



PREVALENCE OF MOTOR IMPAIRMENTS OF HAND AND LEVEL OF AMBULATION FOLLOWING PLASMAPHERESIS IN SUBJECTS WITH GUILLAIN BARRE SYNDROME (GBS)

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ABSTRACT

BACKGROUND AND PURPOSE : Guillain barre syndrome (GBS) is an acute , progressive , symmetrical , ascending demyelinating polyneuropathy characterized by symmetrical limb weakness , areflexia , autonomic disturbances , and mild / absent sensory involvement . After plasma exchange [PE], GBS subjects are discharged with certain degree of improvement and there is very limited research, regarding the evaluation of motor deficits in GBS after plasmapheresis. About 30 of every 100 people continue to experience weakness more than 3 years after the original event, and about 15 of 100 have a long-term weakness that requires assistance, such as walker, wheelchair or other support. This review aimed at determining the Prevalence of motor impairments of hand and level of ambulation following plasmapheresis in subjects with Guillain barre syndrome [GBS].

OBJECTIVES:

To evaluate the hand function in subjects with GBS by using Jebsen Taylor hand function test.[JTHFT] , To evaluate the level of ambulation in subjects with GBS by using functional ambulation category [FAC].

METHODOLOGY : An observational study conducted on 45 subjects , out of which 29 were male and 16 were female , primary outcomes used for the results were Jebsens taylors hand function test (JTHFT) for hand function and Functional ambulation category (FAC) for ambulation ability , which were evaluated before and after plasmapheresis

OUTCOME MEASURES : Hand function assessed by the JTHFT (Jebsens taylor hand function test) , and level of ambulation assessed by FAC (Functional ambulation category).

CONCLUSION : After plasmapheresis , there were still remaining significant motor impairments for hand and there found a significant improvement in FAC grades. So, there is a need to emphasize on rehabilitation even after discharge, with patients on proper exercise adherence and regular follow up.

KEY WORDS : Plasmapheresis , Rehabilitation , Jebsens taylor hand function test , Functional ambulation category .

INTRODUCTION:

- Guillain–Barré syndrome (GBS) is an inflammatory disease of the Peripheral nervous system (PNS) and is the most common cause of acute flaccid paralysis, with an annual global incidence of approximately 1–2 per 100,000 persons per year.
- GBS occurs more frequently in males than in females and the incidence increases with age, although all age groups can be affected¹.
- It can occur at any age but the most common age is 30-50 years, It is most commonly characterized by combination of generalized weakness, paraesthesias of limbs and areflexia. The most common infections reported to be preceding GBS , about 10-14 days are upper respiratory tract infections, others are Campylobacter jejuni, Cytomegalovirus , Mycoplasma pneumonia , Epstein-Barr virus and influenza virus².

- Molecular mimicry plays a substantial role in understanding of GBS particularly the axonal variety. At 2 years after onset, residual motor and sensory impairments are still seen in 55% of patients, pain and fatigue were reported by about an one third of all patients. Impairments may persist beyond this time point, since recovery during the second year was mainly in the area of muscle strength³.
- In studies on patients with GBS, disability has been defined mainly as limited walking ability 10-20% of patients.
- Although distal nerves are prone to compression are susceptible to autoimmune attack, GBS with exclusive hand muscle involvement is rarely found. In patients with this GBS type, the hands present a special variant – bilateral symmetric weakness is common in the finger extensor muscles, especially predominant ulnar extensor involvement leading to claw hands, while the finger flexor muscles remain relatively normal. Finger extensor weakness was a specific manifestation of AMAN type.
- Hand impairment in GBS instantly changes a person's life and is characterized by the complete loss of gross and fine movement, sensory disturbance in all extremities. and inability to perform activities of daily living and vocational work for a prolonged period⁴.
- About 30 of every 100 people continue to experience weakness more than 3 years after the original event, and about 15 of 100 have a long-term weakness that requires assistance, such as walker, wheelchair or other support. Very few people about 3 of every 100 experience a recurrence GBS related weakness years after the original bout.
- In studies on patients with GBS, disability is presented with limited walking ability in 10-20% of patients⁵.
- Rehabilitation plays an important role in GBS, to restore maximum independence in activities of daily living by improving underlying deficit like strength, range of motion, motor control, sensory re-education and teaching compensatory strategies.
- Diagnosis of GBS is based on the patient history and neurological electrophysiological and cerebrospinal fluid (CSF) examinations⁶.
- For atypical cases or unusual subtypes, ancillary testing can be useful Electromyography and nerve conduction studies may be helpful in distinguishing GBS from its mimics. CSF shows a classic pattern of albumin cytologic dissociation with elevated CSF protein levels.
- Most patients with Guillain-Barré syndrome do well with immunotherapy, but a substantial proportion are left with disability.
- Intravenous [IVIg]immunoglobulin and plasma exchange [PE]are equally effective in treating GBS⁷.

