

Il était une fois.....

Prélèvements de CSH chez l'enfant 1991-2025 Photochimiothérapie pédiatrique 1996 - 2025

*Justyna Kanold, Victoria Grèze, Etienne Merlin
Valérie Herve, Emmanuelle Lopez, Delphine Pages, Laurence Chauvet*

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UFR DE MÉDECINE
ET PROFESSIONS PARAMÉDICALES
Université Clermont Auvergne



Prélèvements de CSH chez l'enfant 1991-2025

- historique et environnement
- indications
- mobilisation
- voies d'abord
- amorçage/transfusion
- collecte
- support



Prélèvements de CSH chez l'enfant 1991-2025 : [Historique](#)

- 1990 Premiers prélèvements de cellules CSH par cytaphérèse chez l'enfant en HDJ d'hémato-onco-pédiatrie : 1 lit + 1 COBE Spectra
- 1991 Création d'un Secteur de Cytaphérèse Pédiatrique. Prélèvements des CSH chez l'enfant de petits poids. Le recrutement est régional et extrarégional.
- 1993 Création de l'Unité de Thérapie Cellulaire : prélèvements, transformations et conservation des cellules.
- 1996 Photochimiothérapie extracorporelle (PCE)
- 2004 Certification ISO 9001
- 2006 Accréditation JACIE
- 2010 Nouveaux locaux pour l'aphérèse et la thérapie cellulaire
- 2011 Cryo – PCE
- 2011 Arrivée des Optia
- 2016 Nouveaux locaux pour l'aphérèse
- 2021 Prélèvement de CMN pour les CAR chez l'enfant de petit poids



F. Deméocq



R. Eglizot

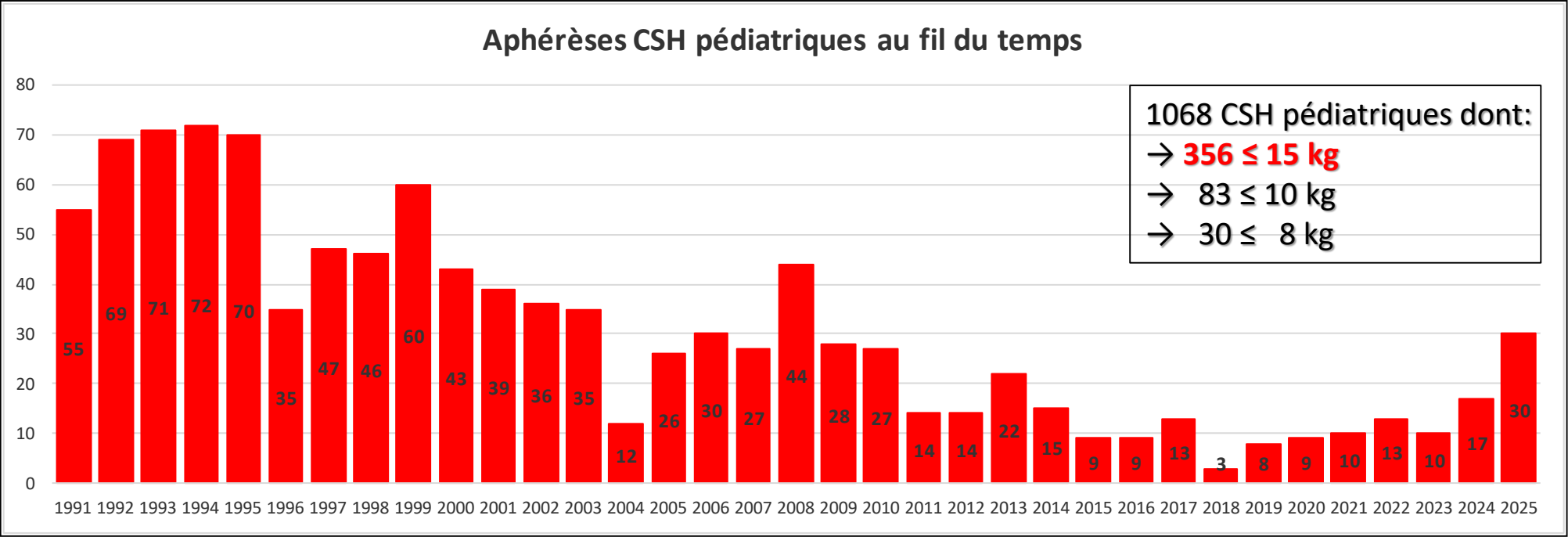
1000 séances d'aphérèse cellulaires/ an

→ CSH Auto et allo

→ CAR-T et DLI

→ PCE

- GvH
- Sezary
- pathologies dermato
- Rejets : rénaux, pulmonaires, cardiaques
- Autres pathologies auto et alloimmunes .



Aphérèses :1068

Patients : 484

Poids : 19 kg (5.8 – 99) (26 pts > 60 kg)

Age: 5.7 ans (0.4 – 20) ans (13 pts > 18 ans)

Lasky LC , Fox SB, Smith J & Bostrom B . Collection and use of peripheral blood stem cells in very small children. *Bone Marrow Transplant* **1991** Apr;7(4):281-4.

Kid : **8.3 kg** with neuroblastoma

Blood cell separator : Fenwal CS3000

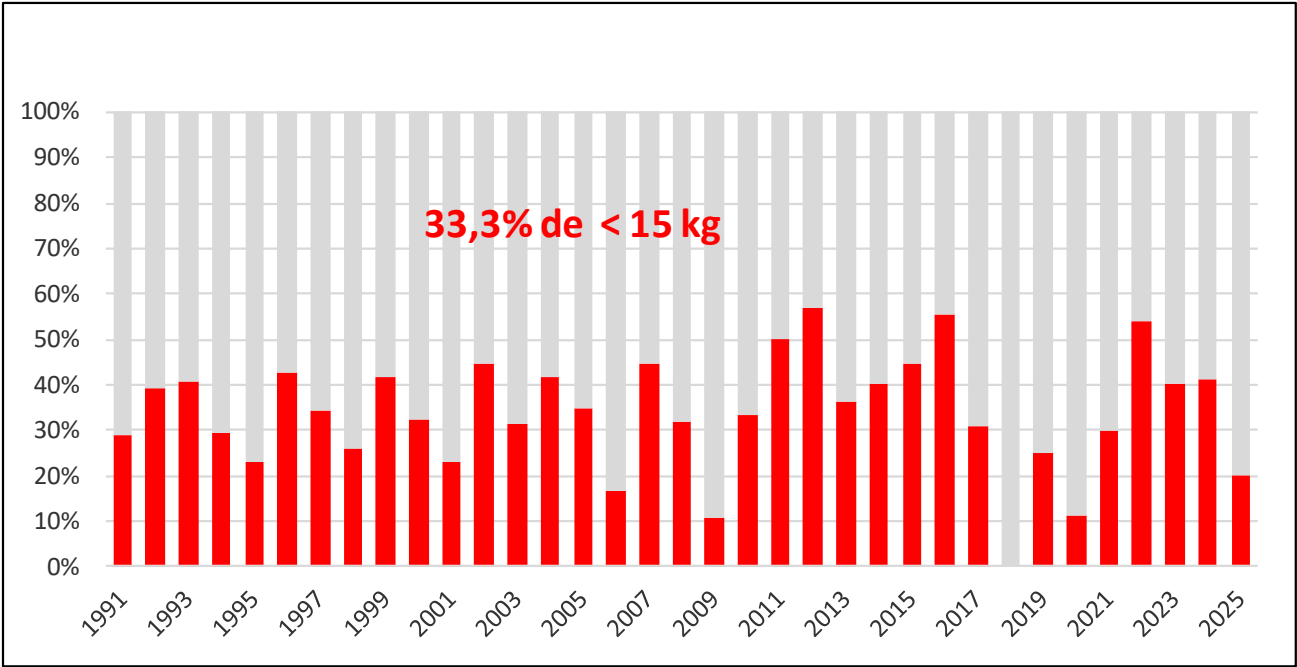
Prime : 250 ml RBC + 100 ml PFC + 100 ml 5% albumin

Heparin (1500 units/h) + ACD rate (1:25-1:32)

