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Original Research Article

A study on therapeutic plasma exchange using apheresis in treatment of Guillain-Barré syndrome in a tertiary care teaching hospital

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ABSTRACT

Background: Therapeutic plasma exchange (TPE) is the separation and removal of plasma from whole blood with replacement by a crystalloid/colloid solution (typically albumin or plasma). The DGHS has established guidelines and recommendations for application of therapeutic apheresis in clinical practice. Guillain-Barré syndrome (GBS) is considered category I indications for TPE. This study was undertaken to establish the effectiveness and safety of therapeutic plasma exchange in GBS which is one of the common indication for TPE at our tertiary care teaching hospital.

Methods: A retrospective study of 30 patients admitted to a tertiary care teaching hospital, from January 2014 to December 2016 with clinical signs of Guillain-Barre syndrome (GBS) and/or GBS variants were evaluated for performing TPE. A total of 104 procedures were performed for 30 patients. Replacement of crystalloids and plasma was used. Medical Research Council scale was used to assess the clinical improvement by measuring the grade of muscle power. Information was collected in a structured proforma and statistical analysis was performed using SPSS software (version 20). P value less than 0.05 was considered statistically significant.

Results: During the study period, 104 procedures were performed on 30 patients on an average of three procedures per patient. The average age of the patients was 41.4±10.4 years. The mean period of illness at admission was 14.5±5.4 (range 4-32) days. In 23 out of 30 patients, more than three TPE procedures were done, out of which 21 patients clinically improved. The common complications during the procedure were chills (16%), hypotension (10%) and non-hemolytic febrile transfusion reaction (10%) and they were managed accordingly. Two (6.7%) patients who were not ambulatory at discharge had significantly ($p < 0.05$) lower grade of power in lower limbs at admission and all patients recovered fully on follow up.

Conclusions: GBS is one of the most commonly occurring clinical paralytic disorders. 76.7% of patients underwent three or more cycles of TPE with 70% had excellent clinical improvement which was comparable with various other studies. Based on results published by various other studies, therapeutic plasma exchange is a comparatively safe and effective procedure.

Keywords: Guillain–Barré syndrome (GBS), Medical Research Council Scale, Therapeutic plasma exchange (TPE)

INTRODUCTION

Therapeutic apheresis is a part of transfusion medicine which establishes the treatment of diseases through removal of blood components or specific blood substances. It is different from blood component collection through apheresis. The Director General Health Services (DGHS) provides standards for voluntary

agreement for apheresis activities.[1] The DGHS has established guidelines and recommendations for application of therapeutic apheresis in clinical practice.[1]

The primary aim in therapeutic apheresis is to remove the pathologic factor such as plasma protein (autoantibody) as in myasthenia gravis, red cells as in sickle cell anemia, leukocytes as in hyperleukocytosis or platelets as in marked thrombocytosis from blood.[1,2] Therapeutic plasma exchange (TPE) is the separation and removal of plasma from whole blood with replacement by a colloid solution (typically albumin or plasma) or a combination of crystalloid/colloid solution. Theoretically, the rule is exchange of a single blood volume will eradicate approximately two-thirds of a substance if it does not move from extravascular sites to the intravascular space. However, continued production of the material or movement from tissues into the intravascular space will end in less apparent reduction even though an equal or even greater total amount removed.[1,3] TPE is usually limited to 1 or 1.5 plasma volumes, or approximately 40 to 60 mL plasma exchanged per kg of body weight in patients with normal hematocrit and average body size.[1]

American Society for Apheresis (ASFA) has published a categorization of indications for apheresis based on the best available evidence.[2,3]

Category I: Apheresis is standard and acceptable as a primary therapy or in conjunction with other therapies. This designation does not imply that apheresis is mandatory in all cases.

Category II: Apheresis is accepted as supportive therapy, either as a standalone treatment or in conjunction with other modes of treatment.

Category III: The optimal role of apheresis therapy is not established. Decision making should be individualized.

Category IV: Published evidence demostrates or suggests that apheresis is ineffective or harmful in these disorders. If apheresis treatment is undertaken in these circumstances, institutional review board approval is desirable.

Guillain-Barré syndrome (GBS), myasthenia gravis (MG), chronic inflammatory demyelinating polyneuropathy (CIDP), and demyelinating polyneuropathy with IgG/immunoglobulin A are considered category I indications by the American Society for Apheresis.[1-3]

Even though therapeutic apheresis is safe, problems do occur. Some adverse episodes do occur in about 4% of events, the majority of them being mild.[4,5]

The common adverse reaction is hypocalcaemia due to infusion of citrate along with the returned blood. The symptoms of hypocalcaemia are perioral and digital paresthesias, nausea, tetany and rarely cardiac arrhythmia. Concurrent supplementation of calcium helps in relieving the patient of sympyomatic hypocalcemia.[1,3] Plasma proteins in replacement plasma can cause allergic events. Other complications with therapeutic apheresis is hypotension, hypovolemia, vasovagal reaction, concurrent drug reaction and transfusion reaction.[1-3]

