Transfusion and Apheresis Science 55 (2016) 136–140

Contents lists available at ScienceDirect

Transfusion and Apheresis Science

journal homepage: www.elsevier.com/locate/transci

Frequency of hemorrhagic complications in plasmapheresis without extracorporeal circuit anticoagulation, in children

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ARTICLE INFO

Article history:
Received 21 January 2016
Received in revised form 2 May 2016
Accepted 3 May 2016

Keywords:
Plasmapheresis
Apheresis
Therapeutic plasma exchange
Anticoagulation

ABSTRACT

Background: The current practice of plasmapheresis at most centers employs anticoagulation of the extracorporeal circuit, which has been associated with complications. There are few studies evaluating the efficacy and safety of using plasmapheresis without any anticoagulation. We report our experience using this strategy in children (1 month to 18 years old) over a period of 5 years.

Results: Two hundred forty-three plasmapheresis sessions without anticoagulation of the extracorporeal circuit, in 27 pediatric patients, were analyzed. Of these, 81.4% were female and the predominant age range was 12–18 years (70.3%). One hundred percent of the patients had PRISM III scale low mortality risk, and the main indication of therapy was acute rejection after renal transplantation (25.9%), followed by recurrence of focal segmental sclerosis in the transplanted kidney (17.2%). Filtration lasted more than 3 hours in 86.8% of cases, with bleeding complications in 2.9% of patients requiring early termination due to associated complications in 3.2% of cases. Other complications were paresthesias (0.41%), vomiting (5%), hypertension during (67.4%) and after therapy (64.6%), and hyperchloremia (46.5%).

Conclusions: In our experience, plasmapheresis without circuit anticoagulation in children is safe and effective, with a low frequency of bleeding and hydroelectrolytic complications, allowing the achievement of therapeutic goals without altering therapy duration and efficiency. Prospective studies are needed to corroborate these findings.

1. Introduction

Plasmapheresis has been used since the last century for therapeutic purposes in a variety of serious illnesses, including renal, neurological, immunological and hematological diseases, and continues to be used currently as an optimal treatment for eliminating excess amounts of substances or components that contribute to bodily harm and potential morbidity and mortality in some patients [1].

In this procedure, a certain volume of plasma or blood cell components is extracted using either of two techniques: centrifugation or filtration [2]. The objective is to eliminate the inherent or foreign substances considered to be responsible for a disease or its clinical manifestations [2].

In spite of the great benefits offered by this therapy, potential side effects have been attributed to it. The most frequent are: electrolytic alterations (hypocalcemia), sensitivity to fresh frozen plasma, hypotension, hypothermia, infection, hemorrhagic alterations, and even death [3].

Traditionally, systemic anticoagulation has been used in extracorporeal therapies, regardless of length and

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http://dx.doi.org/10.1016/j.transci.2016.05.002
1473-0502/

intensity, in order to avoid the activation of the coagulation cascade when the blood comes in contact with the extracorporeal circuit material. However, a few small studies suggest that plasmapheresis could be performed without having to anticoagulate the system, since it is of short duration, and both the circuit and the filter are discarded at the end of the procedure [3].

In general today, strategies without anticoagulation of the extracorporeal circuit are being used, because plasmapheresis removes substances needed for maintaining optimal coagulation (fibrinogen and coagulation factors, among others). In addition, not using anticoagulation has the potential for avoiding electrolyte disturbances mainly derived from the use of citrate anticoagulation [4].

There is limited information regarding the use of plasmapheresis without anticoagulation of the extracorporeal circuit in the pediatric population. In this study we evaluate the frequency of hemorrhage complications and the effect of not anticoagulating the extracorporeal circuit on the efficiency and length of therapy.

