Original Article

A Comparative Analysis of Blood Component Preparation by Two Automated Blood Processing Techniques

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Abstract

Objective : To evaluate and compare two automated blood processing techniques ["Top & Bottom" (Optipress®I) and "Top & Top" (T-ACE II)].

Materials/Methods : Blood components were separated using 200 TERUFLEX® blood bags for the T-ACE II technique and 200 Optipac® blood bags for the Optipress®I technique. An analysis of blood products (FP, red cell:AS-BCR, and LPPCs) in terms of their characteristics was done using CELL DYN 1700 version 1.01, and the efficiency of blood bag systems and automated blood processing techniques was compared.

Results : T-ACE II showed a statistically significant higher residual platelet content in the FP bags compared to Optipress®I (18.61±11.21x10^9 and 14.24±8.58x10^9 respectively, *P*<.001), but showed a statistically significant lower residual leukocyte content than Optipress®I (0.056±0.01x10^9 and 0.064±0.03x10^9 respectively, *P*<.001). The red cell:AS-BCR bags prepared from T-ACE II showed a statistically lower WBC removal compared to Optipress®I (77.23±8.40% and 82.06±8.41% respectively, *P*<.001). In the recovery of RBCs, these was a lower red cell loss from the red cell:AS-BCR bags prepared from T-ACE II than from Optipress®I (78.31±5.67% and 76.76±8.96% respectively, *P*=.04). The LPPCs obtained from BC bags of T-ACE II showed statistically lower platelet yields than LPPCs obtained from BC bags of Optipress®I (328.67±54.23x10^9 and 369.93±58.37x10^9 respectively, *P*=.001).

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Conclusion : T-ACE II demonstrated an improvement in RBC recovery. Optipress®I improved in WBC removal in red cell:AS-BCR, platelet yields in LPPCs. However, the quality of blood products from both T-ACE II and Optipress®I techniques were of the same standard.

Key Word : Automated Blood Processing / Buffy Coat Method / Quality Control of Blood Components

Introduction

The automated blood processing technique (buffy coat method) has recently been introduced as the efficient and effective method to fulfill the standards for blood component production and conform with the American Association of Blood Banks (AABB criteria)[1] and the European guidelines (EC criteria)[2].

A traditional preparation of blood components from whole blood (WB) bags in USA has been the platelet rich plasma (PRP) method. In Europe, some blood centers started to prepare blood components from fractionation of WB bags with the buffy coat (BC) method in 1980s. The change arose from dissatisfaction with the red blood cell (RBCs) contaminated with white blood cell (WBCs) and platelets because they were heavily then left after the removal of PRP[3]. BC extraction via the "Top & Bottom" and "Top & Top" techniques are based on blood component separation by initial high-speed centrifugation. The "Top & Bottom" technique, followed by simultaneous extraction of fresh plasma (FP) at the top outlet, the RBC concentrate constitute the blood extraction bag system keeping the leukocyte-platelet BC layer stable throughout the process within the original extraction bag (as shown in **figure 1**). The "Top & Top" technique, following plasma removal, BC layer was transferred to a satellite bag, remaining the RBC concentrate in the original extraction bag (as shown in **figure 2**).

In Siriraj blood center we have recently substituted a convention fractionation method involving quadruple WB bags by a fractionation system based on "Top & Bottom" technique (Optipress®I, Baxter Helathcare Ltd, Belgium). This study aimed to establish the quality of the new technique, we were compared a quality control study of the blood components derived from routine blood fractionation with "Top & Top" technique (T-ACE II, Terumo Europe N.V., Belgium).

Materials and Methods

Study Design

Experimental controlled trial

Subjects

A total of 400 WB bags were collected from volunteer donors by randomization, meeting the physical examination and medical history requirements of Blood Bank. Each automated blood processing technique (Optipress®I and T-ACE II) was performed using the same number (200) of WB bags since December 2007 to March 2008.

