

台中市醫事檢驗師公會 106年度繼續教育研討會

講題：病人輸注儲存前減除白血球 血品的好處及應用

日期：2017.11.26 時間：14:00 ~14:50

地點：中山醫學大學附設醫院 正心樓0213教室

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主辦單位：台中市醫事檢驗師公會

中山醫學大學附設醫院檢驗科



Leucodepletion is defined:

A blood processing step

--- whole blood

--- RBCs

--- platelet

WBCs down to 5×10^6 residual WBCs
per unit of component



Adverse Effect of Contaminating Leucocytes

- ◆ HLA alloimmunization (Platelet refractoriness, graft rejection),
- ◆ Viral transmission(CMV, EBV, HTLV I and II),
- ◆ Immune suppression(Post-operative infection, cancer recurrence),
- ◆ Transfusion reactions (NHFTR, GVHD)



Worldwide leucodepletion

	Donations	w/o LD	LD
Europe	21.1 Mn	4.8 Mn	16.3 Mn (80%)
USA	13.5 Mn	2.6 Mn	10.9 Mn (82%)
Asia	23.3 Mn	19.1 Mn	4.2 Mn (25%)

LD: leucodepletion
w/o: without

Published on Dec 31, 2015



Achievable standards for leucodepletion

- ◆ AABB standards
< 5×10^6 WBC per unit, at least 1% of the product and 100% pass.
- ◆ European guidelines
< 1×10^6 WBC per unit, 90% pass.
- ◆ Tw standards
 $\leq 5 \times 10^6$ WBC per unit, $\geq 1/1,000$ units and 95% pass.



滅白之紅血球濃厚液 OC 紀錄表

製備單位: 成分課

測試月份: 106 年 9 月

血袋號碼	1U/2U	製備日期	總重 (g)	體積 (ml)	WBC (/μl)	WBC ($\times 10^6/\text{unit}$)
0644454481	1U	106.09.08	213	168	0.5	0.08
0644320977	1U	106.09.08	217	172	0.4	0.07
0644090283 0644090290	2U	106.09.08	325	271	0.1	0.01
0644090252 0644090269	2U	106.09.08	352	295	0.2	0.03
0644266633 0644266640	2U	106.09.08	355	298	0.1	0.01
0644090078 0644090085	2U	106.09.08	334	279	0.4	0.06
0644321011 0644321004	2U	106.09.08	362	305	0.2	0.03
0644253008 0644253015	2U	106.09.08	360	303	1	0.15
0644454405 0644454412	2U	106.09.08	317	263	0.3	0.04
0644266657 0644266664	2U	106.09.08	364	306	0.4	0.06

測試結果: 測試袋數: 10 袋; 合格袋數: 10 袋; 合格率: 100%

合格標準: 白血球殘餘量 $\leq 5 \times 10^6/\text{unit}$

量測儀器 (名稱/編號/校驗效期):

- 電子式磅秤/編號 G103005 /校驗效期 106.09.30
- Nageotte Chamber 血球計數玻片

註: 血袋廠牌 Haemonetics

測試人員: 呂翠芳 09-2715-34 林美雲

品保單位: 林美雲 106.09.10

品保組長

黃耀騰 10.5/16=48

單位主管: 王啓祥 10-11/11-12

負責醫師: 林啓祥 1061013 10203

表 QP-BB-032-6.2-001 (保存 5 年)

醫療財團法人台灣血液基金會台中捐血中心

(減白)