NEED OF THE STUDY:

- After plasmapheresis, GBS subjects are discharged with certain degree of motor improvement and there is very limited research, regarding the evaluation of still existing motor deficits in GBS after plasmapheresis.
 - So, there is a need for immediate evaluation of motor deficits after plasmapheresis to address the level of weakness and motor impairments. This helps in appropriate planning of physiotherapy treatment with proper followup after plasmapheresis in GBS patients.
 - Motor deficits if left untreated further leads to functional limitations, such as performance of Activities of daily living activities (ADL), which may impact on Quality of life (QOL).
 - Rehabilitation can help the GBS subjects to improve and maintain motor function integrity which further helps in decreasing the progression of motor and sensory demyelination feature and helps in restoring the lost function.
- So, this study helps in emphasizing the need of rehabilitation and planning for improvement in patient care by appropriate exercise or rehabilitation in subjects with GBS who undergo plasmapheresis.

AIM OF THE STUDY :

To determine the Prevalence of motor impairments of hand and level of ambulation following plasmapheresis in subjects with Guillain barre syndrome [GBS].

OBJECTIVES OF THE STUDY

- To evaluate the hand function in subjects with GBS by using Jebsen Taylor hand function test.[JTHFT]
- To evaluate the level of ambulation in subjects with GBS by using functional ambulation category [FAC].

HAND IMPAIRMENTS IN GBS :

- In GBS frequent initial symptoms were weak hand grip and clumsy fingers and paraesthesias of hand.
- Hand onset GBS who had antiganglioside IgG, with evidence of preceding of C. Jejuni infection or both often had a history of previous gastrointestinal symptoms but rarely cranial nerve involvement / sensory disturbances.

- In patients with GBS type , the hand presents a special variant , bilateral symmetric weakness is common in the finger extensor muscles , especially predominant ulnar extensor leading to claw hands . while the finger flexor, wrist extensor and wrist flexor muscles remain relatively normal.
- A study of 84 GBS patients reported that 12 patients with AMAN exhibited severe finger extensors involvement ,4 are claw hands . Selective extensor finger weakness was a specific manifestation of AMAN .
- In previous studies AIDP presented weakness in the finger extensor , AMSAN presented weakness of ulnar finger extension .

Although most patients had received plasmapheresis or IVIG within two weeks of onset , it showed irreversible neurological damage. Moderate and mild weakness remained in the arms and legs ⁸.

