Plateletpheresis concentrates produced with the COMTEC cell separator: the French experience

Christian Cofflé a,*, Moktar Benguella a, Martine Domy a, Dominique Cottier a, Freddy Guignier a, Jean Philippe Ngondara a, Anne Carrière a, Maurice Masse a, Christian Naegelen a, Bernard Biggio a, Pierre Tiberghien a, Patrick Hervè a, Ridha Bouzgarrou b, Jean Paul Maurel b, Gérard Vezon b, Madeleine Vidal c, Fabienne Quainon c, Abdelhalim Benamara c, Bernard Lamy c, Jean Louis Beaumont d, Philippe Bierling d, Geneviève Gondrexon e, François Schooneman e, Christian Janot e, Florence Villard f, Jean Jacques Huart f

a EFS Bourgogne Franche Comté, Dijon Site, 8 Bd de Lattre de Tassigny, BP 47834, 21 078 Dijon Cedex, France
b EFS Aquitaine Limousin, Bordeaux Site, Place Amélie Babat Léon, BP 24, 33035 Bordeaux Cedex, France
c EFS Auvergne – Loire, Clermont-Ferrand Site, 30 place H.Duhamel, BP 69, 63003 Clermont-Ferrand, France
d EFS Ile de France, Créteil Site, 1, voie Félix Eboüé, 94000 Créteil, France
e EFS Lorraine Champagne, Nancy Site, Avenue de Bourgogne, 54511 Vandoeuvre les Nancy, France
f EFS Nord de France, Lille Site, 21, rue Camille Guérin, BP 2018, 59012 Lille Cedex, France

Abstract

The latest generation of cell separators such as Trima (Gambro), Amicus (Baxter) and AS-TEC 204 (Fresenius), allow the collection of leucocyte-reduced platelet concentrates without secondary filtration. Fresenius has recently developed the COMTEC cell separator whose performance has been evaluated by several teams in France. This new cell separator is an improved version of the Fresenius AS-TEC 204 cell separator, designed to allow more efficient platelet collections. This study reports on the experience of six French teams (from Bordeaux, Clermont-Ferrand, Creteil, Dijon, Lille and Nancy) who obtained 696 leucocyte-reduced plateletpheresis concentrates in the course of collection using the new Fresenius COMTEC cell separator. All healthy volunteer donors fulfilled French selection criteria for platelet apheresis. Donors were eligible if they had suitable venous accesses, if their bodyweight was >50 kg and if their pre-apheresis platelet count was >150 x 10^9 l^-1. Between 4606 and 5229 ml of blood were processed. The mean volume of the platelet concentrates was between 439 and 493 ml (mean 460 ± 63 ml). The platelet yield was of the order of 5.18 ± 1.02 x 10^{11} with only one platelet concentrate below the norm of 2 x 10^{11} platelets (0.91 x 10^{11}). No plausible explanation for this was found. The residual leucocyte levels conform to current norms. The platelet concentrates contained less than 1 x 10^6 leucocytes per concentrate (mean 0.233 ± 0.150 x 10^6 leucocytes) in more than 97% of the components produced with >95% statistical confidence. The efficacy of the cell separator (52.44 ± 7.35%) is compa-

*Corresponding author. Tel.: +33-674-44-6591; fax: +33-380-70-6005.
E-mail address: christian.coffle@efs.sante.fr (C. Cofflé).

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rable to that of other separators. The Fresenius COMTEC cell separator makes it possible to obtain leucocyte-reduced platelet concentrates which comply with current standards both in terms of platelet content and residual leucocyte level. © 2001 Elsevier Science Ltd. All rights reserved.

Keywords: Cell separator; Donor apheresis; Leucocyte depletion; Plateletpheresis

1. Introduction

WBC reduction in apheresis blood products can be achieved either by filtration (during or after the procedure) or directly during the procedure on the cell separator [1–4]. Filtration results in a platelet loss of about 10–15%, is vulnerable to the risk of filter failure, and, if carried out after the apheresis procedure, is cumbersome, increases production costs and calls for extreme rigour on the part of the technicians in charge of the filtration. The latest generation of cell separators such as the Trima (Gambro), Amicus (Baxter) and AS-TEC 204 (Fresenius), allows the collection of leucocyte-reduced platelet concentrates without secondary filtration. Fresenius has recently developed the COMTEC cell separator whose performance has been evaluated by several teams in France. This new cell separator is an improved version of the Fresenius AS-TEC 204 cell separator [5], designed to allow more efficient platelet collection. This study reports on the experience of six French teams who collected leucocyte-reduced plateletpheresis concentrates, with the new Fresenius COMTEC cell separator.