Methods

Blood components were separated using 200 TERUFLEX® (CPD/AD-5) blood bags for the T-ACE II technique and 200 Optipac®(CPD/

ADSOL) blood bags for the Optipress®I technique. Blood bag systems were centrifuged at 3,028 rpm for 10 minutes for Opipac® blood bags (routine), and 3,150 rpm for 8 minutes for TERUFLEX® blood bags at 22±2^{0}C (Sorval RC3B Plus, Kendro Laboratory Products). After centrifugation; Opipac® blood bag system will BCs depleted using the Optipress®I device by "Top & Bottom" technique (**figure 1**), the TERUFLEX® blood bag system will BCs depleted using the T-ACE II device by "Top & Top" technique (**figure 2**) as followed by recommendation of each coporation[4,5].

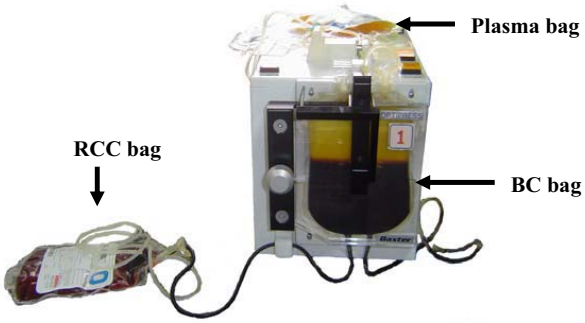

Figure 1. Blood component preparation by "Top & Bottom" (Optipress®I) technique

Figure 2. Blood component preparation using "Top & Top"(T-ACE II) technique

The blood products were fresh plasma (FP), red cell concentrates in additive solution (red cell:AS-BCR) and BC bags marked by pre-established BC volume of 80 mL in the same of both devices. The BCs were left in platelet incubator at 22±2^{0}C without agitation overnight, checked for viral testing. The leukocyte pooled poor platelet concentrates (LPPCs) were prepared using four ABO-identical BCs and one plasma bag of the four donors. The pooled BCs were packed into a centrifuge cup, together with the platelet storage bag and will be centrifuge with refrigerator centrifuge by using centrifugation speed 1,700 rpm for 6 minute for both Optipress®I, and the T-ACE II blood bag systems at 22±2^{0}C.

An analysis of blood products (FP, red cell:AS-BCR, and LPPCs) in terms of their characteristics (volume, leukocyte content, platelet content, erythrocyte content, hematocrit, hemoglobin, RBC recovery and WBC removal) was done using an automated cell counter (CELL DYN 1700 version 1.01, Abott Laboratories, USA) and the quality of blood bag systems and automated blood processing techniques was compared.

Measurements in Vitro

Volume was determined by the weight of an empty bag from that of the full bag. To convert weight to volume, the weight was divided by specific gravity (WB 1.058, red cell:AS-BCR 1.060, BCs 1.050, FP 1.030 and LPPCs 1.030 g/mL).

Calculation

Total Cells/unit

$$= \text{volume (mL) x cell count (cells/µL) x } 10^3$$

RBC Recovery (%)

$$= \left(\frac{\text{final product net weight (g) x Hct (\%)}}{\text{WB net weight (g) x Hct (\%)}} \right) \text{ x 100\%}$$

WBC Removal (%)

$$= 1 - \left(\frac{\text{LPRBC net weight (g) x WBC (cells/µL)}}{\text{WB net weight (g) x WBC (cells/µL)}} \right) \text{ x 100\%}$$

Statistic Analysis

The results were reported as mean, standard deviation, and percentage of component blood products quality. The results were tested for normal distribution using the Kolmogorov-Smirnov test. The quality control results in component blood products using the unpaired t-test and non parametric (Mann-Whitney U test) to compare the means and the χ^2-test to compare the frequencies between groups. We considered a significant result when the p-value was <.05. All data were compared by using statistical software.

Results

An analysis of WBs before separated in terms of their volume, leukocyte content, platelet content, erythrocyte content, hematocrit, and hemoglobin were similar in both T-ACE II blood bags system and Optipress®I blood bags system **(Table 1)**.