GAIT IMPAIRMENTS IN GBS :

- The most characteristic clinical manifestations of GBS are gait disturbances associated with weakness involving the lowerlimbs .
- In 80% of patients , muscle weakness started in lowerlimbs while at presentation four limb weakness are the most frequent . It was found that the upper extremity weakness was mainly distal in 73% of patients , while lower extremity weakness was mainly proximal in 68% and Trunk muscles were involved in 34% of patients .
- Various modes of spread of muscle weakness were seen but ascending variety is the most common occurring 78% of patients .
- In previous studies , Gait deviation index was calculated for right and left leg and later averaged for the patients sessions . It is a single pattern , which describes half of the patients walked with hyperextension of the knee at the middle of stance and 10 patients had flexed knees at gait phase , this flexion was higher than 7degrees . Generally GBS patients walked slower than their healthy peers , with lower cadence and decreased steplength. This can be caused by fatigue and pain reported by nearly all patients. 19 patients had the stance phase longer than 62% of gait cycle
- Pelvis is often used by the patients to generate compensative movements , helping them to maintain relatively efficient locomotion and overcome limitations.
- Standing and gait training with lowerlimb orthosis were effective in improving the walking ability of patients . 60% of GBS patients had foot drop at the start of inpatient rehabilitation , and recommended the use of AFO ⁹.

MATERIALS AND METHODS :

Study design: Single group observational study

Sampling method: convenient sampling

Sample size: 45 patients

Study duration: 1 year July-Aug (2021to 2022)

Study setup: Neurology wards and General wards, at SVIMS hospital, Tirupati.

MATERIALS FOR HAND FUNCTION :

Stopwatch

Chair

Desk

Table

Clipboards

Paperclips

Bottlecaps

Teaspoon

wooden board

Materials for level of ambulation:

Pen

Paper

INCLUSION CRITERIA:

Age: 35-65 years

Both genders

Type: subacute type

Patients who underwent 5 cycles of plasmapheresis

EXCLUSION CRITERIA:

Respiratory complications

Subjects who are on ventilatory support

Consciousness disorder

Uncooperative patients

Sensory type of GBS

Abnormal hepatic and renal function

Any focal disabilities

Contractures /deformities in hand and lowerlimb

A preceding gastrointestinal illness

METHODOLOGY :

- This study has been conducted at Neurology and General wards , at SVIMS , Tirupati during the period of 2021-2022[July -Aug].The study was started after obtaining willingness through written informed consent from the participants before enrolling into the study . Demographic information such as age , gender, known chronic co-morbidities, current medications and a detailed history were collected.
- Total subjects observed for hand function and level of ambulation were 62 subjects, out of which 45 subjects who met with inclusion criteria were included in this study. All the subjects included in the study were given 5cycles of plasmapheresis in neurology ward by neurologists. Subjects were directly observed by the tester during the course of the stay and at end of plasmapheresis.
- Evaluation was done for both the dominant and non-dominant hands. JTHFT and FAC values were measured following post plasmapheresis.

JTHFT : JTHFT was administered by using stopwatch to completion of each test , with the participants in a seated position in front of an adjustable table , the test was administered according the standardized procedure of JTHFT. The test consists of seven subtests ,in which writing is excluded in this study , remaining are card turning , lifting small objects , simulated feeding , stacking checkers , lifting small light objects and heavy objects. The subtests were presented in the same sequence, starting with the non dominant hand and followed by dominant hand. Verbal standardized instructions were given in all subtests , followed by specific questions to ensure test familiarity, total score is summation of all each subtests. Lower scores indicated greater levels of good hand function .

FAC: For FAC, subjects were instructed to wear comfortable clothing and to wear appropriate footwear , subjects were encouraged to use their usual walking aids such as cane , walker etc. during the test. The provision of human support was also provided for the subjects when required during the evaluation process and post plasmapheresis FAC grades were noted .

As a part of conventional physiotherapy, limb physiotherapy was given to all the subjects atleast three times a day across the full range of motion to all the joints. Effleurage massage was given to lower limb for maintenance of circulation.

To maintain integumentary integrity, the 2 hourly change in patient position from supine to sidelying was encouraged .In early stages, wrist / hands / ankle splints were given to maintain the position of the paralysed limbs. All the above mentioned physiotherapy treatment was given till the plasmapheresis was administered.