A total of 6.4×10^8 mononuclear cells/kg collected in **six** procedures



Prélèvements de CSH chez l'enfant ≤ 15 kg 1991-2025



Successful blood stem cell collection and transplant in children weighing less than 25 kg

n=66

F. Deméocq¹, J. Kanold¹, J. Chassagne¹, M.J. Bezou¹, P. Lutz², L. deLumley³, I. Philip⁴, J.P. Vannier⁵, G. Margueritte⁶, J.P. Lamagnère⁷, M.C. Baranzelli⁸, A. Lenat¹, H. Carla¹ & G. Malpuech¹ *Bone Marrow Transplantation* 1994, 13: 43–50

Safe and Efficient Peripheral Blood Stem Cell Collection in the Smallest of Children

n=109

Justyna Kanold, Pascale Halle, Chantal Rapatel, Marc Berger, Piotr Gembara,

*Lionel deLumley, †Jean-Pierre Vannier, ‡Patrick Lutz, ¶Dominique Plantaz,

Georges Malpuech, and François Deméocq *Therapeutic Apheresis* 2(1):49–57, Blackwell Science, Inc. © 1998 International Society for Apheresis

Peripheral blood stem cell collection in children with extremely low body weight (≤8 kg). What have we learned over the past 25 years and where are the limits?

n=26

Victoria Grèze^{1,2,3} | Nadège Rouel^{1,2} | Emmanuelle Rochette^{1,2}

Etienne Merlin^{2,3,4} | Pascale Halle¹ | Dominique Plantaz⁵ |

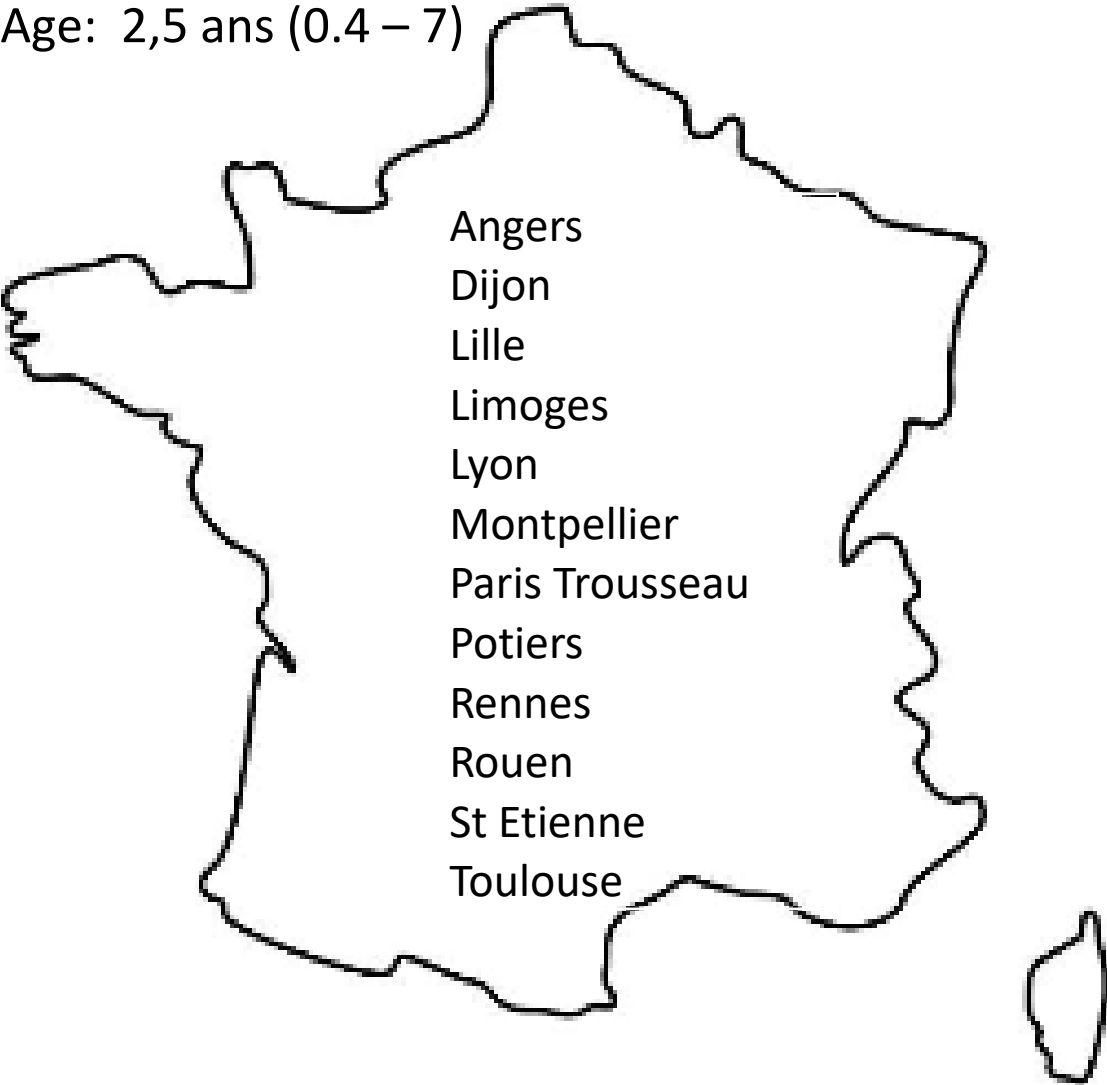
François Deméocq⁴ | Justyna Kanold^{1,2,3,4} *Journal of Clinical Apheresis* ... ASA J Clin Apher. 2020;1–10.

Aphérèses : 356

Patients : 182

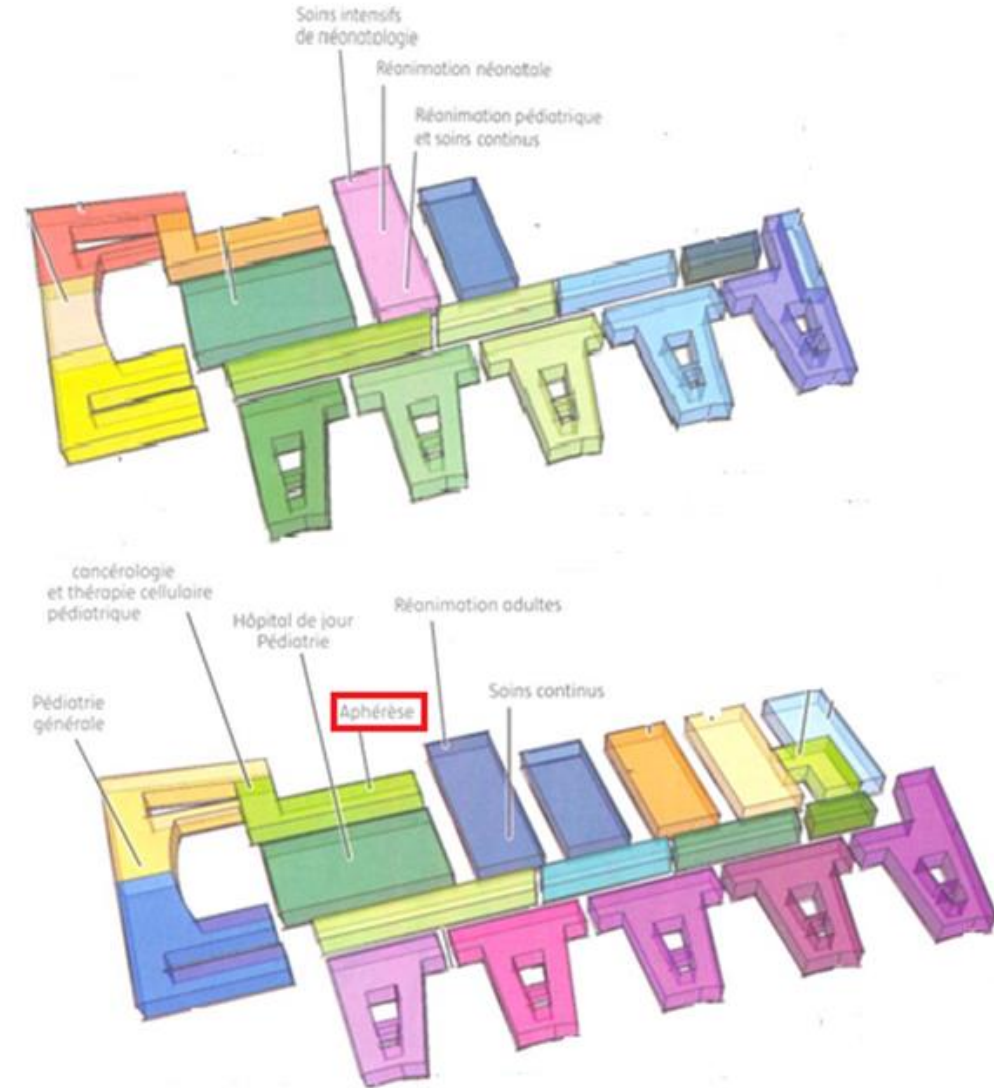
Poids : 12 kg (5.8 – 15)