Table 1. Whole blood characteristics before separation (N=200)

Characteristics	Unit	Optipress®I	T-ACE II	*P*-value
Volume	mL	511.82±6.75	510.88±5.77	.052
Leukocytes	10^9 per unit	3.08±0.78	3.24±0.81	.064
Platelets	10^9 per unit	116.60±28.49	112.61±23.65	.066
Erythrocytes	10^{12} per unit	2.325±0.269	2.340±0.419	.988
Hematocrit	%	37.86±3.34	37.47±3.02	.266
ΨBags with ≥ 33%	%	97	95	.444
Hemoglobin	g/bag	66.29±6.22	65.87±5.56	.780
#Bags with ≥ 45 g	%	92	94.5	.425

#CE criteria, ΨAABB criteria

The quality control results of blood products from both T-ACE II and Optipress®I were same number (200 FP bag, 200 red cell: AS-BCR bags, 200 BCs bags, and 45 LPPC bags).

Quality Control Data of Component Blood Products

Fresh Plasma

Result revealed that T-ACE II showed a statistically significant lower residual leukocyte content (0.056±0.01x10^9 and 0.064±0.03x10^9 per unit respectively, P = .001) and higher residual platelet content in FP bags compared to Optipress I(18.61±11.21x10^9 and 14.24±8.58x10^9 per unit respectively, P <.001). The volume and residual erythrocyte content in FP bags were similar in both devices. In addition, the quality control result in term of residual leukocyte content lower 0.1x10^9 cell/L from both T-ACE II and Optipress®I were not met the CE criteria. FP bags from T-ACE II not met the CE criteria in term of residual platelet content lower 50x10^9 cell/L, as shown in **table 2.**

Table 2. The quality control results of fresh plasma (N=200)

Characteristics	Unit	Optipress®I	T-ACE II	*P*-value
Volume	mL	259.03±23.84	255.59±22.20	.080
Leukocytes	10^9 per unit	0.0641±0.0288	0.0559±0.0149	.001
Leukocytes	10^9 per litre	0.247±0.10	0.219±0.06	.001
#Bag with<0.1x10^9/L	%	0	4	.703
Platelets	10^9 per unit	14.24±8.58	18.61±11.21	<.001
Platelets	10^9 per litre	66.84±41.15	103.29±43.39	<.001
#Bag with<50x10^9/L	%	90	11	<.001
Erythrocytes	10^9 per unit	0.23±0.78	0.18±0.67	.576
Erythrocytes	10^9 per litre	0.90±0.31	0.70±0.26	.477
#Bag with<6x10^9/L	%	91.5	93	.708

#CE criteria

Red Cell Concentrates

Result revealed that T-ACE II showed a statistically significant lower volume in red cell: AS-BCR bags compared to Optipress®I (258.86±19.74 mL and 271.59±19.95 mL respectively, P <.001). Although, 90 percent more of leukocyte content was lower 1.2x10^9 of cases from both devices, this study further showed that the mean leukocyte content was a statistically significant higher in the red cell:AS-BCR bags prepared from T-ACE II compared to Optipress®I (0.73±0.32x10^9 and 0.54±0.28x10^9 per unit respectivly, P <.001). In addition the WBC removal was a statistically significant lower in the red cell:AS-BCR bags prepared from T-ACE II compared to Optipress®I (77.23±8.40% and 82.06±8.41% respectively, P <.001). In the recovery of red blood cells, these was a lower

red cell loss from the red cell:AS-BCR bags prepared from T-ACE II than from Optipress®I (78.31±5.67% and 76.76±8.96% respectively, P =.04), as shown in **table 3.**

Table 3. The quality control results of red cell:AS-BCR (N=200)