分離術血小板 QC 紀錄表

測試月份: 106 年 9 月

採集 單位	分離機		採血 日期	血袋號碼	1U /2U	成品 體積 (ml)	血小板含量		白血球含量		儲存末 期 pH
	廠牌	編號					$\times 10^3/\mu\text{l}$	$\times 10^{11}/\text{U}$	$\times 10^3/\mu\text{l}$	$\times 10^6/\text{U}$	
中港	Fenwal (Amicus)	R106003	106.09.04	0646403951 0646403968	2U	448	1452	3.3	0.0002	0.04	7.3
中港	Terumo BCT (TRIMA)	R102002	106.09.05	0646404170 0646404187	2U	459	1638	3.8	0.0003	0.07	7.5
中港	Terumo BCT (TRIMA)	R103001	106.09.05	0646404255 0646404262	2U	460	1648	3.8	0.0001	0.02	7.6
中港	Terumo BCT (TRIMA)	R098003	106.09.05	0646404156 0646404163	2U	448	1330	3.0	0.0009	0.20	7.4
彰化	Terumo BCT (TRIMA)	R103005	106.09.05	0646097723 0646097730	2U	459	1506	3.5	0.0002	0.05	7.5
三民	Terumo BCT (TRIMA)	R100005	106.09.05	0646299448 0646299455	2U	458	1400	3.2	0.0002	0.05	7.5
豐原	Terumo BCT (TRIMA)	R104003	106.09.05	0646174790 0646174806	2U	453	1550	3.5	0.0003	0.07	7.5
大里	Terumo BCT (TRIMA)	R106001	106.09.10	0646222316 0646222323	2U	461	1706	3.9	0.0002	0.05	7.4
大里	Terumo BCT (TRIMA)	R104002	106.09.11	0646222712 0646222729	2U	454	1642	3.7	0.0002	0.05	7.4
豐原	Haemonetics (MCS+ ED)	R103003	106.09.10	0646175636 0646175643	2U	501	1280	3.2	0.0004	0.10	7.4
三民	Haemonetics (MCS+ ED)	R102001	106.09.10	0646300649 0646300656	2U	510	1170	3.0	0.0003	0.08	7.5
中港	Haemonetics (MCS+ ED)	R104004	106.09.10	0646405658 0646405665	2U	505	1304	3.3	0.0004	0.10	7.5
中港	Haemonetics (MCS+ ED)	R101004	106.09.10	0646405719 0646405726	2U	497	1202	3.0	0.0002	0.05	7.5
中港	Haemonetics (MCS+ ED)	R103004	106.09.10	0646405955 0646405962	2U	500	1320	3.3	0.0001	0.02	7.4
三民	Haemonetics (MCS+ ED)	R101001	106.09.10	0646300687 0646300694	2U	514	1164	3.0	0.0002	0.05	7.5
大里	Haemonetics (MCS+ ED)	R104005	106.09.10	0646222354 0646222361	2U	520	1188	3.1	0.0002	0.05	7.4

機密等級: ☒一般 ☐限閱 ☐密 ☐機密

1/2

測試結果 -血小板含量 測試數: 16 袋, 合格數: 16 袋, 合格率: 100%

-白血球含量 測試數: 16 袋, 合格數: 16 袋, 合格率: 100%

-儲存末期 pH 測試數: 16 袋, 合格數: 16 袋, 合格率: 100%

合格標準 - 血小板含量 $\geq 3.0 \times 10^{11}/\text{unit}$ (合格率 90% 以上)

- 白血球含量 $\leq 5.0 \times 10^6/\text{unit}$ (合格率 95% 以上) (減白成品加測)

- 儲存末期 pH ≥ 6.2 (合格率 90% 以上)

量測儀器 (名稱/編號/校驗效期):


1. 捐血日期 106.09.04: 血球分析儀 Sysmex KX-21/編號 A1639/校驗效期 106.12.31

捐血日期 106.09.05、10、11: 血球分析儀 Sysmex KX-21N/編號 C098014/校驗效期 106.12.31

2. 電子式磅秤/編號 G097028/校驗效期 106.09.30

3. PH METER/編號 G090105/使用前校正

測試人員:  10-27/15:30

單位主管:  10-11/15:00

品保單位:  10-28/16:45

負責醫師:  1061013
10265

表 QP-BB-032-6.6-001 (保存 5 年)

What is Log reduction?

Log reduction: 血品經過白血球減除動作後與未減除前比較所殘留的相對數量。

1 Log :白血球數量比原來少10倍

2 Log :白細胞數量比原來少100倍

3 Log :白細胞數量比原來少1000倍

Log reduction，取決於血袋中白血球的原始數量，並沒有指定白血球的最大數量為何，**原始數量多者即使log reduction值大，不見得白血球殘餘量低**。因此，Log reduction可能不是評估白血球去除率的正確方法。



	Pre-storage leucoreduction	Post-storage leucoreduction
Time of leucoreduction	收集後不久，WBC即從red cells 或 platelets 中被移除，避免釋放發炎性介質如 cytokines。	收集後幾天，WBC從red cells 或 platelets 中被移除，通常給患者之前過濾，或在病床邊過濾。
Techniques used	Lab side filtration In-line filtration apheresis	Lab side filtration Bedside filtration
Advantage used	減少發熱性非溶血輸血反應(FNHTR) 細菌及病毒傳播 HLA 同種異體免疫反應	防止病毒傳播和HLA同種免疫 但不一定能有效預防FNHTR