Age: 2,5 ans (0.4 – 7)



Environnement pédiatrique :

- Unité d'aphérèse créée et dirigée par les pédiatres
- Tous les médecins d'aphérèse sont les pédiatres
- Toutes les infirmières d'aphérèse ont au moins 10 ans d'expérience dans le service d'hémato-onco-pédiatrie
- Stabilité d'équipe médicale et paramédicale, pyramide d'âge garantissant la continuité d'expertise (formation longue !!!)
- Unité de lieu avec le secteur de greffe pédiatrique
- Toutes les spécialités pédiatriques: la Réa pédiatrique, l'imagerie, etc. ... disponible 24/7/365 dans le même bâtiment
- Un plateau complet de thérapie cellulaire : secteur de transformation - Centre de Biothérapie d'Auvergne, communs pour enfant et adulte.



Prélèvements de CSH chez l'enfant 1991-2025

→ historique et environnement

→ **indications**

→ mobilisation

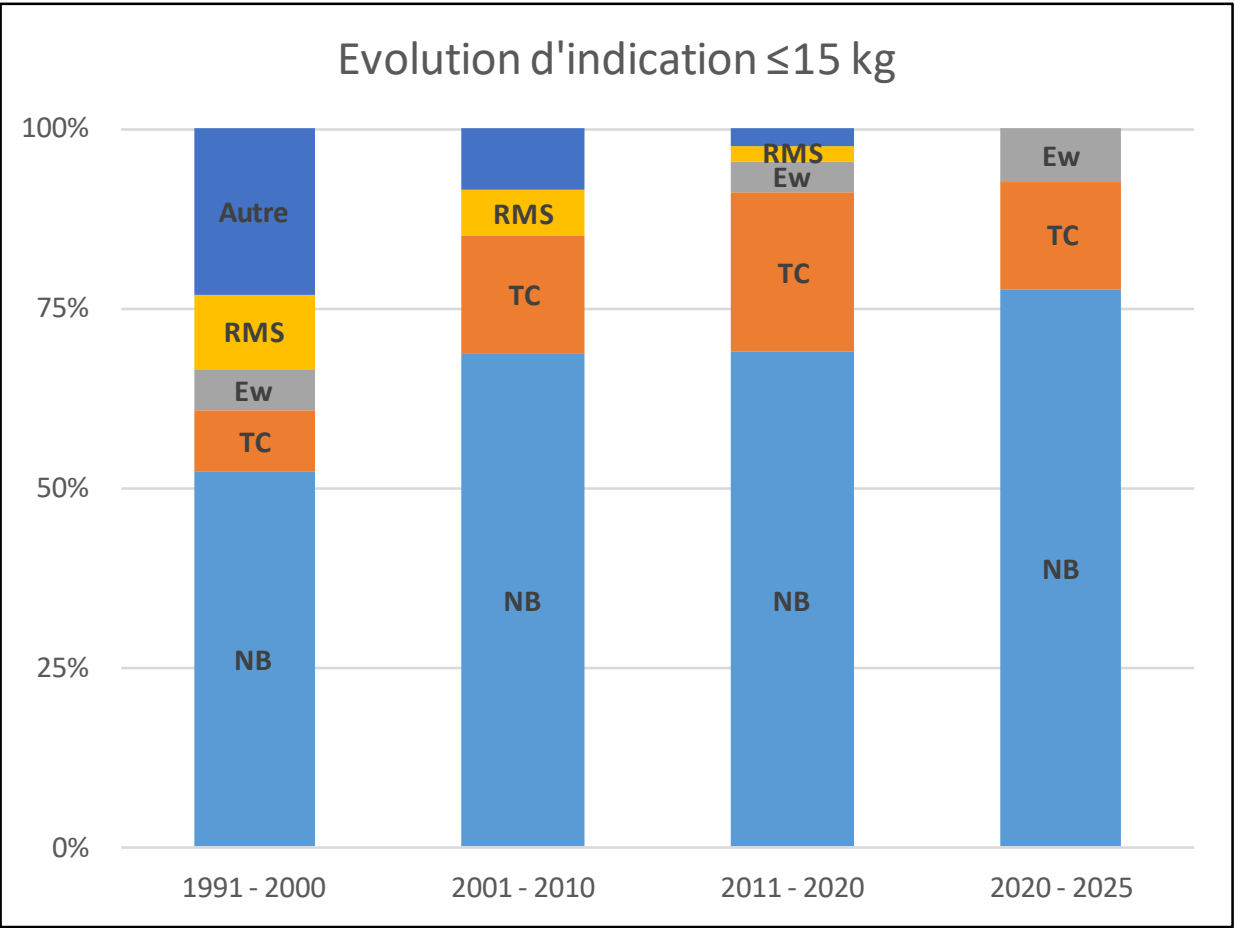
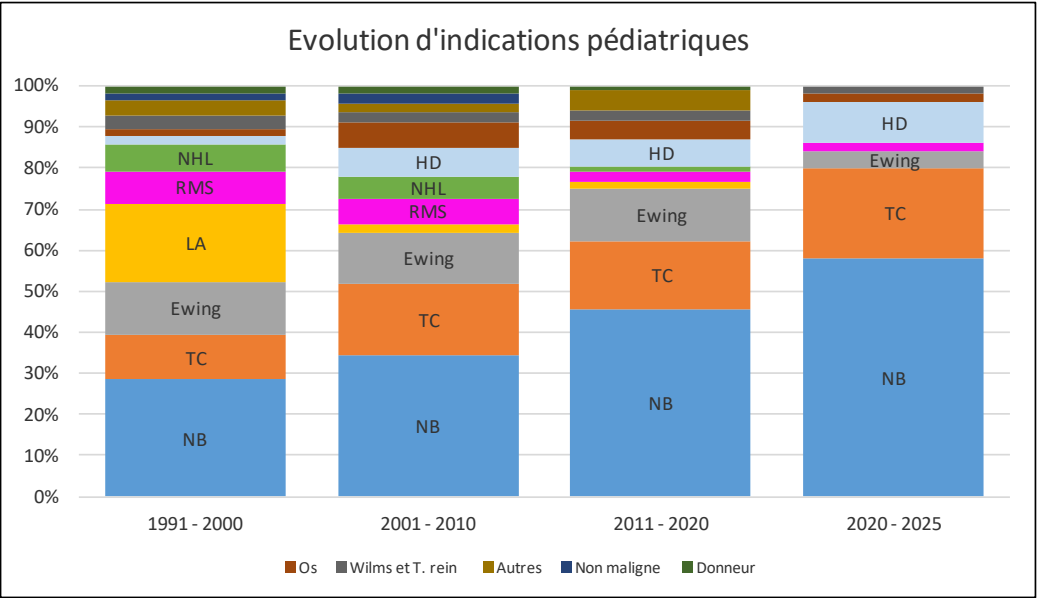
→ voies d'abord

