

# 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. In this observational study conducted at the Mohammed V Military Training Hospital Blood Transfusion Center from January 2016 to December 2019, we aimed to elucidate the practical modalities and therapeutic indications of plasma exchanges. Our findings revealed that among the patients treated, the majority suffered 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%. These results align with existing literature, emphasizing the prevalence of neurological indications for plasma exchanges.

Moreover, the study showcased the effectiveness of plasma exchanges in various neurological conditions, with notable sessions for myasthenia, multiple sclerosis, neuromyelitis, polyradiculoneuritis, and meningoencephalitis. For nephrological pathologies, the sessions were primarily conducted for patients with ANCA+ intra-alveolar haemorrhage and Wegener's disease. Additionally, plasma exchanges demonstrated significant clinical improvements in patients with hematological pathologies, such as Waldenstrom's disease and hemolytic anemia, and autoimmune diseases like thrombotic thrombocytopenic purpura and thrombotic microangiopathy.

Ultimately, this study underscores the importance of collaboration between the transfusion center and clinical and biological services for optimal patient management. The insights gained contribute to the broader understanding of plasma exchange applications in various pathologies, emphasizing its role as a crucial therapeutic intervention.

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

## INTRODUCTION

Plasma exchange (PE), also known as plasmapheresis, is a therapeutic apheresis technique that involves extracting the plasma component from blood, followed by reinfusing cellular elements back

to the patient, along with a substitution fluid. PE exerts therapeutic effects by substituting harmful plasma macromolecules or providing deficient or absent molecules in the patient's plasma.

In pathologies where plasma exchange (PE) is employed as a treatment, plasma serves as the pathogenic vector either by transporting harmful compounds or by lacking a component crucial for homeostasis. The choice of replacement fluid depends on the physiopathological mechanism of the targeted pathology. In cases where there is a deficiency of a plasma element, therapeutic substitution with plasma obtained from healthy donors has proven to be an effective mechanism. The initial application of plasma exchange was conceptualized in 1914, initially in animals, and later in humans in the late 1950s, particularly in addressing the hyperviscosity syndrome of Waldenström's disease.

In this study, we aim to provide an overview of the activities related to the implementation of plasma exchange procedures at the Blood Transfusion Center (BTC) of the Mohammed V Military Training Hospital (MVMTH) over a 4-year period, spanning from January 2016 to December 2019. The primary objective is to contribute to the optimal utilization of transfusion medicine techniques on a national scale. To achieve this, our research objectives include assessing the prevalence of different pathologies treated with plasma exchange, evaluating the effectiveness of the procedure in various medical conditions, and identifying potential areas for improvement in the implementation of plasma exchange protocols. Through this study, we seek to enhance our understanding of the role of plasma exchange in therapeutic interventions and its impact on patient outcomes.

#### **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.

The accessibility of medical records was the main criterion for patient selection, ensuring comprehensive data availability for analysis.

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 milliliters/procedure	Number of procedures
Neurology	meningoencephalitis	2481	3
	Myasthenia	3700	11
	polyradiculoneuritis	2760	4
	neuromyelitis	2350	5

	multiple sclerosis	2070	7
<b>Nephrology</b>	ANCA+ and intra-alveolar haemorrhage	3.540	6
	Wegener's granulomatosis	3442	5
<b>Hematology</b>	Waldenstrom's disease	2700	7
	Hemolytic Anemia	2300	4
<b>Autoimmune</b>	Thrombotic thrombocytopenic purpura	2960	14
	Thrombotic microangiopathy	3077	3

**Table 1:** Distribution of Plasma exchange Sessions by Pathologies and Average Exchanged Volumes

The Plasma exchange sessions were predominantly conducted for neurological pathologies, accounting for 44%. Nephrological and hematological pathologies contributed 16% each, while autoimmune diseases constituted 24%. The detailed breakdown of sessions and associated average exchanged volumes provides insights into the distribution and therapeutic considerations for various medical conditions. Emphasizing the diverse applications and outcomes of Plasma exchange in the studied patient population is detailed in Table 1.

## **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 **Milliliters** 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.

Despite the results consistent with those in the literature, this study has limitations due to the fact that this series concerns a small number of patients and it concerns only one center. Thus, collaboration with other transfusion centers is recommended in order to set up a national register of plasma exchanges, which would help to optimize the indications for this therapy, as well as to standardize procedures and gain a better understanding of the risks and complications associated with plasma exchange.

## **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.

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