2. Materials and methods

A retrospective study was carried out of all the pediatric plasmapheresis sessions without extracorporeal circuit anticoagulation performed at the Fundación Cardioinfantil, Bogotá, Colombia, in patients 1 month to 18 years old, during a period of five years between January 2009 and January 2014. Patients with a history of thrombophilia who used systemic anticoagulation within the last two weeks, and children who received plasmapheresis by ultrafiltration, were excluded. The clinical and demographic characteristics of the patients, as well as the apheresis technique, indications and complications, are described based on information obtained from the institutional electronic and physical chart. A session was defined as a plasmapheresis treatment, and a cycle was defined as the set of scheduled sessions for a particular patient, to treat the underlying pathology.

The population was evaluated according to sex, race, area of hospitalization, number of plasma exchanges performed per patient, and indication of the treatment. All sessions were performed with a volumetric control system, Aquarius (Baxter Lab) model dialysis machine, Mahurkar high flow central venous catheters sized according to the patient's age, and standard plasma filters and circuits from the parent company (Baxter Lab Comp) for adults (greater than 30 kg) or children (5–30 kg). No extracorporeal circuit anticoagulation was used in any of the sessions of any of the patients. No routine or prophylactic electrolytes, such as calcium or magnesium, were used.

Data analysis was performed using the STATA 13 statistical program and the EpiInfo program. A descriptive analysis of the demographic variables, individual characteristics of the children, plasmapheresis performance, and complications was carried out. For continuous variables, measures of central tendency (mean, median) and dispersion (standard deviation and interquartile range (IQR)) were estimated; proportions and relative values were estimated for categorical variables. Likewise, the development of bivariate analysis between the variables associated with the number of sessions, such as the clinical condition of the children, was explored. Statistical significance tests were not employed for the bivariate analysis due to the sample size.

3. Results

Two hundred forty three plasmapheresis sessions without extracorporeal circuit anticoagulation were performed on 27 pediatric patients between 1 month and 18 years years of age, all of which were carried out in the Pediatric Intensive Care Unit. Of these patients 81.4% were female, between 4 and 17 years old (IQR 10–15 years), while for males the age range was 8 to 15 years (IQR 12–14 years). The median age for both sexes was 14 years (Table 1). The largest number of plasma exchanges performed per patient was 41, making up 3.7% of the total number of exchanges. The smallest number of plasma exchanges was one, in six patients, which makes up 22.2% of the total.

The indications for plasmapheresis were: neurologic, rheumatologic, hematologic, renal and infectious diseases. The greatest percentage of sessions performed made up 25.9% due to acute rejection of a transplanted kidney, followed by 17.2% for recurrent focal and segmental glomerulosclerosis in a transplanted kidney, and the least frequent indication was antiphospholipid syndrome (0.4%) (Table 2).

Regarding replacement fluids, 5% albumin was used in 28.4% of the sessions, fresh frozen plasma in 28.1%, and albumin plus fresh plasma in 60.4%.

With regard to the type of solution used, according to the patients' diagnosis, in hemolytic uremic syndrome the predominant solution was fresh frozen plasma (76%), in antiphospholipid syndrome and severe sepsis 5% albumin was used, and in the rest of the pathologies 5% albumin with fresh frozen plasma was used (Fig. 1). All sessions were performed using transmembrane plasmapheresis.

In general, therapy duration coincided with what was originally planned; in other words, two to three hours in the majority of sessions (81.4%) only 18.5% required more than three to six hours. Two hundred forty-three plasmapheresis sessions were conducted.

Extracorporeal circuit anticoagulation was not used in any of these plasmapheresis sessions. Of the sessions, 87.6% were carried out using a temporal high flow dialysis catheter, and 12.3% used a permanent tunneled catheter. The

Table 1
Demographic characterization of the population (27 patients – 243 plasmapheresis sessions).

Sex – number (%)	
Male	5 (18.5)
Female	22 (81.4)
Age – years (SD)	
Mean	12.29 (3.71)
Median	14
Range	4–17
Age by sex – years	
Male	12.4 ± 2.7
Female	12.2 ± 3.9
Race – number (%)	
Hispanic	27 (100)