

Membrane Therapeutic Plasma Exchange (mTPE): Early Technical and Clinical Experience

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Introduction

Separation of plasma using highly permeable filters, referred to as membrane therapeutic plasma exchange (mTPE), has undergone considerable investigation in Europe and Japan. Since nephrologists are well-trained in the management of extracorporeal blood purification and the advancement in technology has allowed performing mTPE using dialysis equipment and dialysis staff, mTPE is gaining popularity amongst nephrologists in the United States¹. We report our single-center early technical and clinical experience using a hollow fiber plasma separator with dialysis equipment and staff to perform inpatient TPE at a large tertiary care academic center.

Methods

Data was prospectively collected on all patients receiving inpatient mTPE since the program's inception in January of 2013. Procedures used the Asahi Plasmaflo™ OP filter with the NxStage® System One™ machine. Indications for TPE were based on published guidelines from the American Society for Apheresis (ASFA)². The mTPE was performed by dialysis technicians in cooperation with nursing staff. Albumin, Fresh Frozen Plasma (FFP) or a combination were used as replacement fluid (RF). The circuit was pre-rinsed with 2 liters of saline without the use of heparin. Anticoagulation was not used as a default in the majority of the procedures. Both regional citrate anticoagulation (ACD-A) and heparin were available as needed on a protocol and used in few treatments. Plasma removal was isovolumetrically balanced with RF, allowing it to go directly to a drain without the use of collection bags or the requirement for weighing. Central venous catheters as well as arteriovenous fistulas and grafts (AVFs and AVGs) with a targeted blood flow rate (QB) of 200 mL/min were utilized for access. The Filtration Fraction (FF) was monitored (RF/QB).

References

- 1) Kaplan AA. Why nephrologists should perform therapeutic plasma exchange. *Dialysis & Transplantation*. Feb 2009.
- 2) Szczepiorkowski ZM et al. Guidelines on the use of therapeutic apheresis in clinical practice—Evidence-based approach from the American Society of Apheresis. *J Clin Apher* 2010; 25: 83-177.

Results

A total of 389 mTPE procedures were performed in 90 patients over a period of ten months (average 4.3 treatments per patient). The mean achieved QB was 174 mL/min. An average of 3654 mL of plasma was exchanged over 111 minutes (exchange rate of 33 mL/min) (See Table 1). 87% of the patients used a central venous catheter as their access while AVF (11%) and AVGs (2%) were used in the remaining patients. Indications for TPE originated from a wide range of specialties (see Table 2). 45% of patients and 43% of treatments had a neurologic indication. Among non-neurologic indications, TTP was the most common indication. Heparin was used in 17 (4.3%) treatments and ACD-A was used in 14 (3.6%) treatments. The average achieved FF was 24.8%.



NxStage® System One™
TPE Machine

Table 1: Patient and Treatment Characteristics

Age (Yrs)	48.6 ± 14
Gender (F:M)	58:32
Exchange Vol. Ordered (mL)	3682 ± 899
Exchange Vol. Achieved (mL)	3654 ± 909
Replacement Fluid	
Albumin N (%)	237 (61%)
FFP N (%)	132 (34%)
Albumin + FFP N (%)	20 (5%)
Achieved Blood Flow (mL/min)	174 ± 26
Therapy Time (min)	111 ± 46
Exchange rate (ml/min)	33
Filter Clotting	5.4%

Results (Cont.)

Table 2: Distribution of Indications for TPE (N=389 tx, N=90 pts)

Diagnosis	Patient N (%)	Treatment N (%)
Thrombotic Thrombocytopenic Purpura (TTP)	14 (16%)	109 (28%)
Neuromyelitis Optica (NMO or Devic's Dz)	15 (17%)	57 (15%)
Acute Humoral Rejection	13 (14%)	43 (11%)
Autoimmune Neuropathy	12 (13%)	48 (12%)
Myasthenia Gravis	9 (10%)	46 (12%)
HLA Desensitization	7 (8%)	23 (6%)
Chronic Inflammatory Demyelinating Polyradiculoneuropathy (CIDP)	5 (5%)	17 (4.3%)
Alveolar Hemorrhage	4 (4%)	10 (2.6%)
Hypertriglyceridemic Pancreatitis	3 (3%)	6 (1.5%)
Post-transplant FSGS	2 (2.2%)	7 (1.8%)
Catastrophic antiphospholipid Ab Syndrome (CAPS)	2 (2.2%)	8 (2%)
Cryoglobulinemia	1 (1%)	5 (1.3%)
Hyperviscosity Syndrome	1 (1%)	3 (0.7%)
Other	2 (2.2%)	7 (1.8%)

Complications of therapy were observed at the following rates: Clotting of the circuit requiring cartridge change 5.4%; Access malfunction 4.6%; Tingling or Paresthesias 1.8%; Low back pain 1%; Hypotension 0.7%. There were no central line associated blood stream infections.

Conclusions

Nephrologists familiar with extracorporeal blood purification can safely and efficiently perform mTPE as an alternative to centrifuge-based therapeutic plasma exchange (cTPE). Advantages of mTPE over cTPE include lack of anticoagulation, use of dialysis equipment/staff and fast exchange rates, which could allow for shorter treatment times.