→ amorçage/transfusion

→ collecte

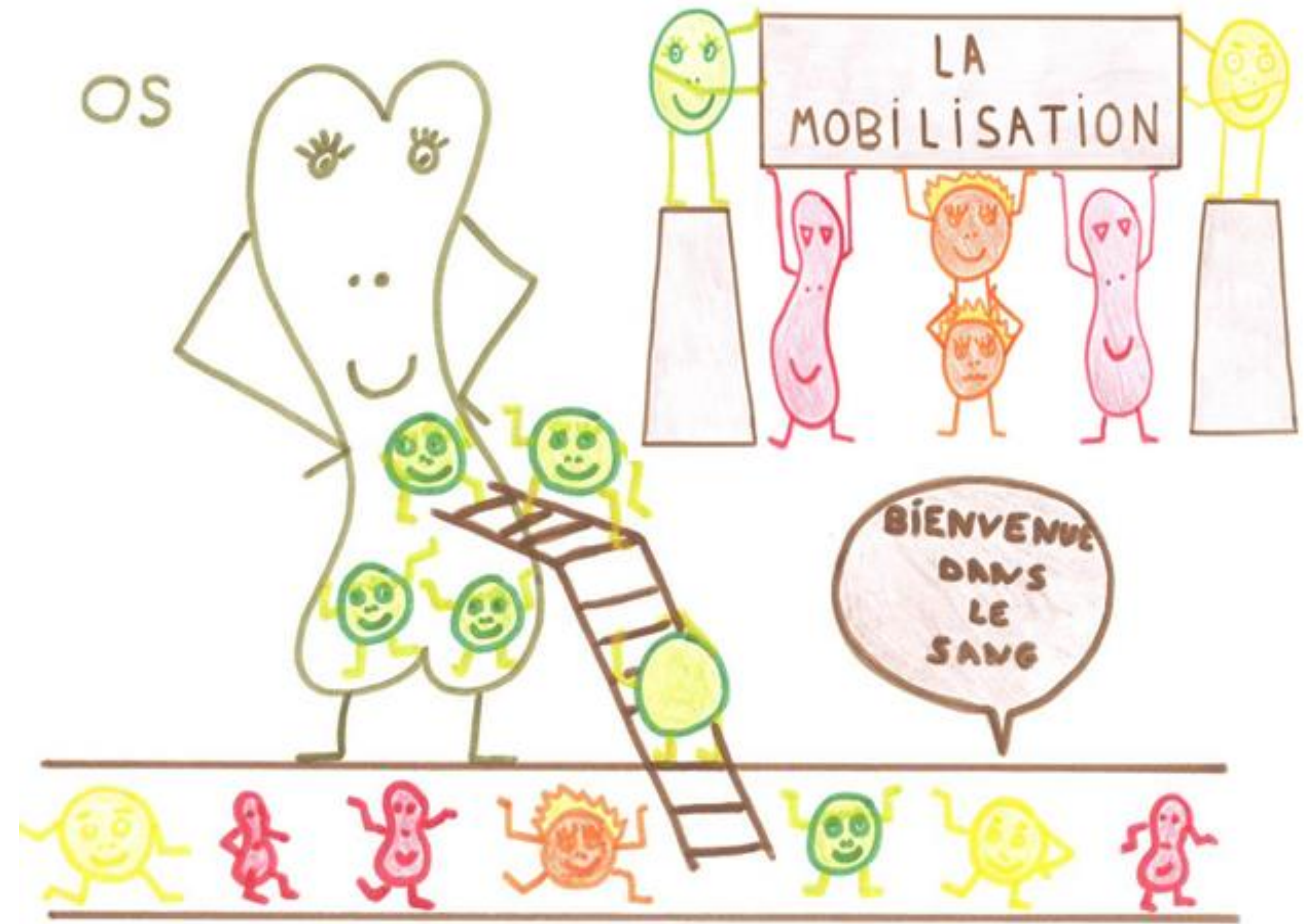
→ support

Prélèvements de CSH chez l'enfant 1991-2025 : Indications



Neuroblastomes
Tumeurs cérébrales

- historique/environnement
- indications
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Use of G-CSF alone to mobilize peripheral blood stem cells for collection from children

J. KANOLD, CH. RAPATEL, M. BERGER, J. CHASSAGNE, P. LUTZ, L. DE LUMLEY, D. PLANTAZ, J. P. VANNIER
G. MALPUECH AND F. DEMÉOCQ CHRU, Clermont Ferrand, France
British Journal of Haematology, 1994, 88, 633–635

Kinetics of hematopoietic progenitor cell release induced by G-CSF-alone in children with solid tumors and leukemias

J Kanold¹, M Berger¹, P Halle¹, C Rapatel¹, C Schoepfer¹, L de Lumley², J-P Vannier³, P Lutz⁴,
D Plantaz⁵, JL Stephan⁶, G Malpuech¹ and F Demeocq¹ *Bone Marrow Transplantation*, (1998) 21, 59-63

Granulocyte colony-stimulating factor alone at 20 µg/kg vs. 10 µg/kg for peripheral blood stem cell mobilization in children

P. Halle¹, J. Kanold¹, C. Rapatel¹, *Pediatr Transplantation* 2000; 4: 285–288

Hematopoietic progenitor cell mobilization and harvesting in children with malignancies: do the advantages of pegfilgrastim really translate into clinical benefit?

E Merlin^{1,2,3}, S Zohar⁴, C Jérôme⁵, R Veyrat-Masson⁶, G Marceau⁶, C Paillard^{1,2,3}, A Auvergnon⁷, P Le Moine⁸, V Gandemer⁹, V Sapin⁶, P Halle^{1,2,3}, N Boiret-Dupré⁶, S Chevret⁴, F Deméocq^{1,2,3},
C Dubray^{1,2,3}, and J Kanold^{1,2,3} *Bone Marrow Transplantation* (2008) 00, 1–7

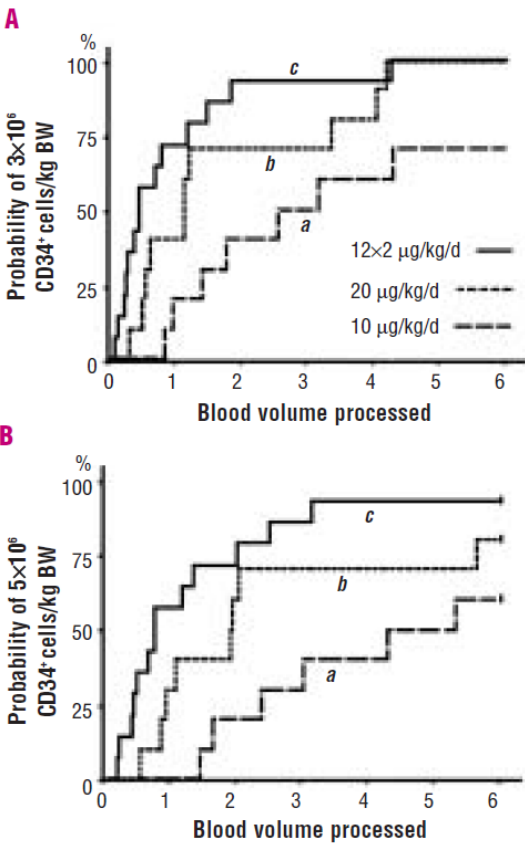
Pegfilgrastim Plus AMD 3100 for Stem-Cell Mobilization in Children

Charlotte Cardenoux, François Demeocq, Justyna Kanold
Pediatr Blood Cancer 2010;55:769

Mobilization of hematopoietic stem cells by plerixafor alone in children: A sequential Bayesian trial