Chest physiotherapy techniques like breathing exercises, pursed lip breathing, spirometry, thoracic expansion exercises, PNF techniques (intercostal stretch, Thoracic vertebral pressure, applied manual pressure,) chest percussion, external tracheal stimulation and inspiratory and expiratory muscle strengthening exercises were given to maintain good bronchial hygiene till the plasmapheresis get started .Mild upper limb exercises and chest physiotherapy techniques like breathing exercises, spirometry, PNF techniques and external

tracheal stimulation were continued during plasmapheresis also. The post values of JTHFT and FAC were recorded for all the subjects on 2nd day after the completion of the plasmapheresis.

STATISTICAL ANALYSIS :

- Statistical analysis was done using the software SPSS 29.9 version . For this purpose the data was entered into Microsoft Excel spreadsheet , tabulated and subjected to statistical analysis.
- Descriptive data was expressed in mean , standard deviation .
- Total 45 patients were included in the study , out of which 29 were male and 16 were female post values of JTHFT and FAC were taken as to analyse hand function and level of ambulation.

Variable		MEAN	S.D
JTHFT card turning	ND	11.9604	5.1563
	D	10.5616	5.7975
lifting small objects	ND	9.9824	4.5485
	D	8.9176	4.6555
simulated feeding	ND	11.4171	6.9707
	D	9.7711	6.8012
stacking checkers	ND	7.6102	3.0544
	D	6.5776	3.0500
lifting light objects	ND	7.9124	3.9488
	D	6.9740	3.8013
lifting heavy objects	ND	8.4147	4.9975
	D	7.6978	5.7182
FAC scale	POST VALUES	3.7333	0.6179

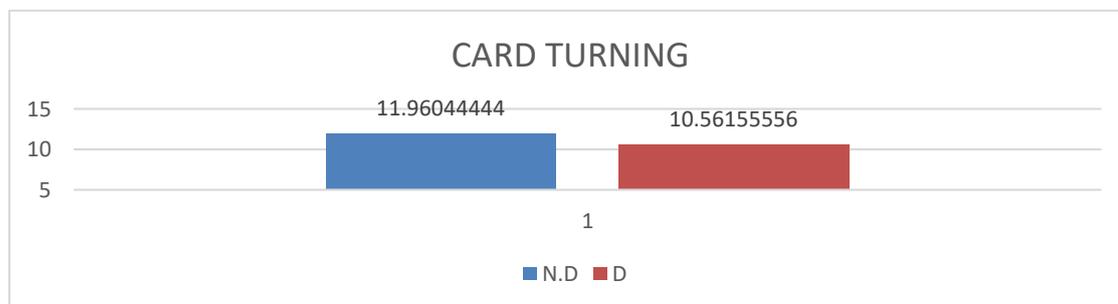
GRAPHS :

1. **For JTHFT** :Graphs were plotted with time taken to perform the subtest in sec on Y axis and dominant and nondominant hand representations on X axis .

2. **For FAC** : For FAC graphs FAC grades were plotted on X axis , and number of subjects plotted on Y axis .

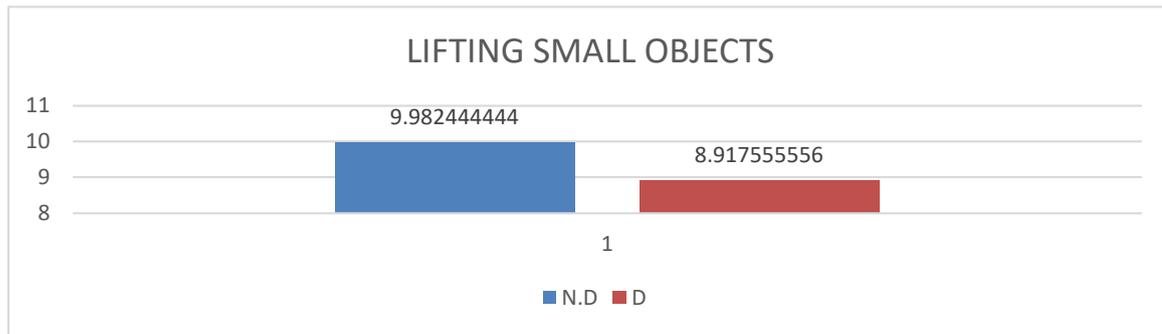
GRAPH 1:

The Following graphical representation denotes card turning ,a component of JTHFT by dominant and non dominant hand. For card turning the mean value for non dominant hand is 11.9604, and for dominant hand is 10.5616 after plasmapheresis



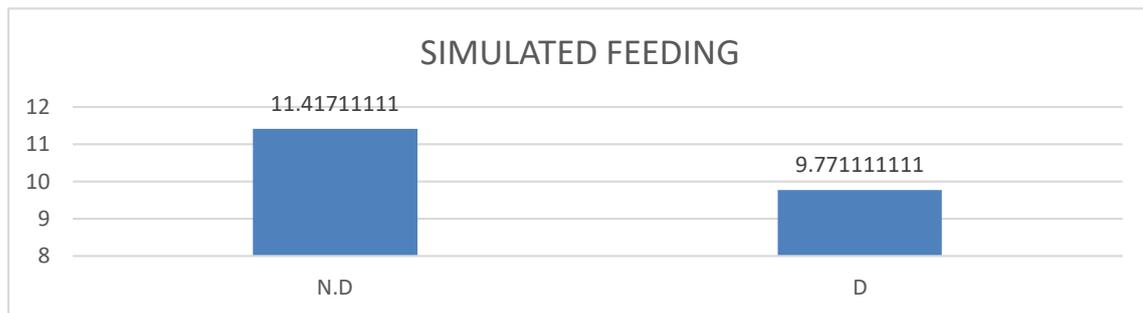
GRAPH 2 :

Following graphical representation shows component of lifting small objects by dominant and non dominant hand . The mean value for non dominant hand is 9.9824 and for dominant hand is 8.9176 after plasmapheresis .



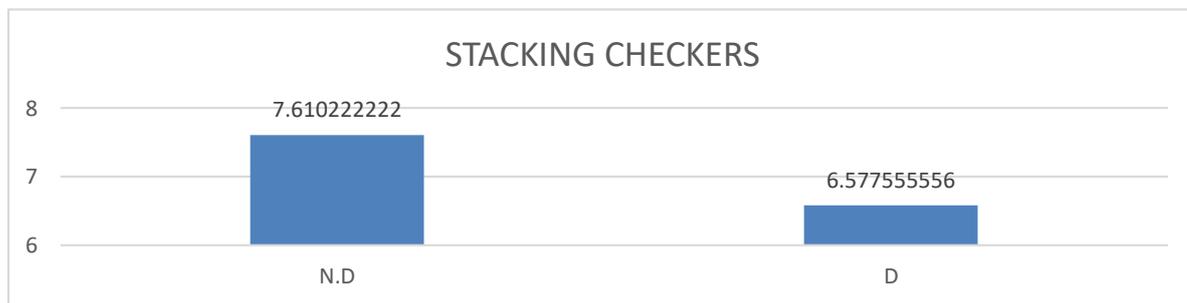
GRAPH 3 :

Following graphical representation shows the mean values of simulated feeding component of non dominant hand and dominant hand as 11.4171 and 9.7711 respectively after plasmapheresis