Characteristics	Unit	Optipress®I	T-ACE II	*P*-value
Volume	mL	271.59±19.95	258.86±19.74	< .001
Leukocytes	10^9 per unit	0.54±0.28	0.73±0.32	.121
#Bags with <1.2x10^9	%	97.5	94	.035
ΨBags with <1.0x10^9	%	94.5	87	.016
Platelets	10^9 per unit	2.11±1.81	2.91±2.02	<.001
Erythrocytes	10^{12} per unit	1.78±0.28	1.87±0.31	.006
Hematocrit	%	55.05±3.18	57.68±3.32	<.001
ΨBags with 55-65%	%	50.5	80.5	<.001
#Bags with 50-70%	%	100	98.5	.248
Hemoglobin	g/bag	50.43±6.01	50.19±5.40	.295
#Bags with ≥ 43 g	%	92	94.5	.425
RBC recovery	%	76.76±8.96	78.31±5.67	.04
ΨBags with ≥70%	%	95	98	.174
WBC removal	%	82.06±8.41	77.23±8.40	<.001
ΨBags with ≥70%	%	90	83	.057

#CE criteria, ΨAABB criteria

Buffy Coats

Rresult revealed that T-ACE II showed a statistically significant lower leukocytes content in the BC bags compared to Optipress®I (2.22±0.67x10^9 and 2.42±0.65x10^9 per unit respectively, P = .003). The BC bags prepared from T-ACE II had a statistically significant lower platelets content compared to Optipress®I (85.69±23.34x10^9 and 95.59±27.72x10^9 per unit respectively, P <.001). The BC bags prepared from T-ACE II had a statistically significant lower erythrocyte content in the BC bags compared to Optipress®I (0.516±0.04x10^{12} and 0.533±0.07x10^{12} per unit respectively, P = .004). While, the BC bags prepared from both T-ACE II and Optipress®I were similar in volume (86.40±2.05 mL and 86.01±3.10 mL respectively, P = .088), hematocrit (50.50±2.86% and 50.54±5.20% respectively, P = .609 , and hemoglobin (15.10±0.89 g/bag and 15.16±1.50 g/bag respectively, P = .972).

Leukocyte Pooled Poor Platelet Concentrates

The result revealed that T-ACE II showed a statistically significant lower volume in LPPC bags compared to Optipress®I (318.71±27.56 mL and 330.55±22.66 mL respectively, *P*= .028). Although, the quality of LPPCs from both T-ACE II and Optipress®I were same standard in term of their residual leukocytes content lower $0.05x10^9$ per single unit of cases (100%). This study further showed that the mean residual leukocyte content in LPPCs was a statistically lower than Optipress®I ($0.077\pm0.02x10^9$ and $0.085\pm0.02x10^9$ per unit respectively, *P* = .006). Although, 95 percent more of platelet yields was > $240x10^9$ of cases with both T-ACE II and Optipress®I techniques, this study further showed that the mean platelet yields was statistically lower in LPPC bags prepared from pooled BC bags of T-ACE II compared to Optipress®I ($328.67\pm54.23x10^9$ and $369.93\pm58.37x10^9$ per unit respectively, *P* = .001).

Table 4. The quality control results of LPPCs (N=45)

Characteristics	Unit	Optipress®I	T-ACE II	*P*-value
Volume	mL	330.55±22.66	318.71±27.56	.028
Leukocytes	10^9 per unit	0.085±0.02	0.077±0.023	.006
Leukocytes	10^9 per single unit	0.021±0.01	0.019±0.01	.105
#Bags with < $0.05x10^9$	%	100	100	
Platelets	10^9 per unit	369.93±58.37	328.67±54.23	.001
#Bags with ≥ $240x10^9$	%	100	95.56	.494
Erythrocytes	10^9 per unit	5.33±0.71	5.16±0.43	.497

#CE criteria

Discussion

The application of good manufacturing practices requires standardized methods of production. The use of automated blood processing techniques reduces the impact of human factors in blood component preparation and improves standardization and quality of blood products.

The main objective of this study was to analyze and compare the quality of blood products of the T-ACE II technique and the Optipress®I technique. Focusing on the red cell:AS-BCR (WBC removal, RBC recovery, hemoglobin, and hematocrit) and the LPPCs (yield of platelet, residual leukocyte content).