Leucodepletion filtration 製備時機

- ◆ Beside
during transfusion
- ◆ In-Lab
before issue from blood bank
- ◆ Pre-storage (捐中 5-8 hrs)
inline filtration before component preparation



Bedside filtration

◆ Disadvantages

- reduced efficacy since slow filtration of warmed blood (?)
- cannot assess product quality
- control of factors difficult
- lack of consistency
- ineffective in preventing effects due to storage changes

◆ Advantages

- reduces cost as used only for selected patients



In-lab filtration

◆ Disadvantages

- additional delay to filter issue
- adverse effects due to storage related change cannot be prevented

◆ Advantages

- easy to standardize
- quality can be assessed
- reduces cost as used only for selected patients



Pre-storage/inline filtration

◆ Disadvantages

- cost escalation unless universal leucodepletion

◆ Advantages

- easy to standardize and convenient
- quality can be assessed
- decreased NHFTR
- decreases alloimmunization and platelet refractoriness







Modern Leuko-reduction filters

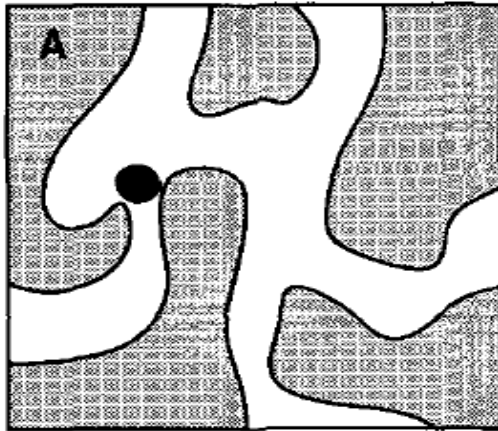
Principle

- ◆ Hard or soft housing
- ◆ Non-woven material (cotton, wool, nylon, polyester polyurethane)
- ◆ Various
 - layers
 - pore size
 - bio compatibility
 - electric charge
 - wet ability etc...

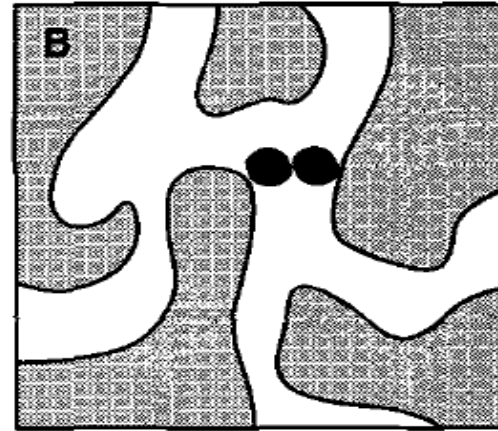


Mechanism of action of leucodepletion filters

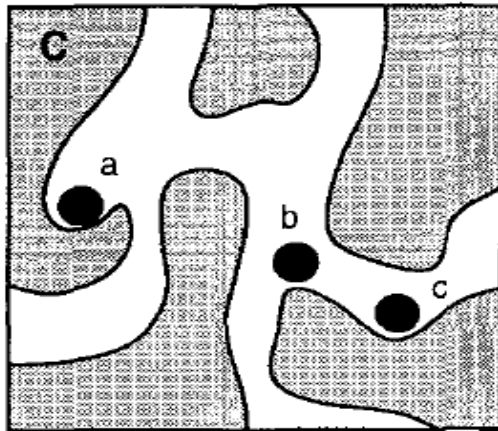
Blocking



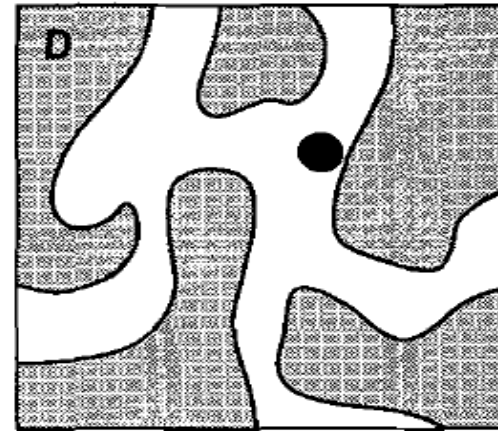
Bridging



Interception



Adhesion

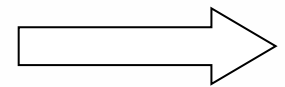


Schematic picture of Leuko-reduction filters

Inlet



											Pores
Gel/debris	C	C	C	C	C	C	C	C	C	C	Coarse
Aggregates	M	M	M	M	M	M	M	M	M	M	Middle
Leukocytes	F	F	F	F	F	F	F	F	F	F	Fine
Leukocytes	F	F	F	F	F	F	F	F	F	F	Fine
..removed											