Fig. 1. Fresenius COMTEC cell separator.

2. Materials and methods

2.1. Participants

This report describes the results of procedures in six French blood centers: Bordeaux, Clermont-Ferrand, Creteil, Dijon, Lille, and Nancy. It represents 696 procedures.

2.2. Cell separator

All procedures were carried out with the COMTEC cell separator (Fig. 1). Compared to the AS-TEC 204 cell separator [5], the COMTEC separator has a new platelet disposable C5 chamber (Fig. 2) and a new plateletpheresis program, the only such program currently available in France from Fresenius. The new interface detection system (C5 interface control) is an adaptation of the charged couple device (CCD) camera featured in the continuous auto-transfusion system (CATS) relating to mechanical assembly, signal processing and controller and illumination unit. An additional fifth pump makes it possible to make a constant hematocrit measurement in the separation chamber with plasma re-circulation. There is a new unit with a smaller ACD pump permitting ACD monitoring.
2.3. Donors

All healthy volunteer donors fulfilled French selection criteria for platelet apheresis. Donors were eligible if they had suitable venous access, if their bodyweight was $>50$ kg and if their pre-apheresis platelet count was $>150 \times 10^9$ l$^{-1}$. The following data were entered in the cell separator program: donor’s sex, height, weight, hematocrit and initial platelet count.

2.4. Procedure parameters

The procedure was carried out in accordance with the manufacturer’s instructions. Each center fixed the separation endpoints by defining an endpoint volume of processed blood in relation to the donor’s tolerance, the desired total platelet yield and the duration of the procedure.

2.5. The ACD-A/whole blood ratio

The ACD-A/whole blood ratio was increased during the procedure from 1:8 to 1:12. The total blood flow rate was always between 50 and 70 ml/min, and was modified only if the donor complained of citrate-related side effects or if there was any problem with the inlet blood pressure. The ACD-A infusion rate must not exceed 1.1 ml/min/l.
of whole blood. The centrifugation speed is 2200 rotations per minute and the interface is automatically set to 31. The following elements may also be integrated into the program: maximum platelet concentration, maximum CPA volume and additional plasma collection.

2.6. Cell count method

The residual leucocyte concentration in the platelet concentrates were determined either by Nageotte hemocytometry [6,7], in the case of the Lille and Créteil centers, or by flow cytometry with the FACS CALIBUR (Becton Dickinson) and LeucoCOUNT assay [8], for the Bordeaux, Clermont-Ferrand, Dijon and Nancy centers. Complete blood counts were performed on donors’ samples pre-apheresis and post-apheresis and in samples from the platelet concentrates using an automated counting appliance: Cobas Argos, ABS, Montpellier, France (Bordeaux); Cell dyn 3500 (Clermont) or 3000 (Dijon), Abbott; Rungis, France; Coulter JT, Coultronics, Margency, France (Créteil), Coulter Max M system, Coultronics, Margency, France (Lille) and Sysmex SE 9000, Roche diagnostic, Meylan, France (Nancy).

2.7. Statistical analysis

Statistical analysis was performed with statistical software (Excel 2000, Microsoft). The results are given as the mean, standard deviation and range. The student’s t-test was used to compare the results of the study [9].

3. Results

3.1. Donor characteristics

There were no significant differences in the weight, total blood volume or pre-apheresis platelet count between the six teams (Table 1). The distribution of male to female donors is different between the groups.

