

Review Article

Platelet Apheresis: Experience of the blood transfusion center of Avicenne military hospital in Marrakesh

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Abstract: Apheresis platelet concentrates (APC) are platelet suspensions obtained by apheresis from a cell separator. These techniques, which appeared a little more than 20 years ago, are currently the best way to obtain platelets in large quantities from a single donor. These separators, whether discontinuous or continuous flow, perform extracorporeal circulation from anticoagulated blood, which allows the collection of platelets, returning to the donor his red blood cells and a more or less important part of his plasma. The procedures used are all automated and often adaptable to the donor's parameters. Apheresis platelet concentrates are single-donor products and therefore limit the transfusion risks compared to standard platelet concentrate mixtures, which are derived from five to six donors on average. The objective of our work is to study platelet donations by apheresis technique, their advantage, indication, and description of the equipment used, during a period of 3 years, from July 2017 until July 2020. And during this period, 29 apheresis procedures were performed by HAEMONETICS' MCS+. The clinical hematology department is the first applicant of APC where acute leukemia and non-Hodgkin's lymphoma are the most treated pathologies by this substitution.

Keywords: Platelet apheresis technique; Apheresis platelet concentrate..

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I. INTRODUCTION

The transfusion of platelets of human origin remains a first-line replacement therapy in the treatment of patients with a bleeding syndrome related to platelet damage, either quantitative or qualitative [1]. The current evolution of practices tends towards the widespread use of single-donor products and the prescription of preventive transfusions, although this remains a major difficulty [2]. Platelet apheresis is a selective platelet extraction technique that appeared a little more than 20 years ago and is currently the best way to obtain platelets in large quantities from a single donor.

The objective of this study is, on the one hand, to describe the different apheresis techniques, the advantages and indications of apheresis platelet concentrates and, on the other hand, to report the experience of the blood transfusion center of the Avicenne military hospital in Marrakesh, concerning platelet donation by this technique.

II. Apheresis Techniques:

There are several apheresis techniques, namely:

1. Discontinuous flow separators:

This is the oldest technique used, treating small volumes of blood in a cyclic manner. The pump flow of the extracorporeal circulation, ideally 100ml/min, directs the whole blood to a centrifugation bowl rotating between 1400 and 1800 rpm. The force of gravity can reach 1300 G at maximum rotation. The centrifugation cycle is interrupted when the bowl contains a pellet of approximately 350 ml of packed cells at 65% hematocrit. The centrifugation pellet is then returned to the patient and a new cycle is started [3]. One of the advantages of this method is that it requires only one venous access. However, the process requires 20% more time than other techniques, and results in greater fluctuations in extracorporeal blood volume that are sometimes poorly tolerated hemodynamically. The separator used in the AMH laboratory is a HAEMONETICS MCS+ discontinuous flow separator. To maintain optimal venous flow, the MCS is equipped with an inflatable armband, which automatically maintains a predetermined pressure during the sample cycle [4].

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2. Continuous flow centrifugation:

Consists in extracting, treating and restoring blood to the subject simultaneously. It is faster but requires two venous access paths. The extracorporeal volume is low, ensuring good hemodynamic tolerance. The centrifugation speed is adjustable from 400 to 5000 rpm depending on the model of the device, resulting in a maximum gravity force in the centrifugation ring of about 1000 G for a speed of 5000 rpm. Usually, 2500 rpm are not exceeded, producing a centrifugation pellet with 70% hematocrit. Current separators are totally automated [5, 6].

3. Filtration:

The principle of this technique is in continuous flow and using a filtering column. The filtration membrane used has a pore size of 0.3 to 0.5 μm , thus allowing the purification of molecules of large molecular weight up to 1000000 daltons [7].

Two techniques can be distinguished:

a. Conventional filtration:

The patient's blood taken from the elbow crease is first mixed with the anticoagulant before passing through a membrane that has pores of 0.2 and 0.8 μm , allowing the separation of plasma and figurative blood elements. This favors the collection of plasma, which is subtracted with toxins and pathological immunological fractions from the body to replace it with various isotonic saline solutions at the same volume, while the patient's cellular elements return to the internal circulation. This technique is more expensive than centrifugation due to the high cost of single-use equipment [8].

b. Cascade filtration:

A first step is distinguished where the collected blood plus anticoagulant passes through a primary filter with a pore diameter of 400 nm. The plasma is then separated from the figurative elements of the blood. In the second stage, the plasma enters the second filter with a pore diameter of 70 nm. Molecules with a high molecular weight, substances harmful to the body, due to their selective membrane filter size are removed [8, 9].

III. Platelet donation by apheresis technique:

1. Donor selection

The donor must meet the selection criteria for blood donors, their age is between 18 and 60 years with a maximum rate of once per 15 days. Each donation is preceded by an interview with the candidate and a clinical examination, essential steps in terms of transfusion safety.

2. Identification of the donor and the donation

Donor identification requires the following information: last name and first name, gender and date and place of birth.