A procedure without proper plasma replacement can lead to loss of clotting factors. A one-plasma-volume exchange will typically reduce coagulation factor levels by 25% to 50%. If the patient has normal hepatic synthetic function, clotting factor levels come back to normal within 2 days. Therefore, majority of patients can withstand TPE every alternate day for 1 or 2 weeks without developing coagulopathies. TPE can also decrease the platelet count. Typically, a sensitive drop in platelet count by 25% can be expected after a one-plasma- volume exchange.[1,2] Serum levels of IgG and IgM improve to about 40% to 50% of the preapheresis level at 48 hours.[3] Hemolysis can happen with incompatible replacement fluids such as D5W or ABO-incompatible plasma. The operator should vigilantly monitor plasma collection lines for pink discoloration indicative of hemolysis. Death during apheresis are rare but has been reported in 0.006% to 0.09% of therapeutic procedures.[3-5] Most deaths are due to underlying medical conditions.[3]

This study was undertaken to establish the effectiveness and safety of therapeutic plasma exchange in GBS which is one of the common indication for TPE at our tertiary care teaching hospital.

METHODS

A retrospective study of 30 patients admitted to a tertiary care teaching hospital, from January 2014 to December 2016 with clinical signs of Guillain-Barre syndrome (GBS) and/or GBS variants were evaluated for performing TPE.

The patient and the patient's relatives were explained about the TPE procedure and informed consent was obtained from all patients. The study was approved by Institutional ethical committee. TPE procedures were done on an alternate day basis using a central line catheter depending on the clinical condition of the patient. The TPE was performed at a minimum of 1 and maximum of 5 cycles of plasma exchange based on the clinical outcome in the patient.

A total of 104 procedures were performed for 30 patients. Acid citrate dextrose:whole blood ratio used was 1:10, blood flow rate was kept between 25 and 50 ml/min depending on the weight of the patient and blood volume of the patient was calculated. Calcium gluconate infusion (10 ml of calcium gluconate in 500 ml normal saline [NS]) was transfused during the procedure to prevent citrate toxicity. Depending on the amount of plasma

exchange, the duration of procedure varied from 1.5 to 2 h. Replacement of crystalloids and plasma was used. Continuous vital signs monitoring was done during the procedure to identify adverse events related to the procedure and treat early. The complications during the procedure were documented and analyzed. The coagulation parameters, renal parameters along with complete hemogram were performed both at the beginning and after the procedure. Medical Research Council Scale was used to assess the clinical improvement by measuring the grade of muscle power.[6] In our centre, TPE is the first line of treatment for GBS. If available, Intravenous immunoglobulin (IVIG) is preferable.

Statistical analysis

Information was collected in a structured proforma. Data was entered in MS Office Excel format and statistical analysis was performed using SPSS software (version 20). The muscle power of the proximal / distal part of the limbs were compared and analyzed. Independent t test with 95% confidence interval (95% CI) was done to compare the mean changes in power in the limbs (the Medical Research Council scale) and the changes in the GBS disability grade (DGD) from time of admission upto time of discharge. P value less than 0.05 was considered statistically significant.[6,7]

RESULTS

During the study period from January 2014 to December 2016, 104 procedures were performed on 30 patients on an average of three procedures per patient. Table 1 shows demographic and clinical characteristics of the study patients.

The average age of the patients was 41.4±10.4 years (range 18-65 years). Nineteen (63.3%) patients were males and eleven (36.7%) were females. The mean period of illness at admission was 14.5±5.4 (range 4-32) days. On admission, generalized areflexia was present in all patients and three patients were admitted with concurrent autonomic dysfunction. An average power of 2 was present in the upper and lower limbs in all patients and were not ambulatory at the time of admission. Two patients (6.6%) had respiratory difficulty and one patient was mechanically ventilated.

Each procedure of TPE took 1.5 to 2 hours. Approximately, 2000 to 2500 ml of plasma was extracted during each procedure. In 23 out of 30 patients, more than three TPE procedures were done, out of which 21 patients clinically improved from grade-0 (complete paralysis) and grade-I (only a trace or flicker of movement in the muscle) to grade-III (movement possible against gravity but not against resistance). 9 patients suffered complications during the procedure and they were treated accordingly. The common complications were chills (16.7%), hypotension (10%) and non-hemolytic febrile transfusion reaction (10%) and they were managed accordingly.

Table 1: Demographic and clinical characteristics of the study patients.

Parameter	Number (n=30)
Gender	
Male	19 (63.3%)
Female	11 (36.7%)
Age (years)	
Mean±SD	41.4±10.4
Range	18-65
Duration of hospital stay (days)	
Mean±SD	14.5±5.4
Range	4-32
Clinical examination	
Generalized areflexia	30 (100%)
Concurrent autonomic dysfunction	3 (10%)
Respiratory difficulty	2 (6.7%)
Ambulatory on admission	0
Nerve conduction studies	9 (30%)
AIDP	9 (30%)
TPE sessions per patient	
Mean±SD	3.6±1.4
Range	3-11
Complications during TPE	9
Chills	5 (16.7%)
Hypotension	3 (10%)
Non-haemolytic febrile transfusion reaction	3 (10%)
Survival Outcome	30 (100%)

One case of machine error was noted, and the procedure was stopped. The machine was calibrated and then the procedures were done.