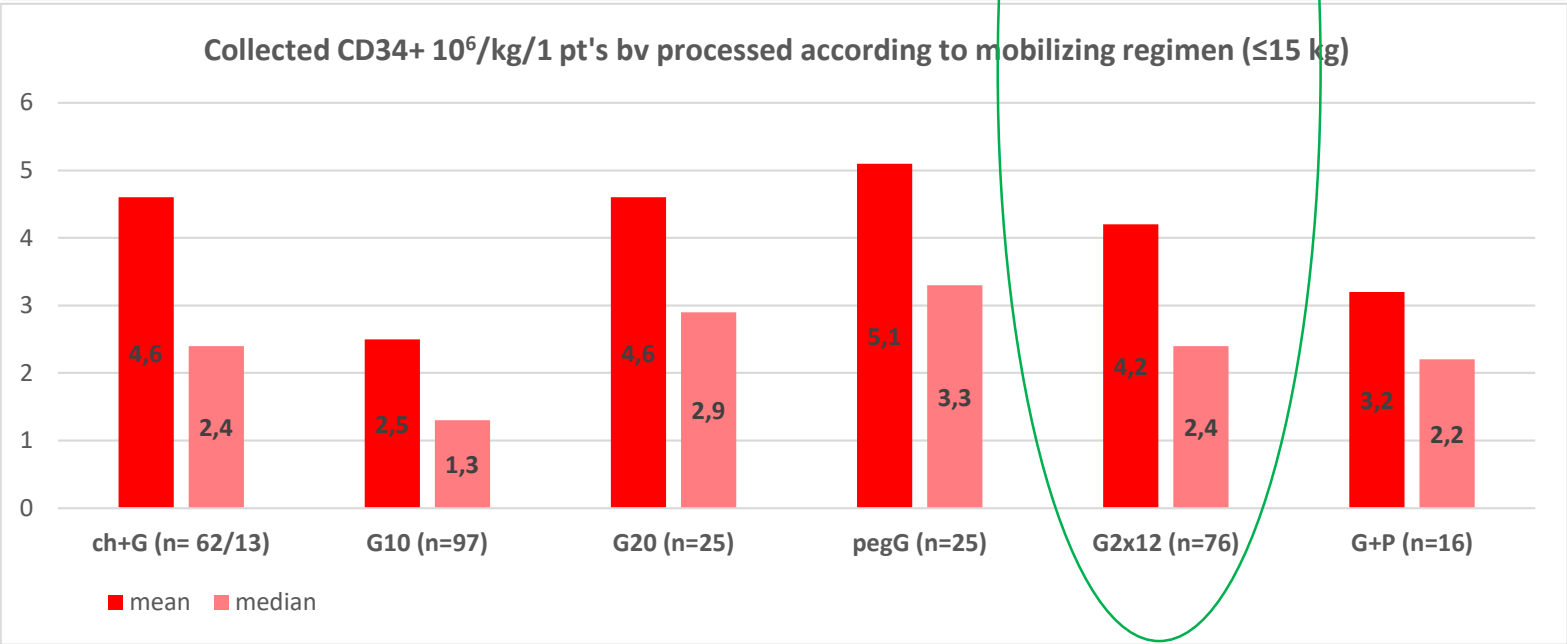
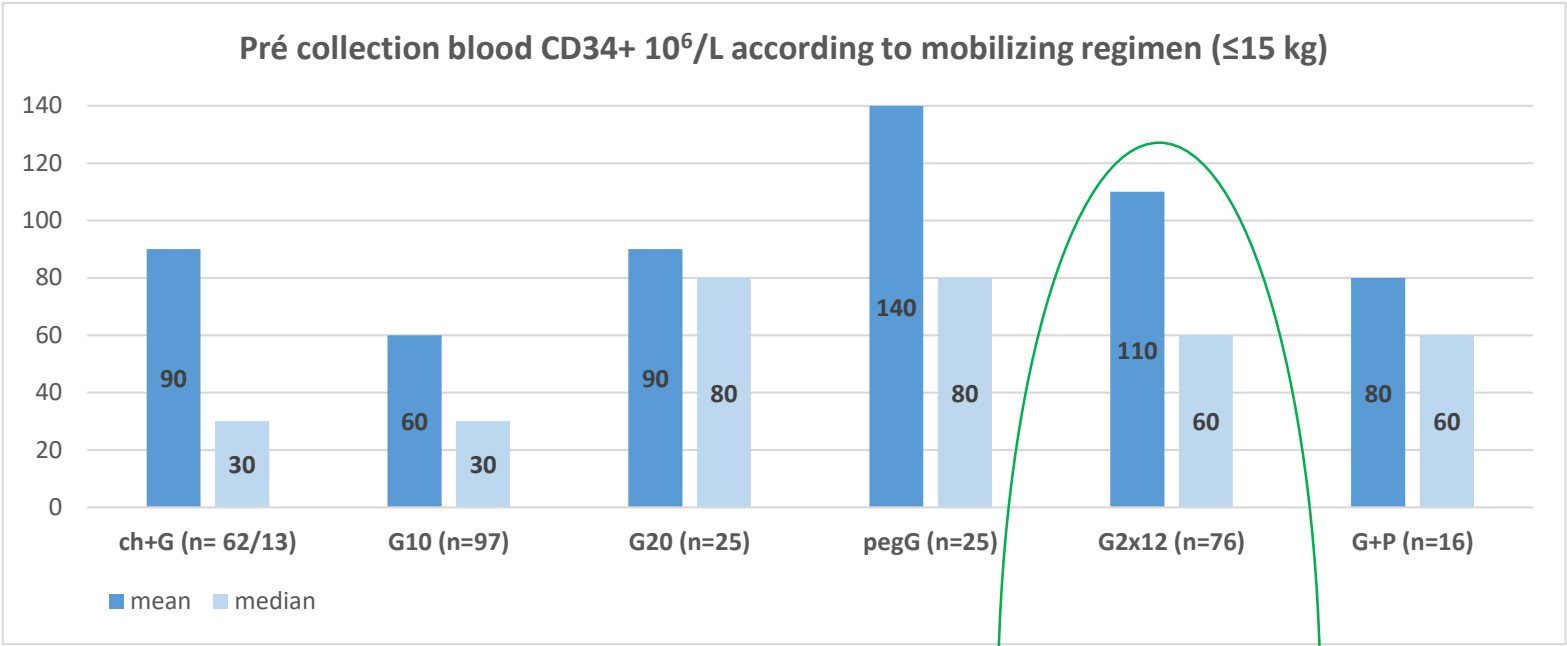
Fanny Chambon^{a,b,c}, Etienne Merlin^{a,b,*}, Emmanuelle Rochette^{a,b}
Pascale Halle^d, Francois Deméocq^{a,b,c}, Justyna Kanold^{a,b,c}
Transfusion and Apheresis Science 49 (2013) 453–458

The pros and cons of split-dose granulocyte colony-stimulating factor alone rather than a single high dose for hematopoietic progenitor cell mobilization in small children (< 15 kg) with solid tumors *Haematologica* 2006; 91:1004-1005



Administering G-CSF in a single dose and avoiding one subcutaneous injection would be beneficial, but avoiding a second apheresis would be a greater advantage in infants.

Prélèvements de CSH chez l'enfant ≤ 15 kg 1991-2025 : Mobilisation

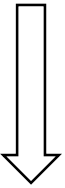


En pratique : G-CSF 12µg/kg x 2 par jour

Samedi: 8h et 20h à domicile
Dimanche: 8h à domicile
20h à l'hôpital (adaptation dose)

Lundi : début collecte

Mardi
Mercredi
Jeudi
Vendredi



Mobilization of hematopoietic stem cells by plerixafor alone in children: A sequential Bayesian trial

Fanny Chambon^{a,b,c}, Etienne Merlin^{a,b,*}, Emmanuelle Rochette^{a,b}
Pascale Halle^d, Francois Deméocq^{a,b,c}, Justyna Kanold^{a,b,c}
Transfusion and Apheresis Science 49 (2013) 453–458

Mozobil seul:

Although a ‘one-day’ mobilization regimen consisting of one injection of 240 µg/kg plerixafor alone in hematological steady state is not efficient enough to collect a complete graft in children with cancer, but may be an attractive option for completing an insufficient graft.