3.2. Apheresis procedures

The blood volume processed was not significantly different between the six groups (Table 2); there was a maximum difference of 623 ml (from 4606 to 5229 ml). There was no significant difference in the volume of ACD-A consumption; averaging 53 ml of anticoagulation solution (from

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**Table 1**

<table>
<thead>
<tr>
<th>Center</th>
<th>n</th>
<th>Male/female</th>
<th>Body weight (kg)</th>
<th>Blood volume (ml)</th>
<th>Platelets (10⁹ 1⁻¹)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bordeaux</td>
<td>102</td>
<td>63/39</td>
<td>71.2 ± 11.4 (47/105)</td>
<td>4930 ± 682 (3080/6443)</td>
<td>232 ± 48.9 (183/425)</td>
</tr>
<tr>
<td>Clermont</td>
<td>100</td>
<td>69/31</td>
<td>76 ± 14 (50/118)</td>
<td>4819 ± 801 (3105/6645)</td>
<td>278 ± 44 (182/428)</td>
</tr>
<tr>
<td>Créteil</td>
<td>132</td>
<td>86/46</td>
<td>72 ± 11 (48/106)</td>
<td>4534 ± 610 (2842/6102)</td>
<td>261 ± 43 (174/390)</td>
</tr>
<tr>
<td>Dijon</td>
<td>162</td>
<td>123/39</td>
<td>74 ± 11.5 (50/112)</td>
<td>4809 ± 655 (3170/6498)</td>
<td>249 ± 42 (168/375)</td>
</tr>
<tr>
<td>Lille</td>
<td>100</td>
<td>75/25</td>
<td>77 ± 15 (45/118)</td>
<td>4945 ± 800 (2998/6802)</td>
<td>269 ± 46 (180/402)</td>
</tr>
<tr>
<td>Nancy</td>
<td>100</td>
<td>87/13</td>
<td>79 ± 12 (51/110)</td>
<td>5054 ± 632 (3320/6400)</td>
<td>244 ± 35.6 (170/348)</td>
</tr>
</tbody>
</table>

**Table 2**

<table>
<thead>
<tr>
<th>Center</th>
<th>n</th>
<th>Processed blood volume (ml)</th>
<th>ACD-A consumption (ml)</th>
<th>Procedure time (min)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bordeaux</td>
<td>102</td>
<td>4905 ± 681 (3080/6443)</td>
<td>619 ± 108 (388/840)</td>
<td>109 ± 3.5 (92/118)</td>
</tr>
<tr>
<td>Clermont</td>
<td>100</td>
<td>4606 ± 561 (3059/5842)</td>
<td>599 ± 97 (408/766)</td>
<td>89 ± 2 (81/91)</td>
</tr>
<tr>
<td>Créteil</td>
<td>132</td>
<td>5117 ± 684 (3196/6800)</td>
<td>576 ± 93 (354/841)</td>
<td>90 ± 12 (53/133)</td>
</tr>
<tr>
<td>Dijon</td>
<td>162</td>
<td>5229 ± 652 (3411/6648)</td>
<td>629 ± 92 (379/824)</td>
<td>100 ± 8 (66/118)</td>
</tr>
<tr>
<td>Lille</td>
<td>100</td>
<td>4744 ± 782 (2538/5867)</td>
<td>590 ± 102 (333/889)</td>
<td>87 ± 16 (45/120)</td>
</tr>
<tr>
<td>Nancy</td>
<td>100</td>
<td>4609 ± 548 (2630/5460)</td>
<td>615 ± 89 (279/763)</td>
<td>88 ± 12 (47/113)</td>
</tr>
</tbody>
</table>
576 to 629 ml). The time taken to complete a plateletpheresis differed by a maximum of 12 min between five groups (not statistically significant) (from 87 to 100 min). The procedure time was longer only in Bordeaux (109 min) \( P = 0.03 \).

### 3.3. Platelet concentrates

The results of the different teams are satisfactory, as may be seen from Table 3. The mean volume of platelet concentrates lies between 439 and 493 ml (mean 460 ± 63 ml). The platelet yield is of the order of 5.18 ± 1.02 \( \times 10^{11} \) with only one platelet concentrate (in Lille) below the norm of 2 \( \times 10^{11} \) platelets per concentrate (0.91 \( \times 10^{11} \)) for which no plausible explanation has yet been found. The residual leucocyte levels conform to current norms. The platelet concentrates contain less than 1 \( \times 10^{6} \) leucocytes per concentrate (mean 0.233 \( \pm 0.150 \) \( \times 10^{6} \) leucocytes) in more than 97% of the components produced with >95% statistical confidence. The efficacy of the cell separator (52.44 ± 7.35%) is comparable to that of other separators.

