. Cognitive deficit m/o/yr, specify
2. Depression m/o/yr, Euphoria m/o/yr,
3. Defective vision Rt m/o/yr, Lt m/o/yr, Fundus
4. Restricted EOM m/o/yr, Facial myokymia m/o/yr, INO m/o/yr,
5. Facial paresis m/o/yr, Bulbar /pseudo bulbar palsy m/o/yr,
6. Hemiparesis, Rt m/o/yr, Spas / fla ; Lt m/o/yr, Spas / fla
7. Paraparesis m/o/yr, Spas / fla ; Sym / asym
8. Quadriparesis, UL m/o/yr, Spas / fla ; LL m/o/yr, spas /fla
9. Neck & trunk wk : m/o/yr, res. Difficultydays /wks ascend / not
10. Pain & temp loss, m/o/yr, ; level
11. Touch, vib, JPS ioss, m/o/yr, ; level
12. Gait ataxia m/o/yr, Limb ataxia m/o/yr,
13. Dysarthria m/o/yr, type
14. Bladder UMN m/o/yr, LMN m/o/yr, Constipation m/o/yr,
15. ED m/o/yr, Others if any : Headache / vomiting / seizures

16. Onset : Acute / subacute / slow
17. Progressive wk/mo ; then static wk/mo ; then improving wk/mo
18. Ventilator days from to day of illness
19. 1st episode or relapse - I / II

20. Fever – at the onset / wk/days back

21. Res. Illness days / wk back ; Diarr illness : days/wk back

22. Chicken pox days / wk back ; measles days / wk back

23. Vaccines days / wk back ; specify the name :

24. HT mo/yr ; DM mo/yr PT mo/yr

25. Others if specify :

---

26. MRI brain :

27. MRI Spinal cord :

28. VEP

29. BERA SEP

30. NCS	DL	Ampli	CV	F	SNAP	Comments
Rt med						
Lt med						
Rt uln						
Lt uln						
Rt pero						
Lt pero						
Rt tibial						
Lt tibial						
Rt sural :		Lt Sural :		H :	EMG :	

31. CSF : Cells Sugar Protein Globulin

32. Diagnosis

a) AIDP b) AIDP variant, specify c) ADEM d) MS

e) MS, relapse f) Spinal MS g) CIDP

33. Outcome at the end of 1st month :

a) Good recovery b) Mild – moderate deficit c) severe deficit

KEY TO MASTER CHART - I

1	Hospital Number	16.	Respiratory failure 1. Present 2. Absent
2	Name		
3	Age		
4	Sex	17.	Ventilator Assistance 1. Needed 2. Not needed
5	Month and year of entry		
6	Residence 1.Madurai 2.Other District 3.Other State		
		18.	No.of days on ventilator

7.	Antecedent illness 1. Respiratory illness 2. GI illness 3. Malignancy 4. Pregnancy 5. Post vital 6. Non specific 7. Nil	19.	CSF status 1. CSF done with normal sugar and cell 2. CSF not done
		20.	CSF protein 1. Elevated 2. Normal 0. Not done
8	Onset and peak interval (in days)	21	Electrophysiological studies 1. Done 2. Not done
9	Upper limb weakness 1. Present 2. Absent		
10.	Lower limb weakness 1. Present 2. Absent	22.	Electro physiological abnormalities 1. Demyelinating 2. Mixed 3. Axonal 0. Not done
11.	Ophthalmoplegia 1. Present 2. Absent		
12.	Facial palsy 1. Present 2. Absent	23	Ventilator days (0-4) 1. Good recovery 2. Mild – moderate deficit 3. Severe deficit 0. Not applicable
13.	Bulbar palsy 1. Present 2. Absent		
14.	Sensory symptoms 1. Present 2. Absent	24	Ventilator days (4-8) 1. Good recovery 2. Mild – moderate deficit 3. Severe deficit 0. Not applicable
15.	Dysarthria 1. Present 2. Absent		
25	Ventilator days (8-12) 1. Good recovery 2. Mild – moderate deficit 3. Severe deficit 0. Not applicable	29	Mixed pattern and Outcome 1. Good recovery 2. Mild – moderate deficit 3. Severe deficit 0. Not applicable
26	Ventilator days (> 12) 1. Good recovery 2. Mild – moderate deficit 3. Severe deficit 0. Not applicable	30	GBS Variant 1. MFS 2. Recurrent GBS 3. Pharyngofacial 4. Bifacial