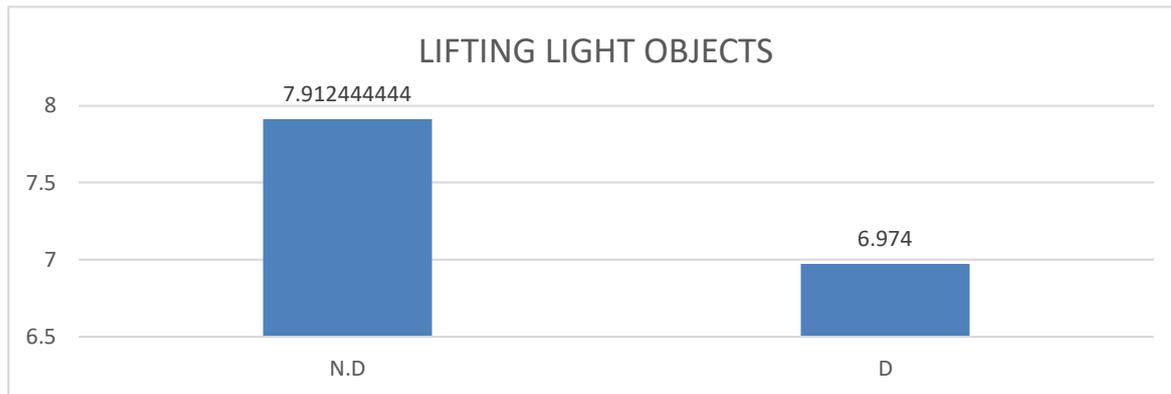
GRAPH 4 :

Following graphical representation shows the component of stacking checkers by dominant and non dominant hand with means values 6.5775 and 7.6102 respectively after plasmapheresis .



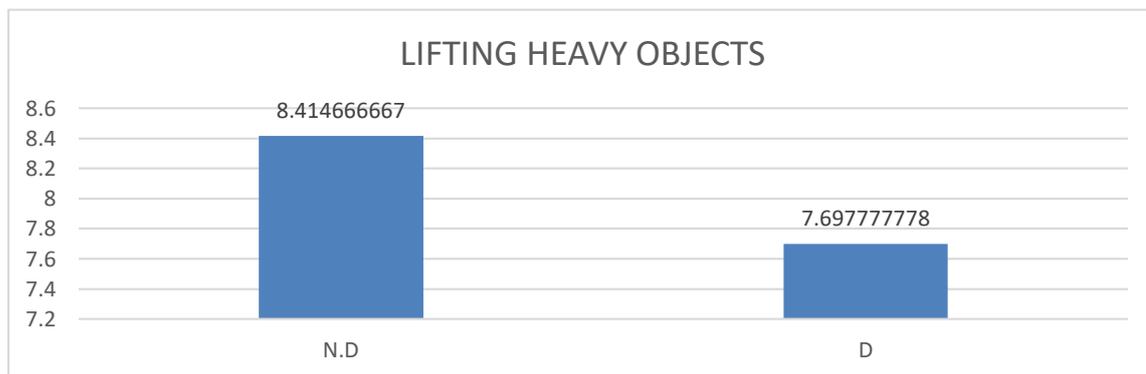
GRAPH 5 :

Following graphical representations shows the component of lifting light objects with mean value for non dominant hand 7.91244, and dominant hand 6.974 after plasmapheresis .



GRAPH 6 :

Following graphical representation shows the component of lifting heavy objects with the mean value for non dominant hand is 8.41466, and dominant hand 7.6977 after plasmapheresis.



GRAPH 7 :

Following graphical representation denotes post plasmapheresis FAC grades , 28 patients are under grade 3to 4 and , 3 patients are under 4 to 5 grades .