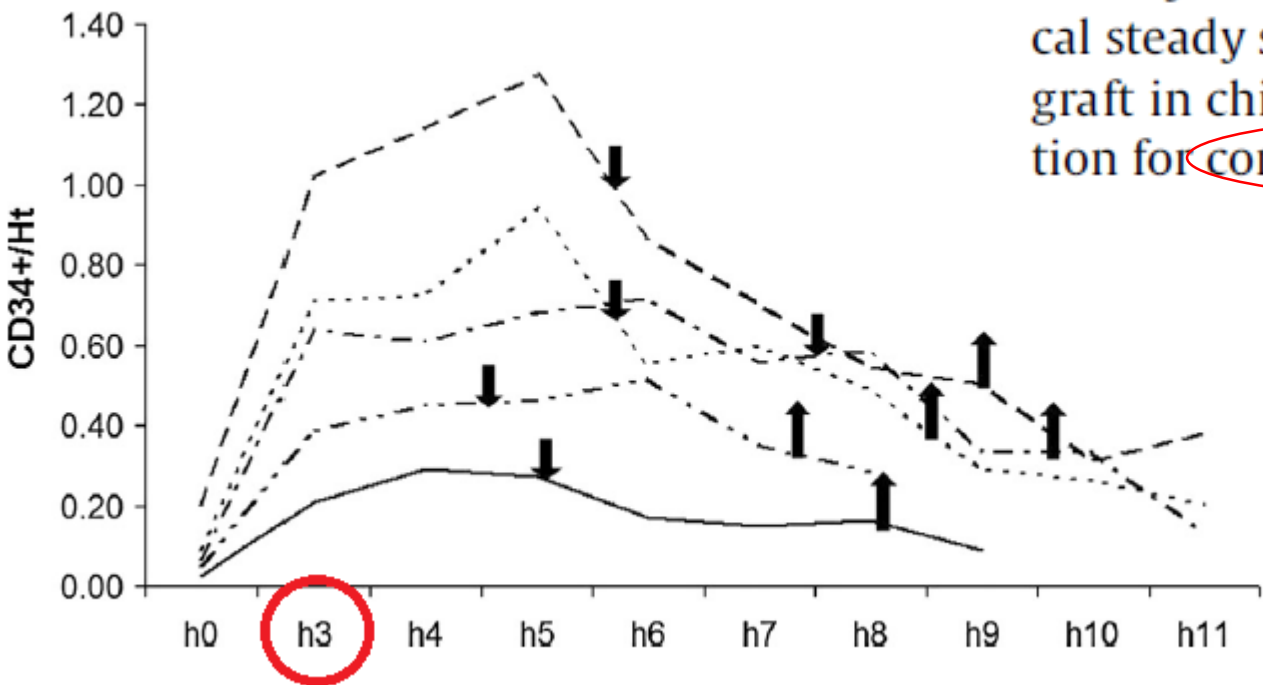
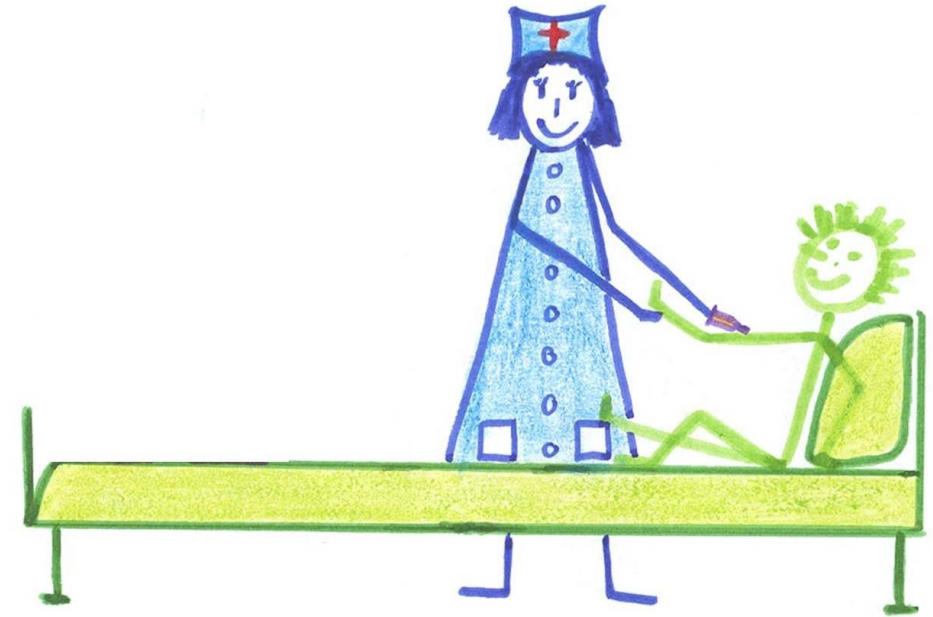
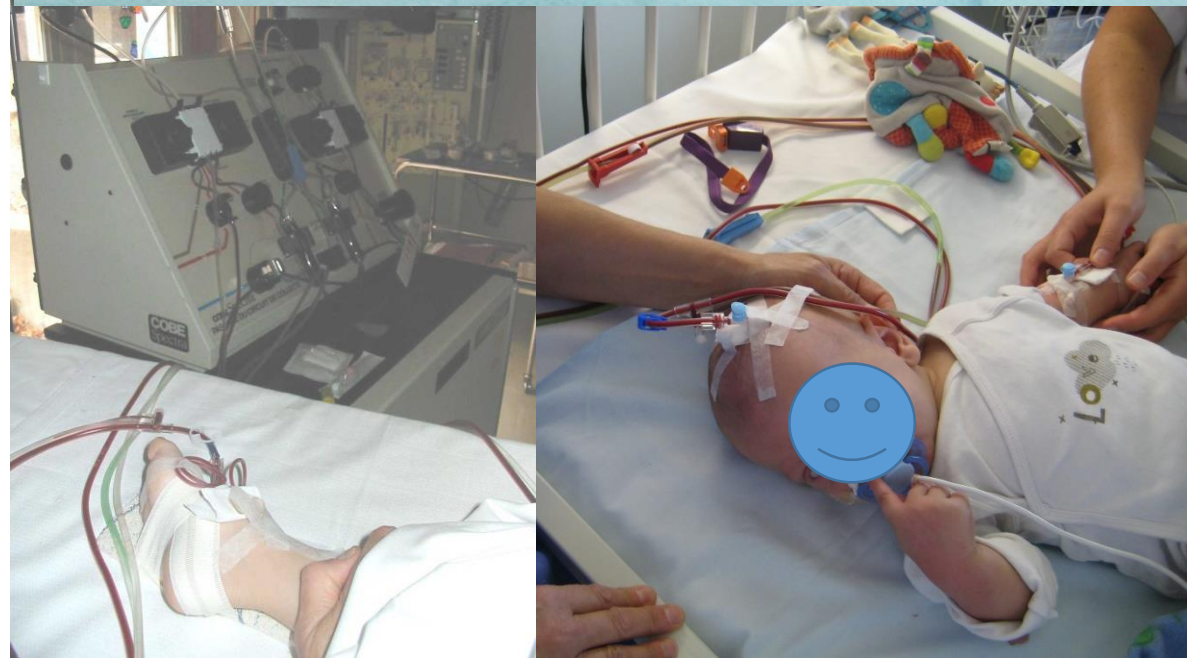
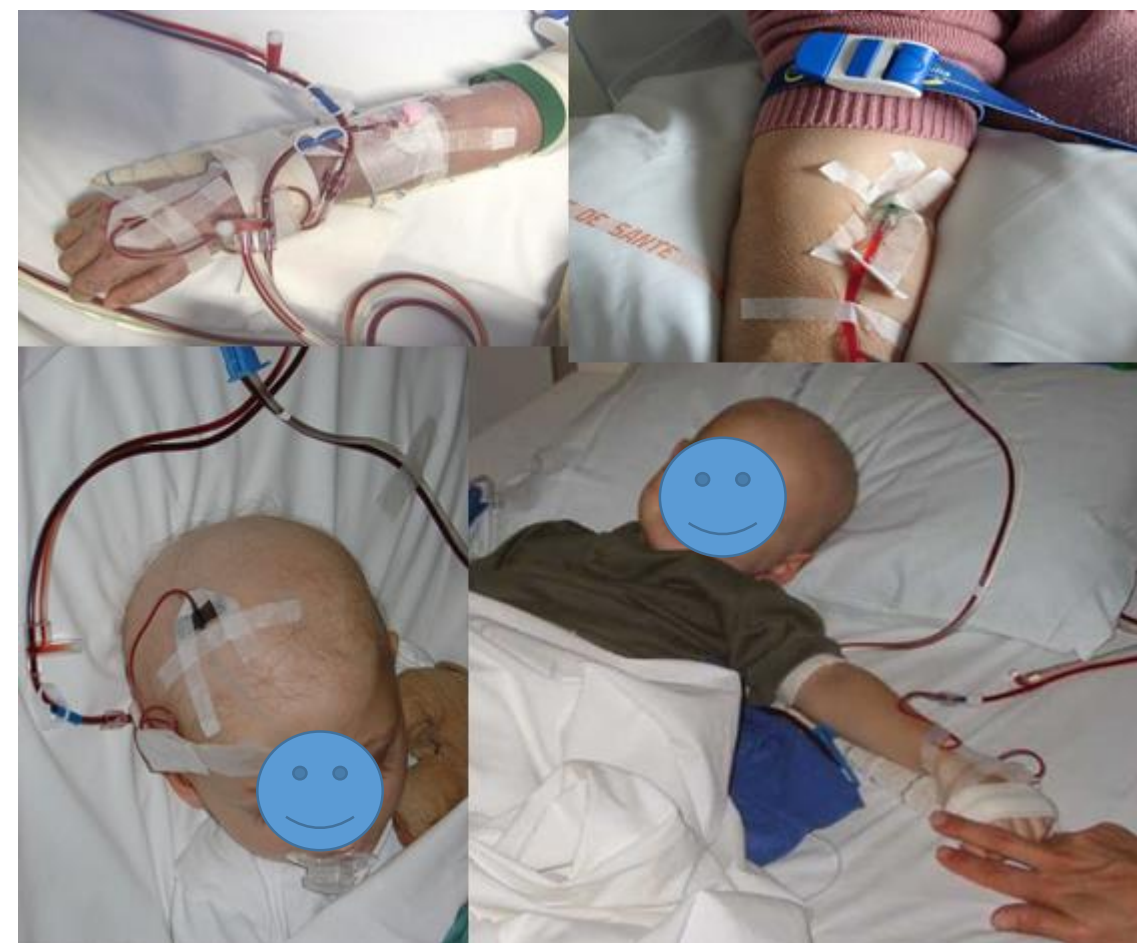