			0. Normal type
27	Demyelinating pattern and outcome 1. Good recovery 2. Mild – moderate deficit 3. Severe deficit 0. Not applicable	31	MRI 0 - MRI not taken 1 – MRI with brain abnormalities 2 – MRI with spinal cord abnormalities
28	Axonal pattern and outcome 1. Good recovery 2. Mild – moderate deficit 3. Severe deficit 0. Not applicable		

KEY TO MASTER CHART - II

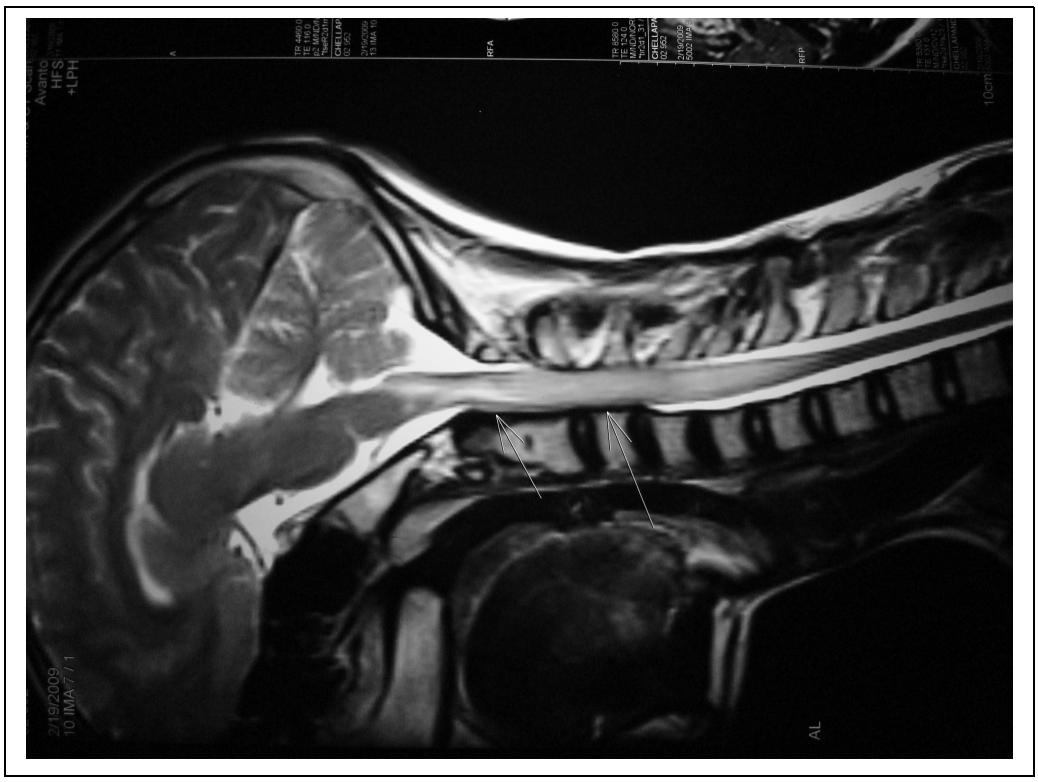
DL	Distal Latency	RU	Right Ulnar
CV	Conduction velocity	LU	Left Ulnar
CB	Conduction Block	RP	Right Peroneal
TD	Temporal Dispersion	LP	Left Peroneal
CMAP	Compound Motor Action potential	RT	Right Tibial
SNAP	Sensory Nerve Action Potential	LT	Left Tibial
RM	Right Median	RS	Right Sural
LM	Left Median	LS	Left Sural
A	Abnormal as per AIDP diagnostic criteria	N	Normal
0	Not obtained	F	F wave