Residual leukocyte content in erythrocyte concentrates (red cell:AS-BCR) is determined by the extent of BC depletion. BC depletion is considered successful when the number of residual leukocyte remains lower 1-1.2 x 10^9 in the resulting erythrocyte concentrates[1,2]. In this study showed 94.5 percent of cases in Optipress®I technique is able to produce

erythrocyte concentrate containing leukocytes lower 1 x 10^9. Under similar condition, the T-ACE II technique can result in products with higher amounts of contaminating leukocytes, corresponding to less severe requirements. Our data confirm reports from other studies[3,6-9] that use of the "Top & Bottom" technique results in better elimination of BC cells from WB; the percentage of WBC removal was 82.06 percent when processed by Optipress®I

Extraction of the BC layer during the blood separation process constitutes a step towards obtaining blood components less contamination by leukocytes and platelets[10]. The use of T-ACE II; following plasma removal, the BC layer was transferred to a satellite bag, remaining the red blood cell concentrates in the original extraction bag. AS-5 was added to the latter following removal of the BC layer. Quality control analysis of blood component obtained with this technique revealed greater leukocyte and platelet contamination of the red cell:AS-BCR than after fractionation using the Optipress®I **(Table 3)**. This was attributed to cell adherence within the original extraction bag in the course of press removal of the BC layer, as a result, platelet yield in the BC layer was less than 80 percent[11]. All of these are the differences in the BC separation technique points to more effective platelet and WBC removal with the Optipress®I.

One disadvantage of the BC method was the loss of RBCs, especially neocytes, the loss of RBCs in the separation of the BCs[7,12,13]. A relatively high loss of red cells into the BCs was found in the "Top & Bottom" bag systems[8]. In our study, we saw a low lost of RBCs from T-ACE II WB bags (21.69%). However, all red cell:AS-BCR bags prepared by both devices did not meet the CE criteria due to the fact that loss of red cells in the BCs was less than 15 percent of the original red cell volume. Whereas, other studies[7-8,12-14] met the criteria in the resulting red cell loss is lower 30 mL[15-16]. The volume of BCs of them were 55-60 mL and 40 percent hematocrit for 5 pooled BCs[17]. Whereas, in our process marked by pre-established BC volume of 80 mL for 4 pooled BCs. But, 92 percent more of hemoglobin of red cell:AS-BCR bags prepared from both devices passed minimum level of quality control (> 43 g/bag). However, we may be planned to increase slightly the blood donation volume in order to increase the final RBCs content, as previously reported[14].

For the preparation of LPPCs, the BCs are centrifuged until the platelets are separated from the other blood cells in cell size. In addition, the concentration of platelets in the supernatant is promoted by the upward displacement of plasma induced by the sedimentation of red cells[18]. Focusing on the LPPC products, it was to know that the final platelet content is lower in the BC obtained from "Top & Top" WB bags when compared with BC obtained from "Top & Bottom" WB bags[7,12,13]. In our study showed that the pooling BCs obtained from Optipress®I WB bags with Optipress®I demonstrated an improvement platelet yields in LPPCs when compared to the LPPCs prepared with BCs obtained from T-ACE II. The reason was that the BCs of Optipress®I remained in the donation bag because the plasma was transferred to a satellite bag by a top outlet and the RBCs were transferred to a satellite bag by a bottom outlet, so the action of cell adherence within the original

extraction bag was not attributed to course of press removal of the BC layer.

The advantage of Optipress®I technique demonstrated an improvement in WBC removal of red cell:AS-BCR, platelet yields in LPPCs, whereas the defect of this technique was lost 23.24 percent of red blood cells into the BCs. Selection for the best quality of blood products should be considered with the cost effective, and weighed with other relatable factors. If we require the high WBC removal in red cell: AS-BCR bags and platelet yields in LPPCs by using Optipress®I, we are conceding high loss of red cell too. If we require the high RBC recovery in red cell:AS-BCR bags by using T-ACE II, we possible to prepare the single platelet concentrate for pooling and the mixture is leukoreduced with filter afterwards. That is slightly increase of the cost, but it has the effectiveness to reduce the incidence of non-hemolytic febrile transfusion reactions (NHFTR). When we consider with processing time and workload for manual pooling platelet concentrates to approximate 20 min/person/ LPPCs bag, whereas, the pooling afterwards is a few time. In the even that, we require the quality of red cell concentrate only this, we may determined to select the PRP method for this instrument. That is possible to leukoreduced with a filter, it is low cost of the triple bag and slightly increase for the cost of filter. But, it can reduce the incidence of NHFTR too. Now, in USA still use the PRP method and leukoreduced filter for preparation of blood components from WB bags. Whereas, the BC extraction is popular method in Europe. However, all of these should be considered with cost effective, comfortable procedures, processing time, workload, policy and other relatable factors before determined to select for first instrument for introduce as the most quality and effective way to fulfill the standards for blood components production.