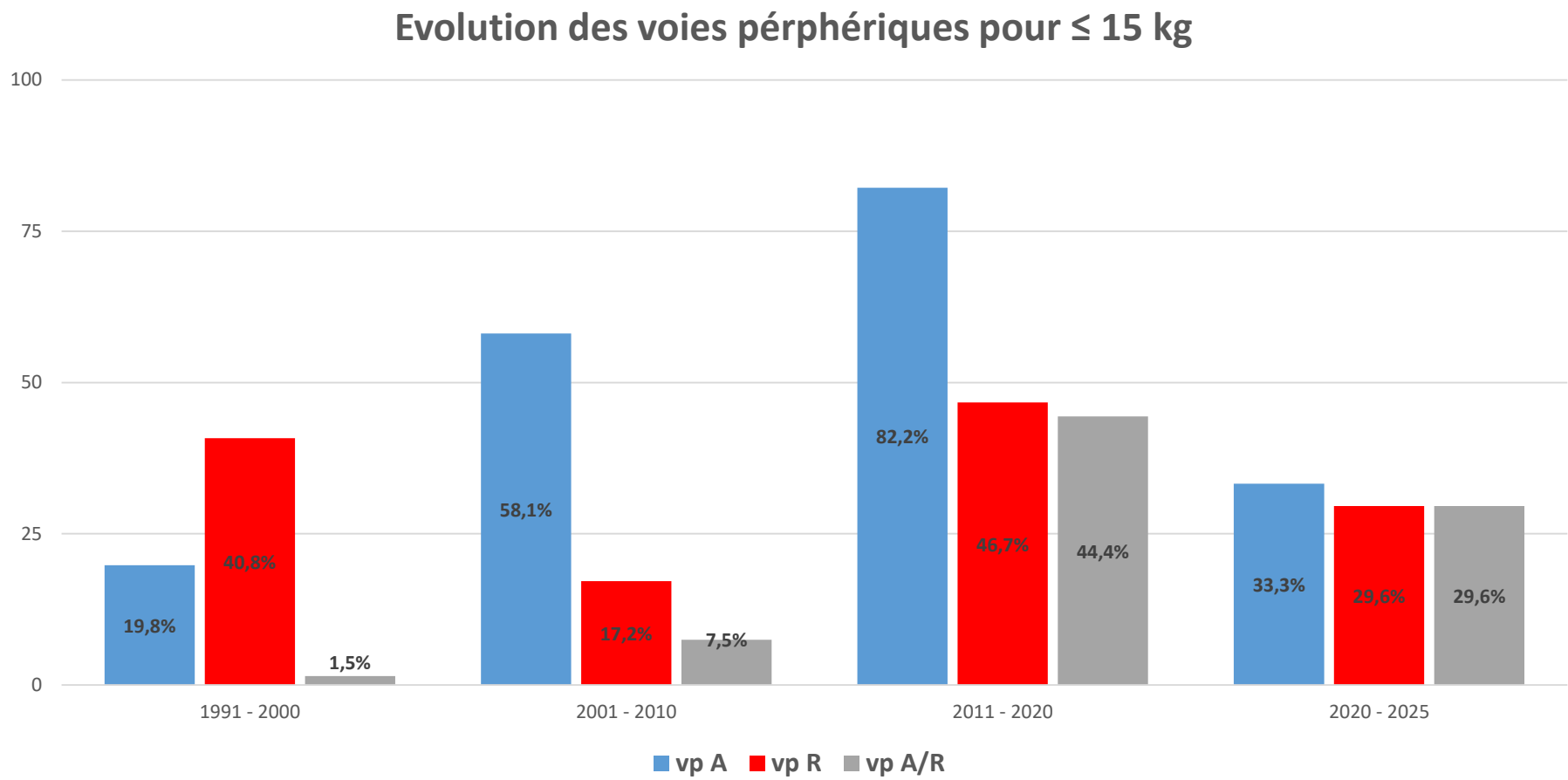
Fig. 1. Kinetics of stem cell mobilization after one injection of 240 µg/kg plerixafor in 5 children

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Prélèvements de CSH chez l'enfant ≤ 15 kg 1991-2025 : Voies d'abord

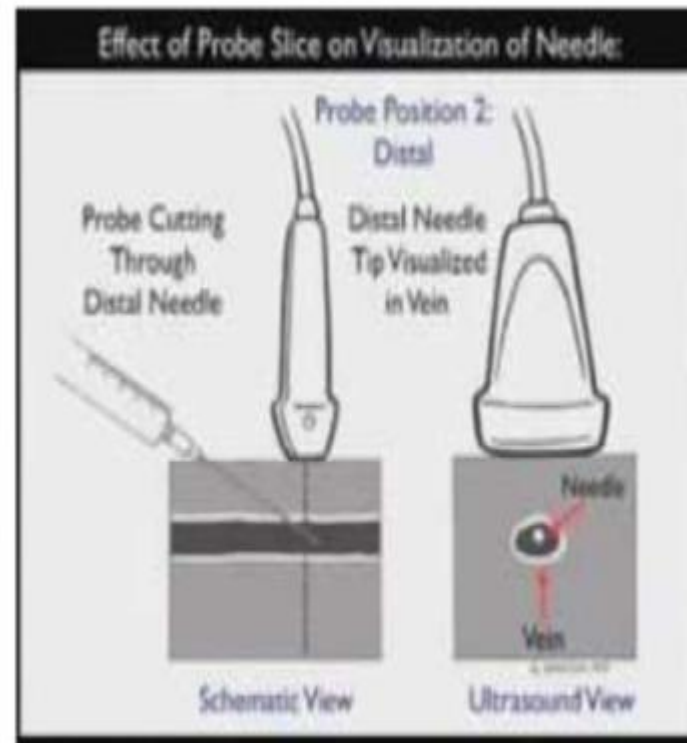
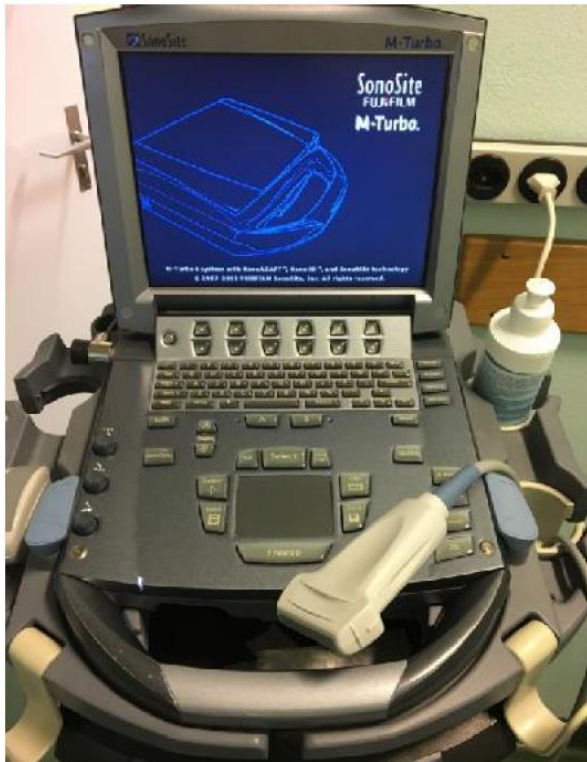




