Clinical Practice Article

PLASMA EXCHANGES: OBSERVATIONAL STUDY AT THE MOHAMMED V RABAT MILITARY TRAINING HOSPITAL BLOOD TRANSFUSION CENTER FROM JANUARY 2016 TO DECEMBER 2019

ABSTRACT:

Since their initial indications as the ultimate treatment for certain serious pathologies, plasma exchanges (PE) have been utilized as frontline therapies up to lifesaving interventions. The purpose of our study is to highlight the practical modalities and therapeutic indications of plasma exchanges, drawing on the original experience of the blood transfusion center at the Mohammed V Military Training Hospital over a period of 4 years, spanning from January 2016 to December 2019.

Among the patients treated with plasma exchanges, the majority suffer from neurological pathologies (37%), followed by autoimmune pathologies such as thrombotic thrombocytopenic purpura and thrombotic microangiopathy (25%), and finally hematological and nephrological pathologies, each representing 19%.

Our findings align with the literature, which identifies neurological indications as the primary pathologies resorting to plasma exchanges, followed by hematological, dysimmunological, renal, and endocrine pathologies.

Ultimately, for optimal patient management, collaboration between the transfusion center and clinical and biological services is indispensable.

Keywords: plasma exchange, transfusion medicine, plasmapheresis, myasthenia, thrombotic microangiopathy.

INTRODUCTION

Plasma exchange (PE) or plasmapheresis is a therapeutic apheresis technique involving the extraction of the plasma component from blood, followed by the reinfusion of cellular elements back to the patient, along with a substitution fluid. PE exhibits therapeutic effects either through the substitution of harmful plasma macromolecules or by providing deficient or absent molecules in the patient's plasma.

The objective of this study is to present an overview of the activities related to the implementation of these procedures at the Blood Transfusion Center (BTC) of the Mohammed V Military Training Hospital (MVMTH) over a period of 4 years, spanning from January 2016 to December 2019. Our aim is to contribute to the optimal utilization of transfusion medicine techniques on a national scale.

MATERIALS AND METHODS:

This is a retrospective study reporting the experience of the Blood Transfusion Center at MVMTH over a 48-month period, from the year 2016 to 2019.

Our study included 16 patients managed in various departments: Intensive Care, Hematology, Nephrology. Inclusion criteria were based on the accessibility of the medical records.

Data for this study were collected by analyzing the duly filled surveillance form by the physician responsible for plasma exchange in each service. The form included patient identification, weight, admitting service and reason for hospitalization, session number, close monitoring of pulse and blood pressure every half hour, withdrawal rate, return rate, volume collected, substitute used, and observations on tolerance.

Patients were subdivided into four categories based on their pathologies:

Sample 1: Patients with neurological pathologies

Sample 2: Patients with nephrological pathologies

Sample 3: Patients with hematological pathologies

Sample 4: Patients with autoimmune pathologies

Two separators were used at our Blood Transfusion Center during this period: Amicus and MCS+ or MCS+3 from Haemonetics.

The vessel puncture is performed under stringent aseptic measures using short catheters. Regarding access routes, the central route is used in most cases. However, when possible, a peripheral route is used. Commonly used substitution solutions include albumin (4%), saline solution (9‰), or PFC in certain cases. The majority of PE procedures, in the Intensive Care and Neurology services, are carried out by a physician and a BTC technician, assisted by a nurse from the care service.

RESULTS:

The patients in our study are divided into 10 females (representing 63% of cases) and 6 males (representing 37% of cases). The average age of our patients is 47 years with a standard deviation of 15.02 years.

Among the patients treated with plasma exchanges during this period, the majority suffer from neurological pathologies (37%), followed by those with autoimmune pathologies: thrombotic thrombocytopenic purpura and thrombotic microangiopathy (25%). Patients with hematological (19%) and nephrological (19%) pathologies make up the remaining cases.

The Amicus TPE procedure is a continuous flow process requiring a disposable double-lumen exchange kit. Patient information such as height, weight, gender, and hematocrit level is necessary to estimate the total blood volume and patient plasma volume.

The MCS+ or MCS+3p from Haemonetics is a discontinuous flow separator with an extracorporeal volume between 300 and 400 ml.

The anticoagulant for the extracorporeal circuit was provided by ACD (Anticoagulant Citrate Dextrose). The ACD/(total blood) ratio should be at least 1/10 to achieve effective anticoagulation.

69 PE procedures were performed in each service based on pathology, involving 16 patients.

The average exchanged volume (AEV) varied between 2300 ml and 3760 ml

Pathologies	Diagnosis	Average exchanged volume in liters/procedure	Number of procedures
Neurology	meningoencephalitis	2481	3
	Myasthenia	3700	11
	polyradiculoneuritis	2760	4
	neuromyelitis	2350	5
	multiple sclerosis	2070	7
Nephrology	ANCA+ and intra-alveolar haemorrhage	3.540	6
	Wegener's granulomatosis	3442	5
Hematology	Waldenstrom's disease	2700	7
	Hemolytic Anemia	2300	4
Autoimmune	Thrombotic thrombocytopenic purpura	2960	14
	Thrombotic microangiopathy	3077	3

Table 1: Distribution of Plasmapheresis Sessions by Pathologies and Average Exchanged Volumes

It is noted that in neurological pathologies, 30 sessions were conducted (accounting for 38%): 11 sessions for patients with myasthenia (37%) with an AEV of 3700 ml in the case of severe myasthenia and 2776 ml in the case of myasthenia without improvement under Ig, 7 sessions for the patient with multiple sclerosis (23%) with an AEV of 2070 ml, 5 sessions for the patient with neuromyelitis (17%) with an AEV of 2350 ml, 4 sessions for the patient with polyradiculoneuritis (13%) with an AEV of

2760 ml et 3 sessions for the patient with meningoencephalitis (10%) with an AEV of 2481 ml.