Conclusion

The results could be shown that the essential component blood products prepared by both automated blood processing techniques passed the minimum level of quality control. The Optipress®I gave the improvement in the WBC removal in red cell:AS-BCR and improved the platelet content in LPPCs. The T-ACE II gave the improvement in RBC recovery in red cell: AS-BCR. However, the selection for first instrument should be considered with the cost effective, policy, and other relatable factors.

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References

1. Standard for blood banks and transfusion service. 21st ed. Bethesda : American Association of Blood Banks, 2002.
2. Guide to the preparation, use and quality assurance of blood components. 11th ed. Strasbourg : Council of Europe Publishing, 2005.
3. Prins HK, de Bruijin JC, Henrichs HP, Loos JA. Prevention of microaggregate formation by removal of “buffy-coats”. Vox Sang 1980;39;48-51.

4. Operator's manual Optipress®I (FDR 4548). Baxter Helathcare Ltd, Belgium.
5. Instruction for use T-ACE II. Terumo Europe N.V., Belgium.
6. Hogman CF, Eriksson L, Hedlund K, Wallvik J. The bottom and top system : a new technique for blood component preparation and storage. Vox Sang 1988; 211-7.
7. Pietersz RN, Dekker WJ, Reesink HW. Comparison of a conventional quadruple-bag system with a "top and bottom" system for blood processing. Vox Sang 1990;59:205-8.
8. de Wildt-Eggen J, Schrijver JG, Bins M. WBC content of platelet concentrates prepared by the buffy coat method using different processing procedures and storage solution. Transfusion 2001;41:1387-83.
9. Nakajo S,Chiba S,Takahashi TA,Sekiguchi S. Comparison of a "top and bottom" system with a conventional quadruple-bag system for blood-component preparation and storage; in Sekiguchi S (ed): Clinical Application of Leukocyte Depletion. Proc 3rd Hokkaido Symp Transfusion Medicine. Oxford, Blackwell, 1993:18.
10. Hurtado C, Bonanad S, Soler M, Mirabet V, Blasco I, Planelles M, et al. Quality analysis of blood component obtained by automated buffy-coat layer removal with a top & bottom system (Optipress®II). Haematologica 2000;85:390-5.
11. Carpio N, Soler MA, Mirabet V, Montoro JA. Obtainer de hemoderivados medianly separator NPBI. III Congreso National de la SETS. Malaga, 1992.
12. Larrea L, Ortiz deSalazar MI, Roig R, Soler MA. Fully automated processing of buffy coat derived pooled concentrates. Transfusion 2005;45:642-3.
13. van Delden CJ, de Wit HCJ, Smit Sibinga CT. Comparison of blood component preparation systems based on buffy coat removeal : component specifications, efficiency, and process costs. Transfusion 1998;38:860-6.
14. Heaton WAL, Rebulla P, Pappalettera M, Dzik WH. A comparative analysis of different methods for routine blood component preparation. Transfus Med Rev 1997;11:116-29.
15. Walker RH, editor. AABB Technical manual, 10th ed. Arlington, VA, USA. American Association of Blood Banks, 1990.
16. Recommendation No.R(95) 15 on the preparation, use, and quality assurance of blood components 5th ed. Strasbourg, France: Council of Europe Press, 1998.
17. Cid J, Claparols M, Pinacho A, Hernandez JM, Ortiz P, Puig L, et al. Comparison of blood component methods from whole blood bags based on buffy coat extraction. Transfus Apher Sci 2007;33:243-7.
18. Loos JA, Wautier JL. Leukocyte depletion : a biotechnical transfusion story. Transfus Med Rev 1998;5:64-79.