ABBREVIATIONS

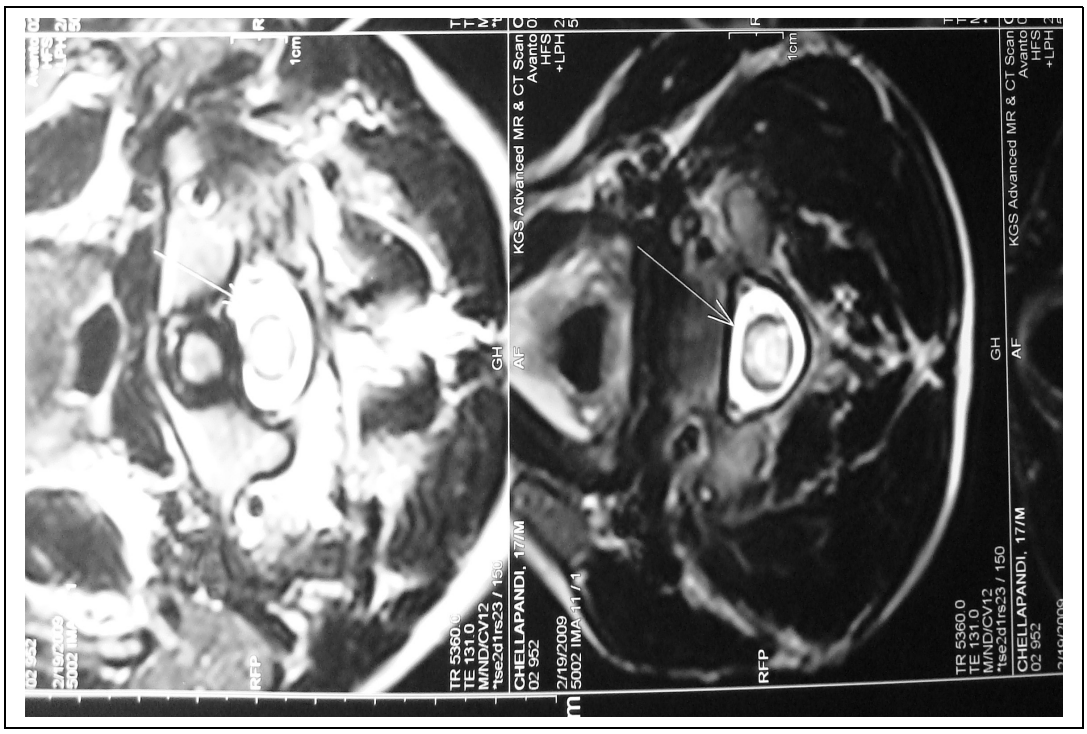
MS	Multiple Sclerosis
CNS	Central Nervous System
MRI	Magnetic Resonance Imaging
CSF	Cerebro Spinal Fluid
OCB	Oligo Clonal Bands
IgG	Immunoglobulin G
VEP	Visual Evoked Potential
BAEP	Brainstem Auditory Evoked Potential

SEP	Somato Sensory Evoked Potential
ADEM	Acute Disseminated Encephalo Myelitis
GBS	Guillian Barr'e Syndrome
ADIP	Acute Demyelinating Inflammatory Polyradiculoneuropathy
TT	Tetanus Toxoide
TNF	Tumour Necrosis Factor
IL	Inter Leukin
MFS	Miller Fisher Syndrome
AMAN	Acute Motor Axonal Neuropathy
ASAN	Acute Sensory Axonal Neuropathy
CMAP	Compound Motor Action Potential
SNAP	Sensory Motor Action Potential
ULN	Upper Limit of Normal
LLN	Lower Limit of Normal
DL	Distal Latency
CV	Conduction Velocity
PAN	Poly Arteritis Nodosa
SLE	Systemic Lupus Erythematosis