3. Clinical examination and biological controls

A clinical examination including a weight measurement, blood pressure, and cardiac auscultation. A blood count and platelet count is performed before the first donation, a hemostasis test must be requested including a measurement of the quick time, the cephalin and activator time, and the fibrinogen level, and serologies (HIV, hepatitis b and c, HTLV) [5, 11].

4. Contraindications to donation

The contraindications are chronic nephropathy, chronic endocrinopathy, diabetes, cirrhosis, acute or chronic hepatitis, acquired immunodeficiency syndrome, ulcer, asthma, chronic hemophilia, cancer, angina, myocardial infarction, and people who have spent time in malaria areas [3, 4, 12].

5. Collection

The duration of collection is conditioned by the maximum quantity of platelets collected and the rate of collection, the latter must be between 30 and 80 ml/min. The total quantity of platelets collected must not exceed 8.10¹¹ in a volume of 200 to 600 ml, the maximum volume of anticoagulant solution injected per session must not exceed 1 l, the maximum extracorporeal volume during collection must not exceed 20% of the donor's blood mass, the total duration of the collection must be less than 2 hours 30 minutes.

6. Storage of apheresis platelet concentrate

At the blood establishment, under gentle and continuous agitation at a controlled temperature between 20 and 24°C, for a maximum of 5 days.

V. Experience of the blood transfusion center of the AMHM

The apheresis technique is used since 2017, at the blood transfusion center of the AMH in Marrakesh, motivated by the high demand of platelets in patients.

1. Materials and methods:

a. The framework of the study:

Service of blood transfusion of H.M.A Marrakesh.

b. Equipment:

- Apheresis machine: MCS+ apheresis machine (HAEMONETICS) with single use kit.
- Anticoagulant.
- Sodium chloride.

c. Donors:

- 29 donors undergo pre-donation biological tests.
- The collected bags are screened for infectious diseases transmissible by blood transfusion (HIV, HBV, HCV, HTLV) and immunohematological analyses.

2. RESULTS

a. Analysis of donations:

The average age of the donors was 43 years, with a clear male predominance of 97%.

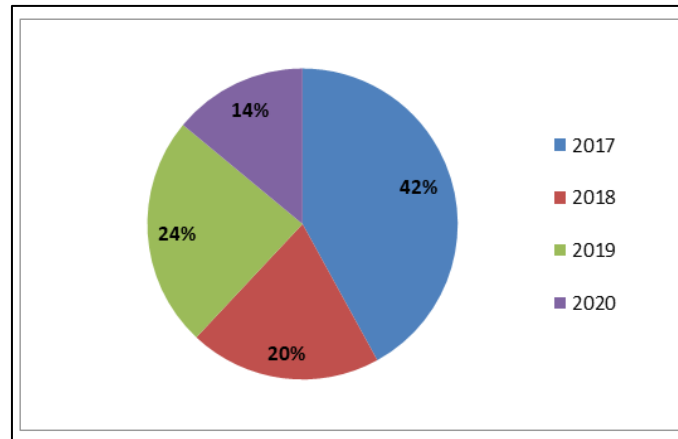


Figure 1: Distribution of APC donations by year

b. Analysis of Requests:

The clinical hematology department is the number one requestor of APC.