นิพนธ์ต้นฉบับ

การวิเคราะห์เปรียบเทียบส่วนประกอบของเลือดซึ่งเตรียมโดยเครื่องบีบแยกส่วนประกอบเลือดแบบอัตโนมัติ 2 วิธี

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บทคัดย่อ

วัตถุประสงค์ : เพื่อวิเคราะห์เปรียบเทียบคุณภาพของส่วนประกอบของเลือดซึ่งเตรียมโดยเครื่องบีบแยกส่วนประกอบของเลือดแบบอัตโนมัติ ระหว่างวิธี “Top & Bottom” Optipress®I และ “Top & Top” (T-ACE II)

วิธีการศึกษา : ผู้ศึกษาได้ทำการแยกส่วนประกอบของเลือด โดยใช้ถุงเจาะเก็บเลือด TERUFLEX® ซึ่งใช้กับเครื่องบีบแยกส่วนประกอบเลือดแบบอัตโนมัติ T-ACE II จำนวน 200 ถุง เปรียบเทียบกับส่วนประกอบของเลือดที่เตรียมด้วยถุงเจาะเก็บเลือด Optipac® ซึ่งใช้กับเครื่องบีบแยกส่วนประกอบเลือดแบบอัตโนมัติ Optipress®I จำนวน 200 ถุง และนำมาตรวจสอบระบบคุณภาพของส่วนประกอบเลือดทั้งพลาสมา(FP) เม็ดเลือดแดงเข้มข้น (red cell:AS-BCR) และเกร็ดเลือดเข้มข้น (LPPCs) เพื่อเปรียบเทียบประสิทธิภาพของถุงและระบบการบีบแยกส่วนประกอบเลือดแบบอัตโนมัติ ตรวจนับปริมาณเซลล์โดยเครื่อง CELL DYN 1700 เวอร์ชั่น 1.01

ผลการศึกษา : พบว่า ระบบ T-ACE II ที่ทดสอบมีปริมาณเกร็ดเลือดในพลาสมาสูงกว่าระบบ Optipress®I ($18.61\pm11.21\times10^9$ และ $14.24\pm8.58\times10^9$ ตามลำดับ, $P<.001$) แต่มีเม็ดเลือดขาวปนมาน้อยกว่า Optipress®I ($0.056\pm0.01\times10^9$ และ $0.064\pm0.03\times10^9$ ตามลำดับ, $P<.001$) ในเม็ดเลือดแดงเข้มข้นมีความสามารถในการลดจำนวนเม็ดเลือดขาว (WBC removal) ต่ำกว่า Optipress®I (ร้อยละ 77.23±8.40 และ 82.06±8.41 ตามลำดับ, $P<.001$) เมื่อพิจารณา RBC recovery พบว่า T-ACE II มีการสูญเสียเม็ดเลือดต่ำกว่า Optipress®I (ร้อยละ 78.31±5.67 และ 76.76±8.96 ตามลำดับ, $P=.04$) เกร็ดเลือดเข้มข้นซึ่งเตรียมจากถุงบัฟฟี่โคทของระบบ T-ACE II มีปริมาณเกร็ดเลือดต่ำกว่า Optipress®I อย่างมีนัยสำคัญ($328.67\pm54.23\times10^9$ และ $369.93\pm58.37\times10^9$ ตามลำดับ, $P=.001$)

สรุป : ระบบ T-ACE II มีประสิทธิภาพต่อการกลับคืนของเม็ดเลือดแดงสูงกว่า Optipress®I ส่วนระบบ Optipress®I มีประสิทธิภาพในการลดจำนวนเม็ดเลือดขาว และให้ปริมาณเกร็ดเลือดที่สูงกว่า T-ACE II อย่างไรก็ตาม พบว่าส่วนประกอบหลักของเลือดซึ่งเตรียมโดยเครื่องทั้ง 2 ระบบมีคุณภาพตามเกณฑ์มาตรฐาน

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