T2 MRI OF SPINAL CORD SHOWING CERVICAL DEMYELINATION

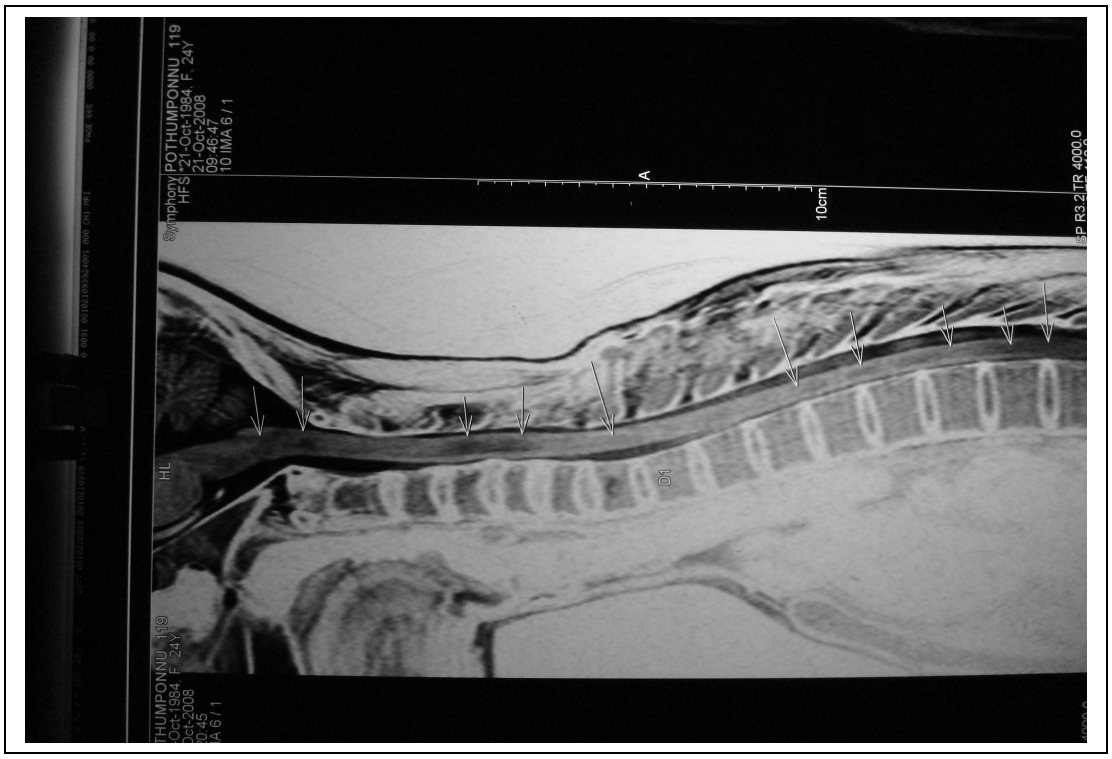


SAGITTAL VIEW

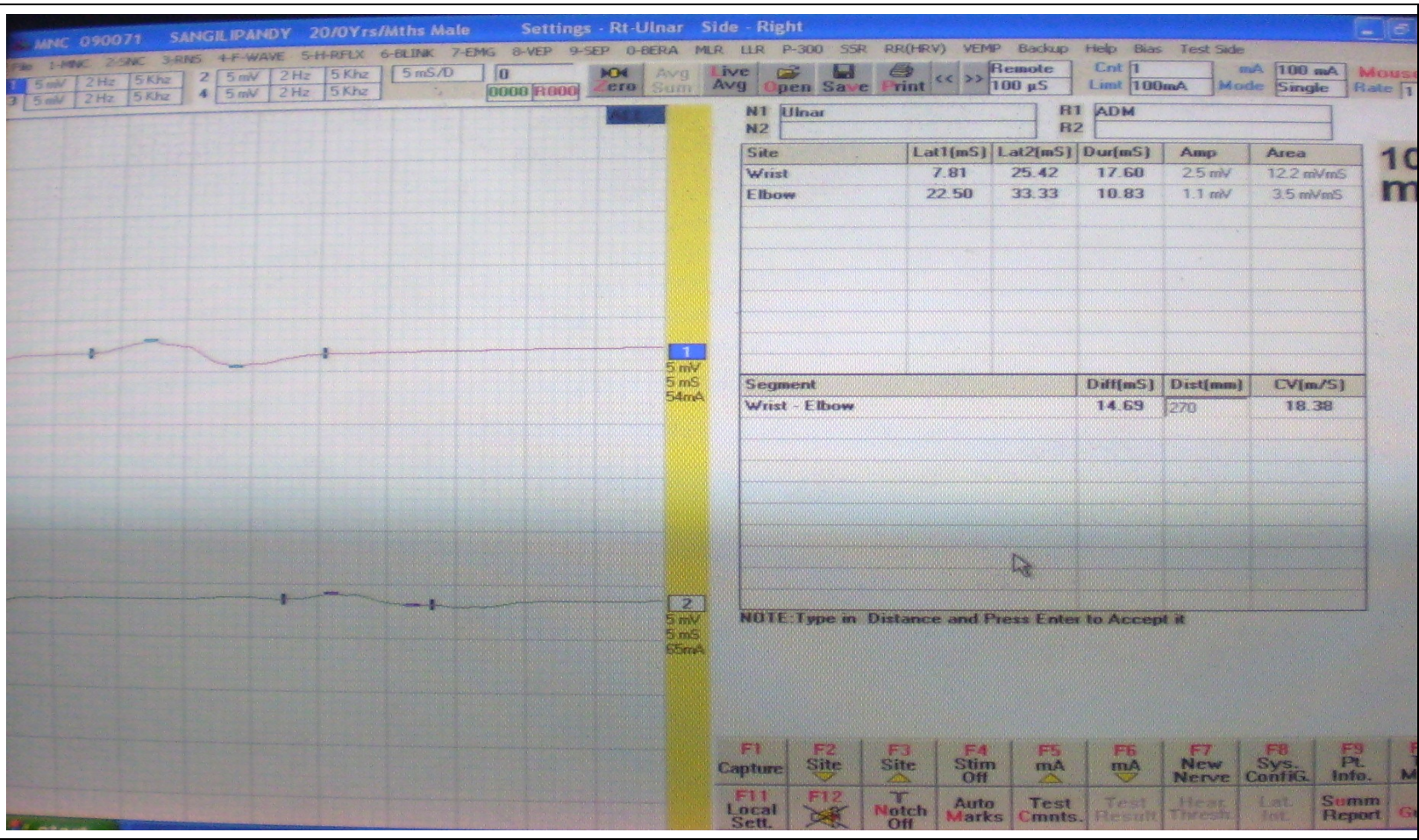


TRANSVERSE VIEW

MRI SPINAL CORD SHOWING MULTI FOCAL SPINAL DEMYELINATION




D9
D12
HL
10cm
10cm
A
POTHUMPONNU_119
21-Oct-1984, F, 24Y
21-Oct-2008
08:46:47
10 IMA 6/1


MNC 090071 SANGILIPANDY 20/0Yrs/Mths Male Settings - Rt-Ulnar Side - Right
N1 Ulnar
N2
R1 ADM
R2
Site | Lat1(mS) | Lat2(mS) | Dur(mS) | Amp | Area
Wrist | 7.81 | 25.42 | 17.60 | 2.5 mV | 12.2 mV/mS
Elbow | 22.50 | 33.33 | 10.83 | 1.1 mV | 3.5 mV/mS
Segment | Diff(mS) | Dist(mm) | CV(m/S)
Wrist - Elbow | 14.69 | 270 | 18.38
NOTE:Type in Distance and Press Enter to Accept it
F1 Capture
F2 Site
F3 Site
F4 Stim Off
F5 mA
F6 mA
F7 New Nerve
F8 Sys. Config.
F9 Pt. Info.
F11 Local Sett.
F12
Notch Off
Auto Marks
Test Cmnts.
Test Result
Hear. Thresh.
Lat. Int.
Summ Report