

A RETROSPECTIVE STUDY IN OUTCOMES OF PLASMAPHERESIS IN NEUROLOGICAL DISORDERS IN A TERTIARY CARE HOSPITAL

Neurology

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ABSTRACT

The term 'Apheresis' is used to describe the process of removal of abnormal blood constituents by extracorporeal blood purification methods. Plasma exchange (PE) involves the separation and removal of plasma from corpuscular blood and the replacement of it with various fluids, while plasmapheresis only refers to the removal of plasma. Common neurological disorders in which PE is indicated are myasthenia gravis, Guillain-Barré syndrome, and chronic inflammatory demyelinating polyneuropathy. Though minor complications may arise as in any procedure, it is generally safe but not as widely used as Intravenous Immunoglobulin (IVIG). Our aim is to study the outcome of plasmapheresis in neurological disorders in our institution with regard to Clinical indications, recovery, complications and cost effectiveness of plasmapheresis in neurological disorders in a rural care setting by retrospective Descriptive Analysis. The main indication for plasmapheresis was Guillian Barre syndrome. The most common complications were paraesthesias and/or cramps and hypotension. There was no mortality. Patients improved well on follow up disability score Clinically as well on electrophysiological parameters on Nerve conduction studies. The analysis of Plasmapheresis done in our department shows that the procedure is safe, with only minimal procedure related complications and no mortality and cost effective, efficacious alternative to IVIG in a rural care setting.

KEYWORDS

Plasmapheresis, Guillain-Barré Syndrome, IVIG

INTRODUCTION:

The term 'Apheresis' is used to describe the process of removal of abnormal blood constituents by extracorporeal blood purification methods.

Plasma exchange (PE) involves the separation and removal of plasma from corpuscular blood and the replacement of it with various fluids, while plasmapheresis only refers to the removal of plasma.

Most neurological disorders that are treated with PE are associated with presumed aberrant humoral immune responses, including myasthenia gravis, Guillain-Barré syndrome, and chronic inflammatory demyelinating polyneuropathy.

The technical terms that we need to understand are

- Plasmapheresis: Automated, selective removal of plasma by centrifugation.
- Plasma exchange (PE) - Removal of patient plasma and replacement with another fluid (eg, donor plasma, colloid, crystalloid).
- Hemapheresis (also called cytapapheresis) - Selective removal of abnormal blood cells or excessive numbers of cells.
- Dialysis - A diffusion-based treatment best suited for the removal of fluid or small molecules (eg, uremic toxins, some drugs) from the blood using a filter.
- Plasma filtration - A technique that separates plasma from cellular components with a highly permeable filter (plasma filter) using a dialysis or hemofiltration machine.

PROCESS OF PLASMAPHERESIS:

- The aim of plasma exchange is to significantly reduce circulating pathologic substances (antibodies) from the plasma.
- Substance to be removed must have a sufficiently long half life.
- Substance to be removed must be acutely toxic and resistant to conventional therapy.

Techniques used are

- Centrifugal cell separators
- Membrane plasma filtration

Plasma Volume Estimate:

It is calculated by

- Plasma volume (in litres) = $0.07 \times \text{weight (kg)} \times (1 - \text{hematocrit})$.
- Usually 1-1.5 TPV or 30-40 ml/Kg of plasma is removed per cycle and replaced with plasma expanders like albumin or Fresh Frozen Plasma (FFP)
- 2-5 alternate day cycle.

Choice of Replacement Solution-Albumin

Advantage:

1. No risk of hepatitis/HIV
2. Stored at room temperature
3. Allergic reactions are rare
4. No concern about ABO blood group
5. Depletes inflammation mediators

Disadvantage:

1. Expensive
2. No coagulation factors
3. No immunoglobulins

Choice of Replacement Solution-FFP

Advantage:

1. Coagulation factors
2. Immunoglobulins

Disadvantage:

1. Risk of hepatitis, HIV transmission
2. Allergic reaction
3. Hemolytic reaction
4. ABO incompatibility
5. Citrate load

There is no consensus on the ideal replacement solution during PE. Albumin and cross-matching plasma have been recommended. Colloid replacement can be achieved with fresh-frozen plasma, albumin, albumin and saline, or albumin and plasma expander solutions.

Common Adverse Events:

Usually patients undergoing PE may have hypotension, paresthesias, cramps, anaphylactic reaction.

Rarely pulmonary oedema, pneumothorax, Cardiac arrhythmia,

cardiac arrest are reported.