### 3.4. Donor safety

In terms of donor safety, we observed no complications during and after the procedure. A few cases of mild citrate reactions (<0.5%) were observed; these were reversed by reducing the ACD infusion rate.

### 4. Discussion

The COMTEC cell separator does not yet have a specific plasma program validated in France and the plasma that can be obtained during the collection of platelet concentrates is used only for adjusting the platelet concentration to a level to ensure optimum preservation for 5 days (platelets <1.2 \( \times 10^{6} \) ml\(^{-1}\) and 6.4 < pH < 7). It is difficult to quantify the amount of leucocytes contained in this plasma using our usual methods, but it is certainly less than 633 leucocytes per liter. No threshold for residual leucocyte levels has yet been fixed in France.

The leucocyte-reduced plateletpheresis concentrates obtained with this cell separator comply with the current French standards.

The higher the donor’s initial platelet count, the higher the count in the platelet concentrate. However, there is no correlation between the number of donor leucocytes and the contaminating leucocytes in the concentrate.

Few secondary effects were observed in the donor (0.5%), probably because of the low extra- corporeal volume (<160 ml) and control of the citrate infusion.

The appliance is less noisy than rival cell separators and the Fresenius AS-TEC 104.

It has certain advantages over the previous generation of Fresenius cell separators [10] as follows:

- Excellent platelet yields due to whole blood standardization by plasma recirculation.
- Optional extra plasma collection – particularly interesting in the case of a high concentration of the platelet product.
- Simplified, more user-friendly menu compared to previous Fresenius separators; PC menu-algorithm optimized for customizing the product, anticoagulation and procedure.
- Low level of leucocyte contamination – more reliable than that obtained on the previous

### Table 3

<table>
<thead>
<tr>
<th>Center</th>
<th>( n )</th>
<th>Concentrate volume (ml)</th>
<th>Platelet yield ( \times 10^{11} )</th>
<th>Efficacy (%)</th>
<th>Leucocytes ( \times 10^{6} )</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bordeaux</td>
<td>102</td>
<td>442 ± 86 (273/617)</td>
<td>4.83 ± 1.3 (2.08/7.96)</td>
<td>56 ± 7 (33/72)</td>
<td>0.162 ± 0.175 (0.015/1.189)</td>
</tr>
<tr>
<td>Clermont</td>
<td>100</td>
<td>439 ± 66 (249/544)</td>
<td>5.95 ± 1.18 (3.28/8.64)</td>
<td>57 ± 7 (37/76)</td>
<td>0.10 ± 0.10 (0.01/0.5)</td>
</tr>
<tr>
<td>Créteil</td>
<td>132</td>
<td>465 ± 53 (295/592)</td>
<td>4.74 ± 0.79 (2.60/6.57)</td>
<td>49.64 ± 5.31 (37.28/62.55)</td>
<td>0.123 ± 0.043 (0.08/0.2)</td>
</tr>
<tr>
<td>Dijon</td>
<td>162</td>
<td>493 ± 75 (278/618)</td>
<td>5.46 ± 1.1 (2.8/6)</td>
<td>55.8 ± 12.6 (16/142)</td>
<td>0.18 ± 0.124 (0.01/0.335)</td>
</tr>
<tr>
<td>Lille</td>
<td>100</td>
<td>441 ± 18 (336/488)</td>
<td>5 ± 0.7 (0/6)</td>
<td>40 ± 6 (25.3/53.4)</td>
<td>0.286 ± 0.137 (0.09/0.707)</td>
</tr>
<tr>
<td>Nancy</td>
<td>100</td>
<td>477 ± 78 (261/633)</td>
<td>5.1 ± 1.06 (2.34/8.08)</td>
<td>56.2 ± 6.2 (40/71)</td>
<td>0.545 ± 0.324 (0.02/0.71)</td>
</tr>
</tbody>
</table>
AS-TEC 204 separator (less flexible for modifying collection rates and changing anticoagulant ratios).

- Plasma pump controls plasma flow appropriately and constantly optimizes the interface position. Optimal component quality is maintained throughout the entire procedure (the plasma pump provides a consistent hematocrit as a function of the pre-programmed donor hematocrit).

5. Conclusion

The Fresenius COMTEC cell separator makes it possible to obtain leucocyte-reduced apheresis platelet concentrates complying with current standards both in terms of platelet content and residual leucocyte level.

References