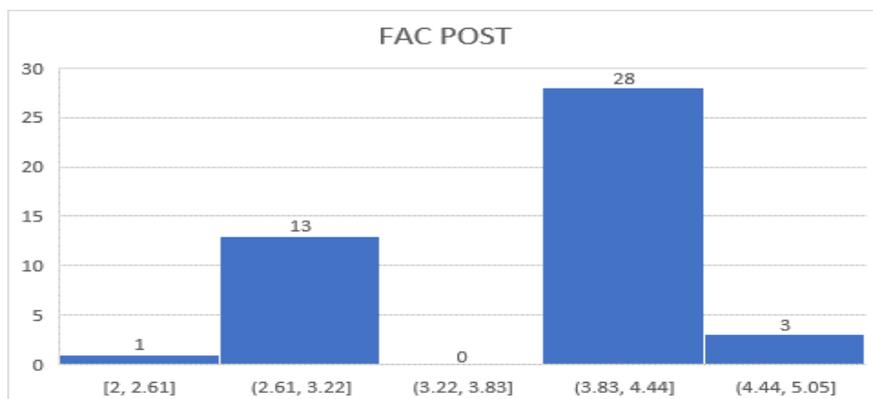


Fig 6 : following pie diagram shows non dominant hand impairments at 26.57% for card turning, 22% for lifting small objects, 25.30% for simulated feeding, 16.80% for stacking checkers, 17.50% for lifting large light weight objects, 18.60% for lifting heavy objects

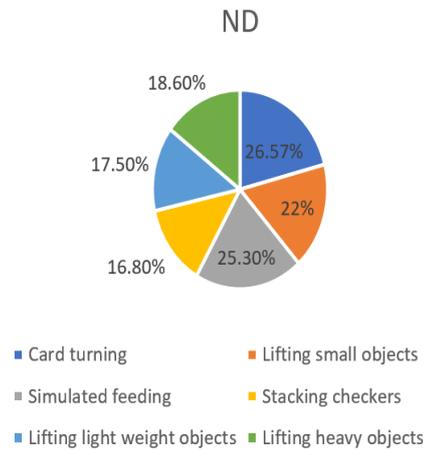
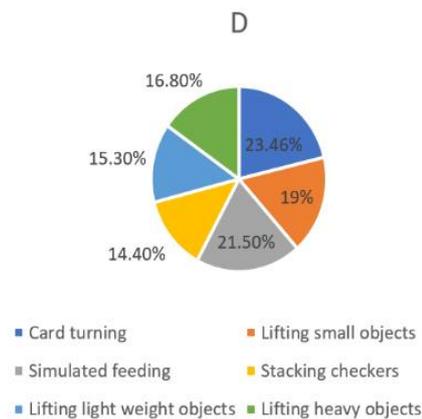


Fig 7 : Following pie diagram shows impairments of dominant hand at 23.46% for card turning, 19% for lifting small objects, 21.50% for simulated feeding, 14.40% for stacking checkers, 15.30% for lifting large light weight objects, 16.80% for lifting heavy objects.



RESULTS :

After plasmapheresis, the impairments in hand function and level of ambulation were tested by JTHFT and FAC, and results were analysed. The mean scores of all the 6 subtests in JTHFT showed motor impairments even after plasmapheresis with no much difference between dominant and nondominant hand.

Results of Motor impairments of hand function for non dominant hand are at 26.57% for card turning, 22% for lifting small objects, 25.30% for simulated feeding, 16.80% for stacking checkers, 17.50% for lifting large light weight objects, 18.60% for lifting heavy objects, whereas for dominant hand at 23.46% for card turning, 19% for lifting small objects, 21.50% for simulated feeding, 14.40% for stacking checkers, 15.30% for lifting large light weight objects, 16.80% for lifting heavy objects.

The level of ambulation in 28 patients were found to be under 3 to 4 grades of FAC and 3 patients under 4 to 5 grades of FAC after plasmapheresis.

DISCUSSION :

GBS is an acute , progressive , symmetrical , ascending demyelinating polyneuropathy characterized by symmetrical limb weakness , areflexia , autonomic disturbances , and mild / absent sensory involvement .

The most common type of GBS is Acute inflammatory demyelinating neuropathy(AIDP) , other subtypes include : Acute motor axonal neuropathy (AMAN), Acute motor sensory axonal neuropathy (AMSAN) and Miller fisher syndrome (MFS) . Usually symptoms start distally progress towards proximally. Plasmapheresis and intravenous immunoglobulins are the main treatment of choice in GBS

In the present study , aim is to determine the prevalence of motor impairments of hand and level of ambulation following plasmapheresis in subjects with GBS and objectives are to evaluate the hand functioning in subjects with GBS after plasmapheresis by using JTHFT and to evaluate the level of ambulation by using FAC.