There was no significant difference in the demographic and other clinical characteristics. Two (6.7%) patients who were not ambulatory at discharge had significantly lower grade of power in lower limbs (P <0.05) at admission and all patients recovered fully on follow up.

DISCUSSION

The present study was done in a tertiary care teaching hospital from January 2014 to December 2016. This study involved both male and female patients of age groups between 18-65 years. The main objective of the present study was to establish the effectiveness and safety of therapeutic plasma exchange in GBS patients.

GBS is one of the most commonly occurring clinical paralytic disorder, with an average annual incidence of 1-2 per 100,000 population. It is a debilitating disease because up to one third of the affected persons require mechanical ventilation with approximately 20% remain severely disabled, and with mortality rate of 2% despite immunotherapy.[8]

The American Academy of Neurology (AAN) had published guidelines that TPE or IVIG fastens the recovery of patients with GBS. Both the treatment modalities are equally efficient.[9] The AAN states and recommends TPE for GBS patients who are non-ambulatory and IVIG treatment for patients who are ambulatory within two weeks of onset of neurologic symptoms.[10] IVIG is preferred due to ease of administration and availability but the cost factor is nearly double that of TPE. As, the efficacy of TPE is equivalent to that of IVIG and is less expensive, TPE can tried as the first option in developing country like India.

76.7% of patients underwent three or more cycles of TPE with 70% had excellent clinical improvement which was comparable with Kishore et al and Basic-Jukic et al. 30% of patients suffered complications which was comparable with various other studies.[11,12]

The limitations of the study is that it is a single centre study and a retrospective study with comparatively less number of study subjects. Based on results published by various other studies, ttherapeutic plasma exchange is a comparatively a safe and effective procedure.

CONCLUSION

Therapeutic plasma exchange can be carried out safely in Guillain-Barré syndrome and has been documented to be valuable as first line or adjunctive therapy in certain diseases. In developing countries, TPE is a cost-effective choice and it reduces the duration of stay in hospital and incidence of permanent paralysis and decreases the morbidity and mortality associated with GBS.

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Ethical approval: The study was approved by the Institutional Ethics Committee

REFERENCES

1. Directorate General of Health Services, Transfusion Medicine Technical Manual, 2nd edition. Directorate General of Health Services, Ministry of Health and Family Welfare, Government of India, New Delhi; 2003:242-243.
2. Szczepiorkowski ZM, Winters JL, Bandarenko N, Kim HC, Linenberger ML, Marques MB. Guidelines on the use of therapeutic apheresis in clinical practice-evidence-based approach from the Apheresis Applications Committee of the American Society for Apheresis. J Clin Apher. 2010;25:83-177.
3. Tobian AAR, Shirey RS, Montgomery RA, Tisch DJ, Ness PM, King KE. Therapeutic plasma exchange reduces ABO titers to permit ABO incompatible renal transplantation. Transfusion 2009;49:1248-54.
4. Norda R, Berseus O, Stegmayr B. Adverse events and problems in therapeutic hemapheresis. A report from the Swedish registry. Transfus Apher Sci. 2001;25:33-41.
5. McLeod BC, Sniecinski I, Ciavarella D. Frequency of immediate adverse effects associated with therapeutic apheresis. Transfusion. 1999;39:282-8.
6. Hermans G, Clerckx B, Vanhullebusch T, Segers J, Vanpee G, Robbeets C, et al. Interobserver agreement of Medical Research Council sum-score and handgrip strength in the intensive care unit. Muscle Nerve. 2012;45:18-25.
7. Hughes RA, Newsom-Davis JM, Perkin GD, Pierce JM. Controlled trial prednisolone in acute polyneuropathy. Lancet. 1978;2:750-3.
8. Yuki N, Hartung HP. Guillain-Barré syndrome. N Engl J Med. 2012;366:2294-304.
9. Hughes RA, Wijdicks EF, Barohn R, Benson E, Cornblath DR, Hahn AF, et al. Practice parameter: immunotherapy for Guillain-Barré syndrome: Report of the quality standards subcommittee of the American Academy of Neurology. Neurol. 2003;61:736-40.
10. Basic-Jukic N, Kes P, Glavas-Boras S, Brunetta B, Bubic-Filipi L, Puretic Z. Complications of therapeutic plasma exchange: Experience with 4857 treatments. Ther Apher Dial. 2005;9:391-5.
11. Kishore CK, Vijayabhaskar J, Vardhan VR, Sainaresh VV, Sriramnaveen P, Sridhar AV, et al. Management of Guillain-Barré syndrome with plasmapheresis or immunoglobulin: our experience from a tertiary care institute in South India. Ren Fail. 2014;36:732-6.
12. Basic-Jukic N, Kes P, Glavas-Boras S, Brunetta B, Bubic-Filipi L, Puretic Z. Complications of therapeutic plasma exchange: experience with 4857 treatments. Ther Apher Dial. 2005;9:391-5.

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