NEUROLOGICAL INDICATIONS FOR PE:

- 1.Acute Inflammatory Demyelinating Polyneuropathy (AIDP)
- 2.Guillain-Barré Syndrome (GBS)
- 3.Polyneuropathy associated with paraproteinemia
- 4.Lambert Eaton Myasthenic Syndrome (LEMS)
- 5.Multiple Sclerosis(MS)
- 6.Neuromyelitis Optica Spectrum Disorder(NMOSD)
- 7.Steroid Responsive Encephalopathy Associated with Autoimmune Thyroiditis(SREAT)
- 8.N methyl D Aspartate Receptor (NMDA R) Autoimmune encephalopathy

CONTRAINDICATIONS:

- Active infection
- Hemodynamic instability
- Allergy to fresh frozen plasma or albumin
- Allergic to heparin
- Hypocalcemia

According to American Society for Apheresis (2016) – ASFA Categories are

ASFA I Indications

- AIDP/GBS
- CIDP
- Myasthenia gravis
- Polyneuropathy with paraproteinemias
- NMDA receptor antibody encephalitis

ASFA II Indications

- Acute Disseminated Encephalomyelitis(ADEM)
- LEMS
- Acute MS exacerbation
- NMOSD
- SREAT

ASFA III Indications

- Paraneoplastic neurological syndromes
- Chronic progressive MS
- NMOSD maintenance

ASFA IV Indications

- Amyotrophic lateral sclerosis
- Inclusion body myositis
- POEMS syndrome

PROCEDURE FOLLOWED:

After confirming indication for plasmapheresis, and after following due ethical procedure for informed consent, ECG, Chest X ray, Serology for HIV, Hepatitis B and C and blood grouping were done and cardiac and respiratory statuses were assessed. The subclavian vein was catheterized i with a double lumen catheter, under local anesthesia, under aseptic precautions. A chest X-ray was routinely taken after subclavian catheterization, to assure proper placement of the catheter. The goal was to perform approximately 1L of plasmapheresis on alternate days, minimum of 3 cycles with replacement by FFP/albumin.

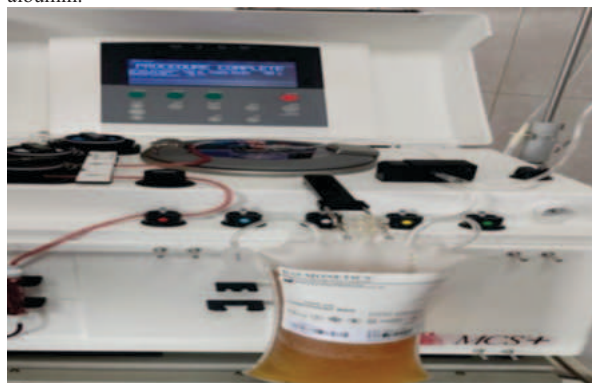


Fig 1– Plasmapheresis Machine On Automated Completion Of Procedure

Adequately hydrated the patient with 500ml-1L of Normal saline prior to procedure and during the procedure with Vitals monitoring . The blood pump speed was started at 75 ml/min and maintained between 80-100 ml/min according to Blood pressure of patient.Blood pressure (BP) and pulse were monitored every 15-30 minute intervals during the sessions and patients were closely observed for changes in appearance, development of symptoms (e.g., lightheadedness, nausea, paresthesias, etc.), and overall status. Hypotension was treated by lowering the pump speed or temporarily stopping the procedure and infusion of normal saline or fresh frozen plasma (FFP). Patients are strictly monitored in intensive care and day following procedure.

MATERIALS AND METHODS:

Study Design: Retrospective Descriptive study

Study Setting: Department of neurology, Chengalpattu medical college

Study Duration: 2 years

Study Period: 01/01/2023 to 31/12/2024

Study Population: Patients admitted to the neurology department at Chengalpattu medical college who have undergone plasmapheresis for Neurological Indications.

Inclusion Criteria

Patients admitted to the Neurology department at Chengalpattu medical college who have undergone plasmapheresis for Neurological Indications

Exclusion Criteria

Patients with similar conditions treated by Intravenous immunoglobulin and Pulse steroids therapy

Patients who are not willing for study

RESULTS:

Age /Sex, Clinical presentation ,Diagnosis of Patient,Indication for PE, If patient has GBS, type of GBS, Number of cycles of PE done, Disability score at presentation, discharge and on follow up, Response to Treatment, Adverse events noted, Nerve conduction studies on presentation and on follow up were observed and studied.

The results of our study are 12 patients who met our inclusion criteria were observed and studied.