Regarding nephrological pathologies, 14% of sessions were conducted for 3 patients, including: 6 sessions for the patient with ANCA+ and intra-alveolar haemorrhage (54%) with an AEV of 3450 ml for the first three sessions and 3700 ml for the last three et 5 sessions for the patient with Wegener's disease (46%) with an AEV of 3442 ml.

For hematological pathologies, 11 procedures were conducted (14%): 7 sessions for patients with Waldenstrom's disease (64%) et 4 sessions for the patient with hemolytic anemia (56%).

In autoimmune diseases, the number of procedures performed for 4 patients was 17: 14 sessions for patients with thrombotic thrombocytopenic purpura (71%) et 3 sessions for patients with thrombotic microangiopathy (29%).

DISCUSSION:

Various scientific societies have issued recommendations for the indication of plasma exchanges (PE). The recommendations of the American Society for Apheresis (ASFA) have the advantage of using an evidence-based approach, proposing four categories of indications (first-line treatment, second-line treatment, Unsettled status, ineffective or deleterious), summarizing therapeutic schemes used by pathology, and being regularly updated. There are no specific recommendations for patients hospitalized in intensive care.

Out of the thirty PE records conducted, we selected 16 due to the comprehensiveness of patients' clinical records. Indeed, in the absence of certain information or data, other records were not exploited.

In our series, women represent two-thirds of the 16 patients selected, with an average age of 47 years. Neurological pathologies are the most frequent among the patients in our series. Alongside the Neurology department, patients from the Intensive Care, Hematology, and Nephrology services underwent PE for various indications.

Several indications can be considered. For some of them, the effectiveness of PE has been verified either through studies on large patient series or through numerous observations, the objective analysis of which establishes a cause-and-effect relationship between the treatment and the obtained result. Among these

indications, some are particularly noteworthy, such as malignant dysglobulinemia, thrombotic thrombocytopenic purpura, Guillain-Barré syndrome, myasthenia crisis, Goodpasture syndrome, and acute pancreatitis.

It is challenging to review all indications that can benefit from the contribution of PE in the therapeutic protocol within this context. In neurology, myasthenia represents a medical emergency.

In our series, 11 PE procedures were performed with an average volume of 3700 liters per procedure. PE sessions significantly improved the clinical course of patients.

For Guillain-Barré syndrome or acute polyradiculoneuritis, the early application of PE reduced the duration of intensive care unit (ICU) hospitalization, the duration of the acute phase of the disease, and the intensity of motor deficit for all patients. Thus, PE was instrumental in reducing the duration of assisted ventilation and the recovery time for motor function.

In our series, 4 PE sessions were conducted, with at least 2 sessions for each patient. During exacerbations, PE was combined with corticosteroids or immunosuppressants.

For hematological pathologies, four PE sessions were performed, demonstrating significant clinical improvement in patients with hemolytic anemia. In Waldenstrom's disease, two patients with plasma hyperviscosity syndrome underwent a total of seven PE sessions, resulting in a remarkable clinical evolution.

In Goodpasture syndrome, PE led to a decrease in the titers of anti-basement membrane antibodies and immune complexes. The vital and functional prognosis was dramatically improved by PE. Its effectiveness is recognized in reducing mortality and improving renal failure.

A woman suffering from Wegener's disease underwent only 2 PE sessions as the diagnosis was uncertain.

CONCLUSION:

It is essential to emphasize that plasma exchanges represent a significant therapeutic advancement for certain severe diseases inadequately controlled by conventional treatments.

Optimal patient management requires well-structured and collective decision-making, as well as adequate training of personnel, especially considering that plasma exchanges may need to be initiated urgently.

Therefore, it is imperative to have experienced practitioners and well-defined operating standards to evaluate these techniques effectively.

References

1. Korach J-M. Hémaphérèse thérapeutique adulte et pédiatrique, Réanimation 14. 2005; 10 : 641Ŕ650
2. Lefevre P, Lassale B. Echange plasmatiques EMC. Anesthésie-réanimation 1995; 36-738A-10
3. Korach J-M. Hémaphérèse thérapeutique adulte et pédiatrique, 14 2005; 10 : 641 650
4. Lefevre P, Lassale B. Echange plasmatiques EMC. Anesthésie Réanimation. 1995; 36-738-A-10
5. Beliwr, Brainf Hg, Ness Pm, Kickier Rs. Improved survival in thrombotic thrombocytopenic purpurahemolytic uremic syndrome. Clinical experience in 108 patients NEJM.1991; 325: 398-403
6. Schwab PJ, Fahey JL. Treatment of Waldenstrom's macroglobulinemia by plas-mapheresis. N Engl J Med 1960; 263:574–9.
7. Solomon A, Fahey JL. Plasmapheresis therapy in macroglobulinemia. Ann InternMed 1963; 58:789–800.