Outlet LR

Flow in one direction

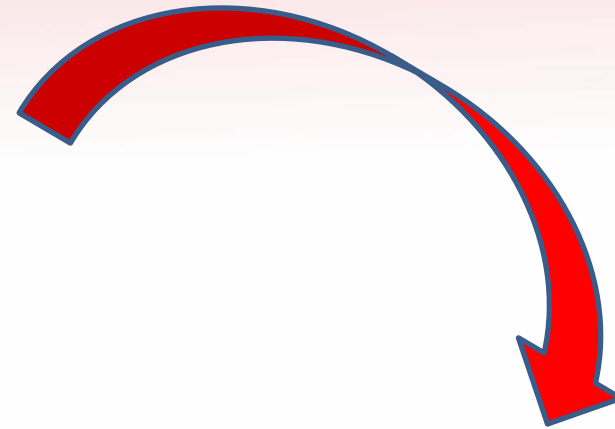
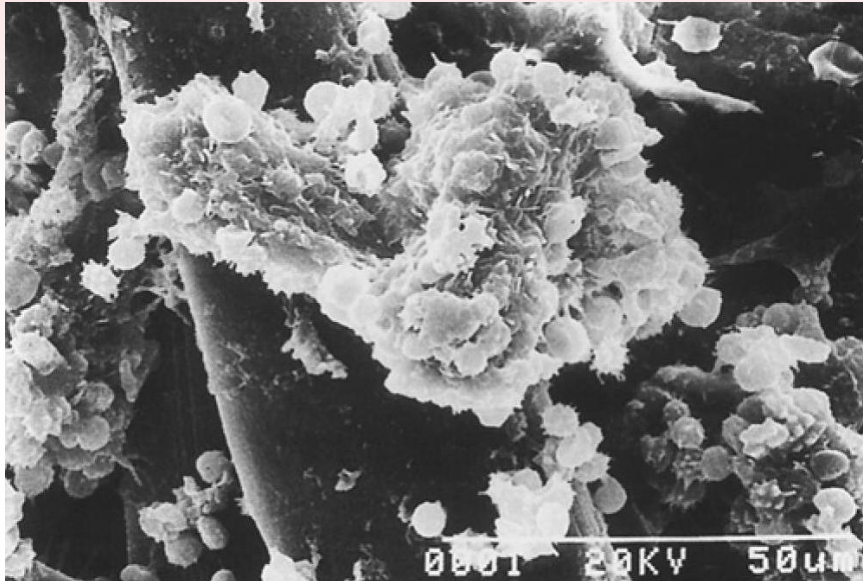
Priming (wetting)

Time for filtration

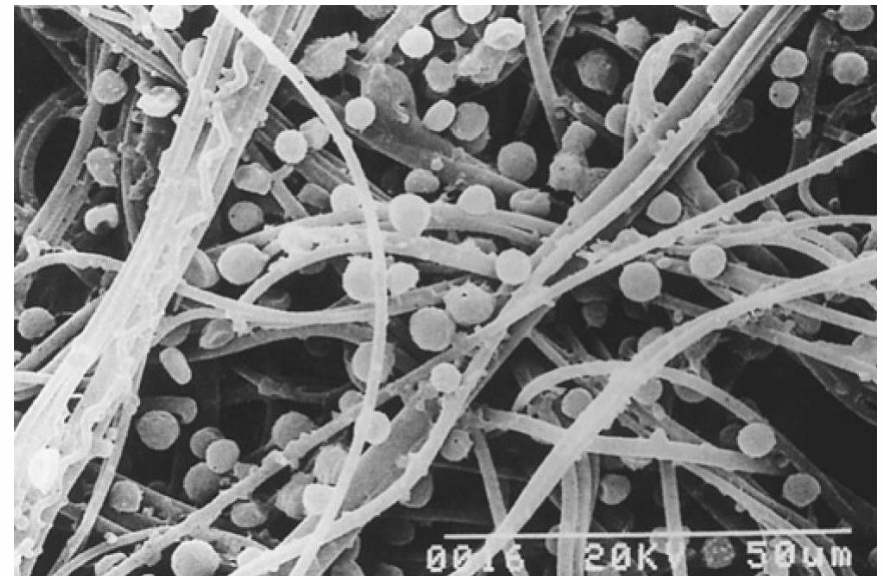
Emptying (reduce loss of component in filter)