Age Distribution:

Majority of patients were between 40-60 years (9 patients) 2 patients belonged to 20-40 years and 1 patient to more than 60 years age group

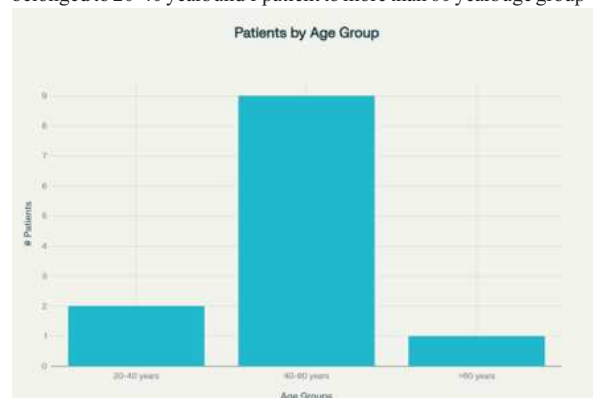


Fig 2– Age distribution bar diagram

Neurological Indications :

Table 1 : Neurological Indications In Our Study For Plasmapheresis

Neurological disease	Number of Patients (%) N = 12
1) Guillain Barre syndrome	8 (66.7%)

2) Recurrent LETM (NMOSD)	2 (16.7%)
3) Myasthenia Gravis	1 (8.3%)
4) Stiff Person Syndrome	1 (8.3%)

We had majority of patients from GBS who underwent PE– 8 patients from GBS, 2 patients of NMOSD and each 1 patient of Myasthenia Gravis and Stiff Person syndrome underwent plasmapheresis.

PLEX CYCLES:

- Among 12 patients,
- 11 patients had 3 cycles of PE
 - 1 patient had 4 cycles of PE

Type Of GBS:

Among 8 patients of GBS,

- 6 patients were Acute Inflammatory Demyelinating polyneuropathy (AIDP) subtype of GBS
- One patient each belonged to Acute Motor Axonal Neuropathy (AMAN) and Acute Motor and sensory Axonal Neuropathy (AMSAN) subtype by clinical and Nerve conduction studies (NCS)

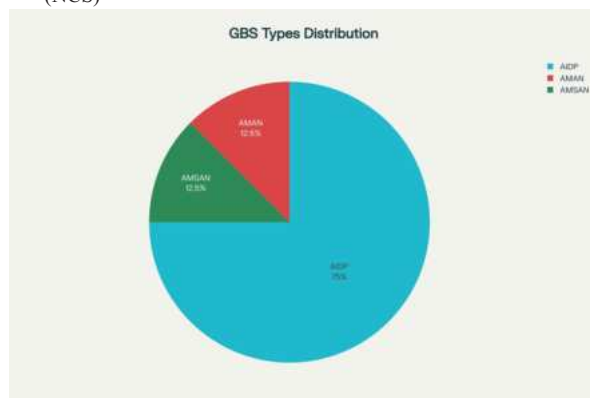


Fig 3: Pie chart diagram of GBS subtype

NCS Follow Up In GBS:

Out of 8 patients with GBS- NCS comparison of initial NCS study and at 2 months follow up study could be done in

- 6 patients with AIDP (Two patients had Normal NCS and 4 patients had AIDP pattern with recovery on follow up)
- 1 patient with AMSAN(Features of AMSAN with recovery on follow up)

Hughes GBS Disability Score On Follow UP:

We could follow 7 GBS out of 8 patients who underwent plasmapheresis and assessed their GBS disability score on admission and 8 weeks following discharge

- Four Patients improved from GBS disability score of 4 to 2 on follow up
- Three patients improved from GBS disability score of 4 to 1 on follow up
- One patient newly detected as Myasthenia gravis with Thymoma progressed to Myasthenic crisis, recovered well with Plasmapheresis and underwent thymectomy, Postoperative period was uneventful.

Table 2 – Adverse Events In PE

Complications	Number of Patients N=12
1) Paresthesias and Cramps	4
2) Hypotension (Mild)	3
3) Hypotension (Moderate-Severe)	1

4) Thrombophlebitis	1
5) Allergy / Urticaria	2

Adverse Events:

The following adverse events were noted in our study.

No mortality was observed

DISCUSSION:

Hence we have observed how is the process of Plasmapheresis and it's role in Neurological disorders. The Procedure is safe , though it is an interventional method when protocols are strictly adhered.

In our study Majority of patients who underwent plasmapheresis belonged to age group of 40-60 years.

Guillain-Barré syndrome seems to be major neurological disorder, among which AIDP subtype is most commonly observed to be benefited from PE.

Patients had only minor adverse events during procedure as it is stated like paresthesias, cramps. Hypotension should be closely monitored during procedure by strictly monitoring vitals and could be managed appropriately.

Patients improved well clinically on disability score on follow up and also follow up NCS Studies.

Cost incurred was comparatively lower than IVIG cost, hence it is useful in a rural care setting

CONCLUSION:

-The main indication for plasmapheresis was Guillian barre syndrome mainly AIDP subtype

-The most common complications were paraesthesias and/or cramps and hypotension .

-There was no mortality in our case series.

-Plasmapheresis is not only a safe and effective treatment but also a cost effective alternative to IVIG, for various immune mediated neurological disorders

-Plasmapheresis effectively removes immunoglobulins, helpful in acute management of GBS, myasthenia crisis, autoimmune encephalitis.

-Indications, technique, and replacement fluid choice tailored by diagnosis.

-Guidelines emphasize evidence grading and disease-specific recommendations.

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Conflict of Interest : Nil

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