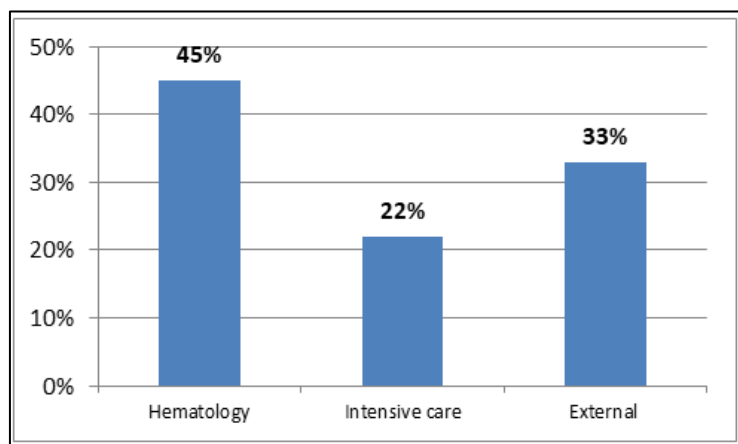


Figure 2: Distribution of APC requests by requesting department

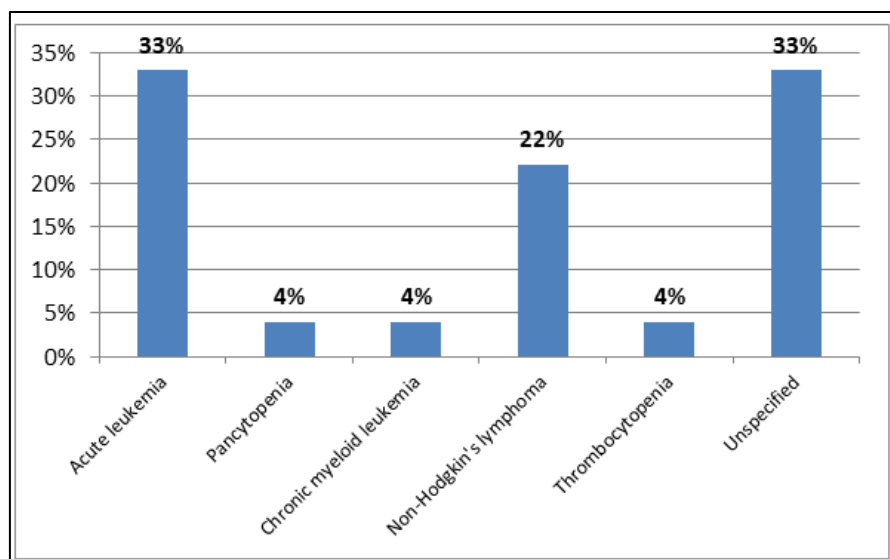


Figure 3: Distribution of CPA requests by pathology

3. DISCUSSION

Platelet donation by the apheresis technique represents a considerable advance in the automation and standardization of platelet concentrates. This single-donor platelet dose therefore limits immunological and infectious transfusion risks, if compared to the same dose obtained from several units of CPS. Apheresis also allows for product purification, reduced procedure time and preparation steps, adaptation of donor parameters to the platelet collection procedure, and thanks to closed systems, allows for the integration of leukoreduction filters. The disadvantages are limited, and are represented by the reinfusion of citrate with its well known signs, a rather large extracorporeal volume (250 to 450 ml), perfectible safety, and the release of particles from the plastic elements of the kit, causing signs of intolerance.

The platelet concentrate from apheresis (CPA) is collected using a haemonetics MCS+ cell separator. This is a discontinuous flow separator that performs extracorporeal circulations from anticoagulated blood and allows only the platelets to be collected and the other blood components to be returned to the donor. This allows for a larger collection of platelets. The minimum amount of platelets contained in an APC is [2, 10, 11] and cannot exceed [8, 10, 11]. Selection for platelet donation is based on an interview, a clinical examination, a biological assessment and an ECG. During collection, which is performed at the apheresis unit, a CTS physician monitors the collection. Labeling of the platelet bag is the rule. After immunohematological and serological qualification, the bag is kept until it is distributed. Quality control of the APCs is performed regularly.

VI. CONCLUSION

The development of APC is becoming a necessity in the context of transfusion safety and efficiency. Apheresis technology has been evolving for several years, from the first cell separators to a better comfort, but progress is to be made in the miniaturization of separators so that they can be available in mobile teams and in the improvement of platelet expiration and conservation.

BIBLIOGRAPHIE

1. Chakroun, T., Abdelkefi, S., Bouslama, M., Houissa, B., Zaier, M., Miled, A., ... & Yacoub, S. (2008). Platelet-leukocyte aggregates as a marker for platelet activation in platelet concentrates. *Transfusion Clinique et Biologique: Journal de la Societe Francaise de Transfusion Sanguine*, 15(4), 148-153.
2. Schooneman, F. (2005). Dons en aphérèse. Actualités et perspectives. *Transfusion clinique et biologique*, 2(12), 208-211.
3. Meyer, D., Bolgiano, D. C., Sayers, M., Price, T., Benson, D., & Slichter, S. J. (1993). Red cell collection by apheresis technology. *Transfusion*, 33(10), 819-824.
4. Strauss, R. G. (1993). Therapeutic granulocyte transfusion. *Blood*, 81, 1675-1678.
5. Stefanutti, C., Lanti, A., Di Giacomo, S., Mareri, M., De Lorenzo, F., Landolfo, A., & Isacchi, G. (2004). Therapeutic apheresis in low weight patients: technical feasibility, tolerance, compliance, and risks. *Transfusion and apheresis science*, 31(1), 3-10.
6. Klein, H. G., ed. (1996). Standards for blood banks and transfusion services. 17th ed. Bethesda, MD: American Association of Blood.
7. Ridet, C. (2013). Echange plasmatique en néphrologie: techniques et indications. *Néphrologie*, 10, 1-12.
8. Group coopératif de la société française d'hémaphérèse. (2005). Hémaphérèse adulte et pédiatrique. *Réanimation*, 14, 641-650.
9. Hemophenix Médical. la filtration. [en ligne] (20 janvier) 2012)17. <http://hemofenixmedical.eu/cascade/principe.html>17T
10. Smith, J. W., Axelrod, F. B., Ness, P. M., & Gilcher, R. O. (1995). Improved red blood cell products: collection by apheresis. *Transfusion*, 35(suppl), 665.
11. Jones, A. L. (1988). The IBM blood cell separator and blood cell processor: a personal perspective. *Journal of Clinical Apheresis*, 4(4), 171-182.
12. Marc, Z. (2006). Physiologie de la mégacaryopoïèse. *MAJ*.

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