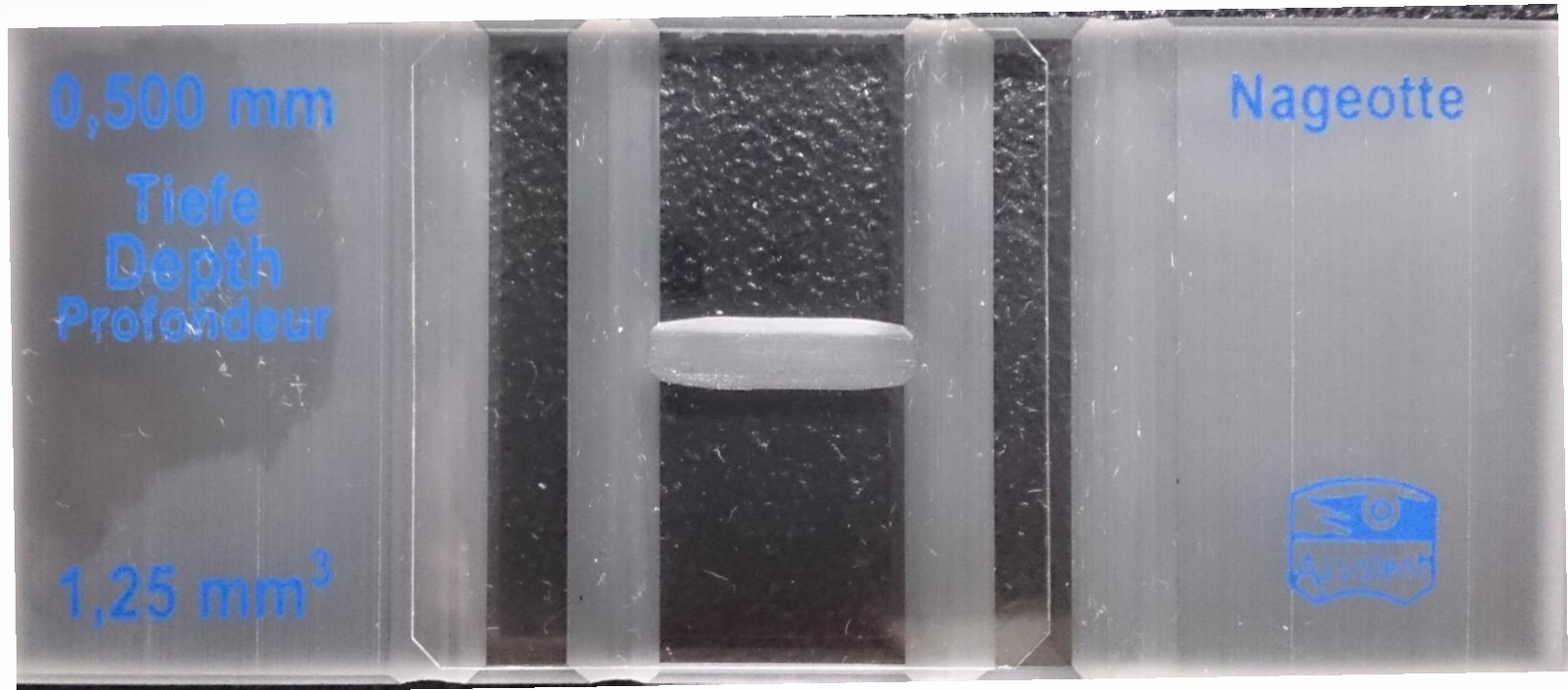
Upstream layer

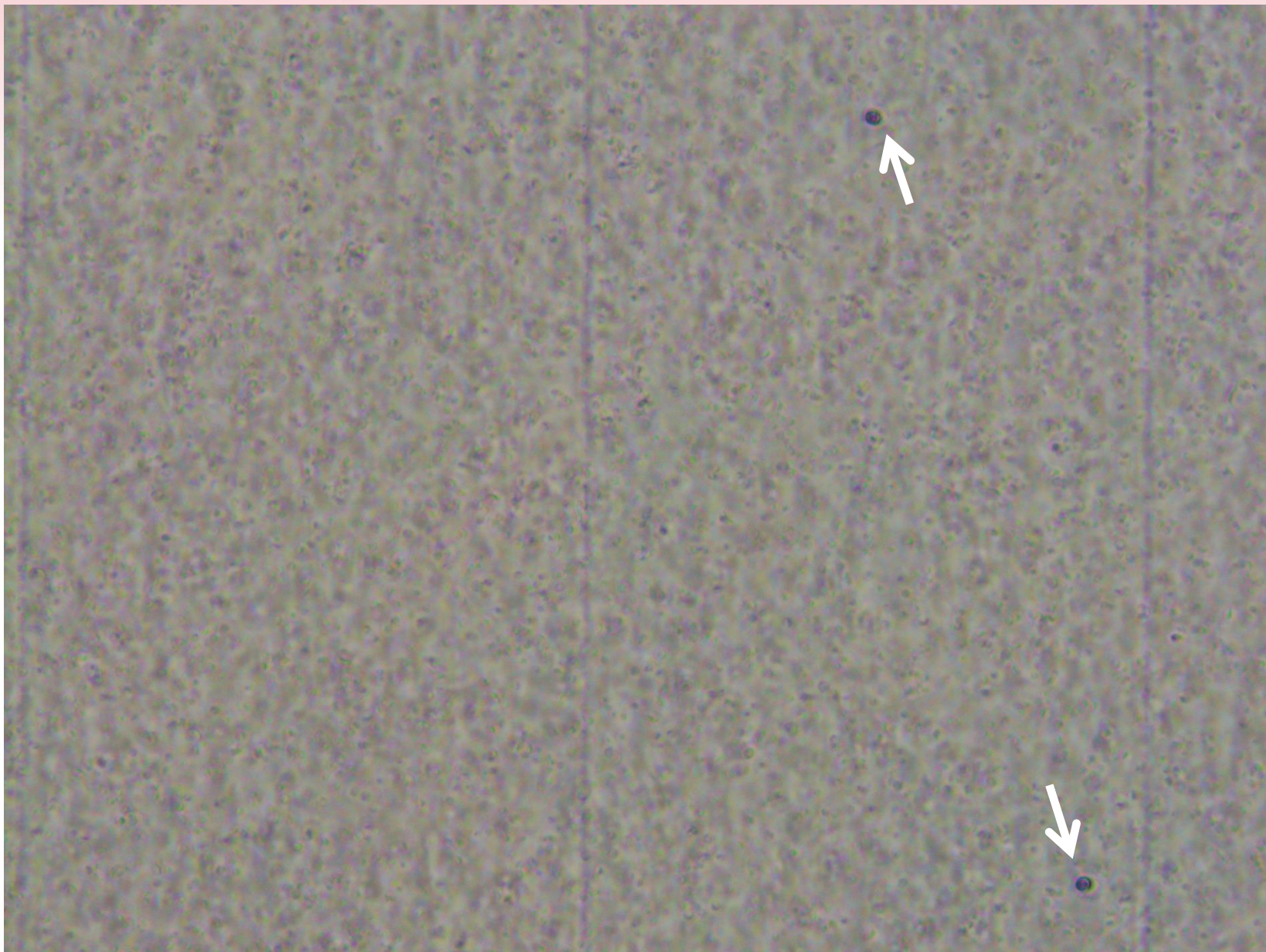


Downstream layer



Nageotte Countering Chamber





Clinical benefits of leucocyte reduction

- ◆ Proven relevant clinically 臨床實證
- ◆ Likely clinically relevant 可能相關
- ◆ Unproven clinically 有待證實



Proven relevant clinically

- ◆ Reduced frequency and severity of NHFTR ($< 5 \times 10^8$)
- ◆ Reduced risk of CMV transfusion ($< 5 \times 10^6$)
- ◆ Reduced risk of HLA alloimmunization and platelet refractoriness ($< 5 \times 10^6$)
- ◆ Reduced mortality and organ dysfunction in cardiovascular surgery patients



Likely clinically relevant

- ◆ Reduced infectious risk associated with immunomodulation.
- ◆ Reduced direct risk of transfusion transmission bacteria.



Unproven clinically

- ◆ Avoidance of variant creutzfeldt-Jacob disease(vCJD)
- ◆ Avoidance of HTLV- I , -II, and EBV etc.
- ◆ Reduced risk of graft versus host disease(GVHD)
- ◆ Reduced risk of transfusion associated acute lung injury(TRALI)



Adverse effect of leukoreduction

- ◆ The major disadvantages associated with leukocyte reduction is **cost**.
- ◆ It had been happened **hypotension** during the **bedside** filtration.
- ◆ It can occur even with the **prestorage** leukoreduction of blood products in which a **defect in the metabolism of kinins** may be a risk factor.



謝謝指導