Total 45 GBS subjects were included based on inclusion criteria , out of which 29 were male and 16 were female . Primary outcomes used for the results were JTHFT and FAC after plasmapheresis.

JTHFT is an objective test used for the measurement of fine and gross motor hand function that includes simulated activities of daily living . It has 7 subtests which are writing , card turning , lifting small objects , simulated feeding , stacking checkers , and lifting large light weighted objects and lifting heavy objects . Writing is excluded in this study and remaining 6 subtests were performed , with both nondominant and dominant hands and score is calculated by sum of time taken for each subtest , which is rounded to the nearest second¹⁰ .

Plasmapheresis is used to remove circulating autoimmune antibodies which damage myelin sheath of peripheral nerve . It exerts its beneficial effects by removing both auto antibodies and alloantibodies from the circulation of the patient .In addition, it also removes monoclonal proteins, toxins and immune complexes that might be present in patients circulation . This in turns decrease the severity of symptoms , accelerate motor recovery , decrease time on ventilator and significantly increased ability of walking in greater proportions of patients after four weeks¹¹ .

Intravenous immunoglobulins(IVIG) is an another choice of treatment . It is an expensive treatment and usually administered within 2 weeks from the onset which helps for recovery as much as plasma exchange. It is known to prevent the immune system from attacking the body owns tissue . IVIG delivers donor plasma to subjects bloodstream through an intravenous route. The healthy immunoglobulin contains antibodies that fight against GBS antibodies and dilute them which otherwise are responsible for harming the bodys nerves¹² .

Results of Motor impairments of hand function for non dominant hand are at 26.57% for card turning, 22% for lifting small objects , 25.30% for simulated feeding , 16.80% for stacking checkers , 17.50% for lifting large light weight objects , 18.60% for lifting heavy objects , where as for dominant hand at 23.46% for card turning , 19 % for lifting small objects , 21.50% for simulated feeding , 14.40% for stacking checkers , 15.30% for lifting large light weight objects , 16.80% for lifting heavy objects.

FAC is a 6 point functional walking test that evaluates ambulation ability , determining how much human support the patient requires while walking . It is a visual measurement of walking and simple to use , easy to interpret, and quick to administer . The subjects level of ambulation in the FAC grades found to be under 3to 4 grades for 28 patients and under 4 to 5 grades for 3 patients after plasmapheresis. 28 subjects were ambulatory , dependent on physical assistance – level 2 , and ambulatory under dependency of supervision . 3 subjects were ambulatory with independent on level surface and with independent ambulation¹³ .

Therefore this study showed the prevalence of motor impairments of hand both in dominant and non dominant hands with less impairment at level of ambulation even after plasmapheresis emphasizing the need for physiotherapy further . Muscle weakness or paralysis can be one of the most debilitating symptoms of the disease if not treated properly in the initial phase of GBS .

Therefore adequate rehabilitation programme need to be administered to the subjects after the plasmapheresis to maintain range of motion, to strengthen the muscles which decrease the risk of contractures and deformities and helps to improve functional performance in activities of daily living .

This study showed that there is significant prevalence of motor impairments of hand with less ambulation impairment in GBS subjects even after plasmapheresis .

CONCLUSION:

This study concludes that there were still significant motor impairments of hand and minimal impairment at the level of ambulation followed by plasmapheresis .This study directs for the need of rehabilitation even after discharge with proper exercise adherence and regular followup.

Recommendations:

- 1.Study can be done with age specific , type specific GBS
- 2.Further followup studies can be done .

Limitations :

3. Sample size small
4. Pre plasma values for JTHFT not taken

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