Chambre implantable :
A = 4/356
R = 21/356

L'échographe portable:

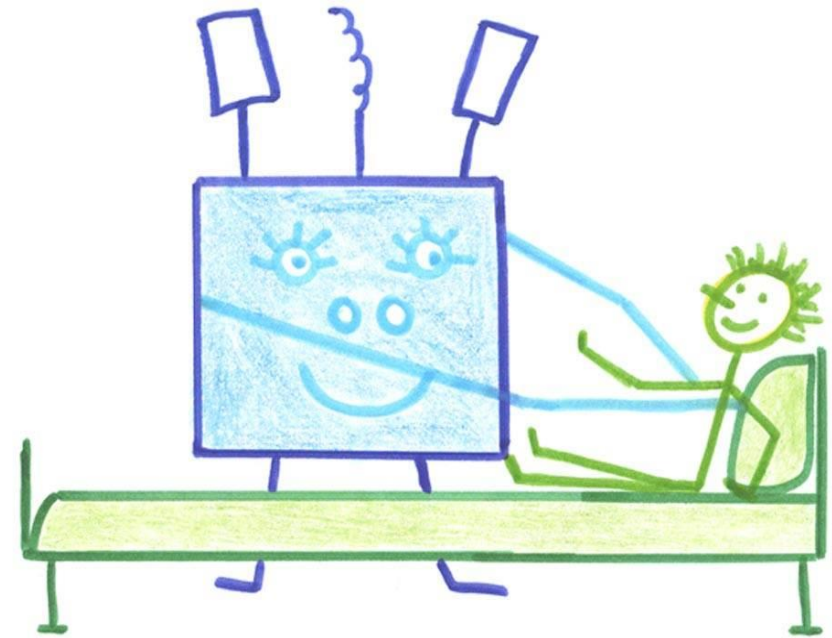
- Evite le recours à la pose de cathéter centraux invasifs
- Diminue le temps de ponction
- Augmente le pourcentage de réussite
- Permet de ponctionner des veines « impiquables ».
- Diminue le stress des patients et augmente leur confort.
- Permet de proposer l'aphérèse thérapeutique au plus grand nombre de patients



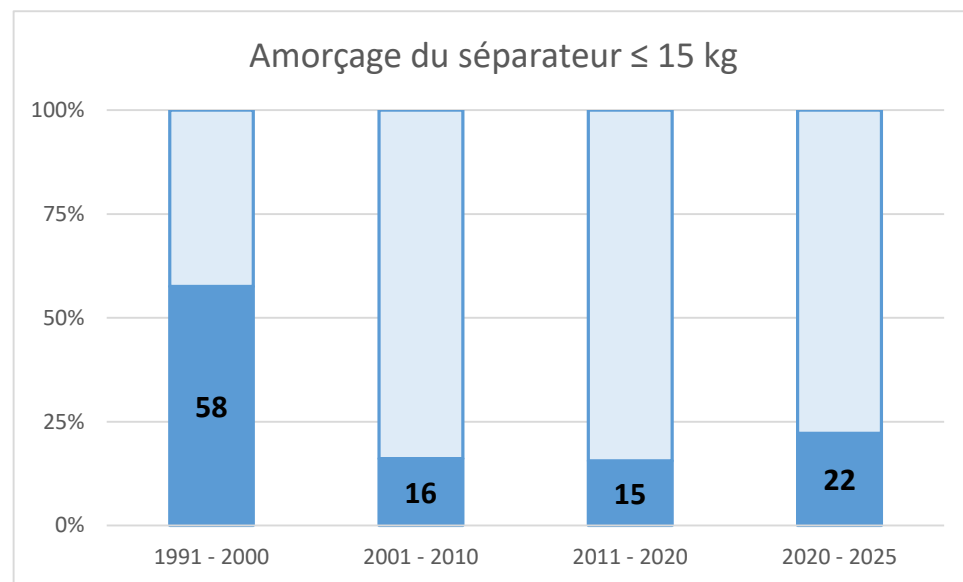
Les cathétres IV écho-guidés constituent une alternative aux cathétres veineux centraux chez 85 % des patients.

- L'expertise de l'IDE permet d'adapter les aiguilles ou cathéters aux veines de l'enfant.
- Privilégier les voies existantes.
- Toujours évaluer les voies périphériques avant de poser un KT central.
- Choisir un abord veineux permettant un débit suffisant.
- Utiliser petits moyens évitant à enfant déperdition calorique pour favoriser vasodilatation.
- Ne pas hésiter à passer la main.
- Prévoir une fixation efficace mais minimale et confortable.
- L'enfant coopératif favorise la réussite => pas de précipitation.

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Prélèvements de CSH chez l'enfant ≤ 15 kg 1991-2025: Amorçage/transfusion



Evolution d'amorçage:

< 25 kg

< 15 kg

En fonction de la masse sanguine

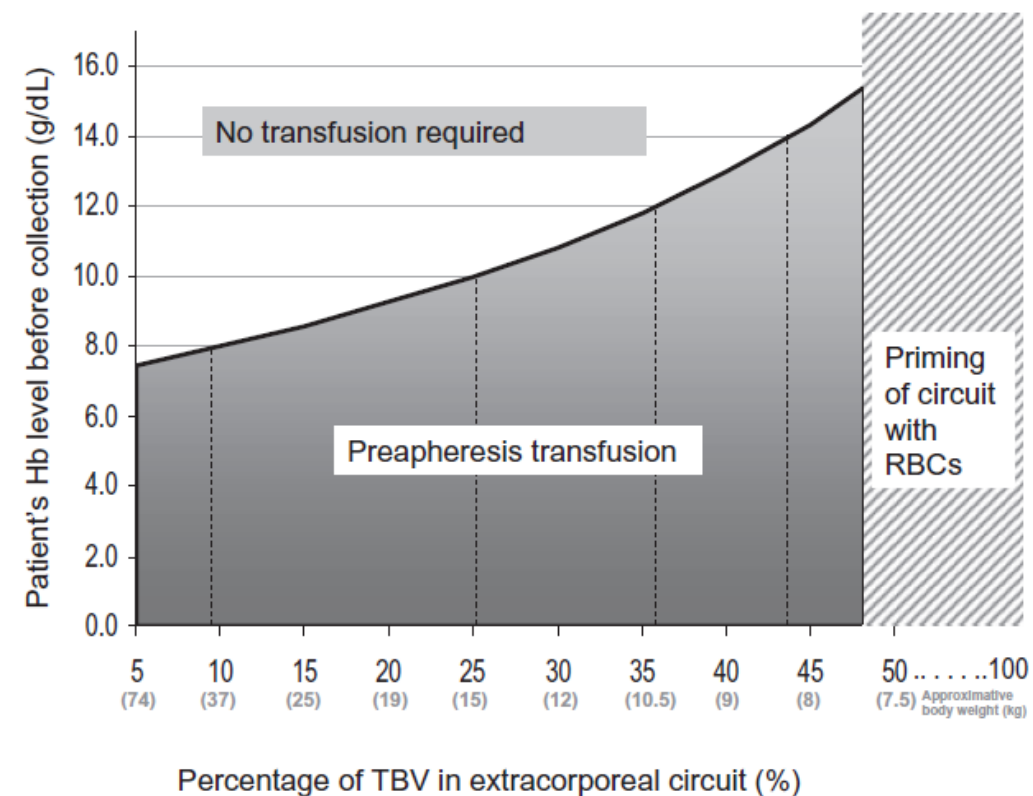
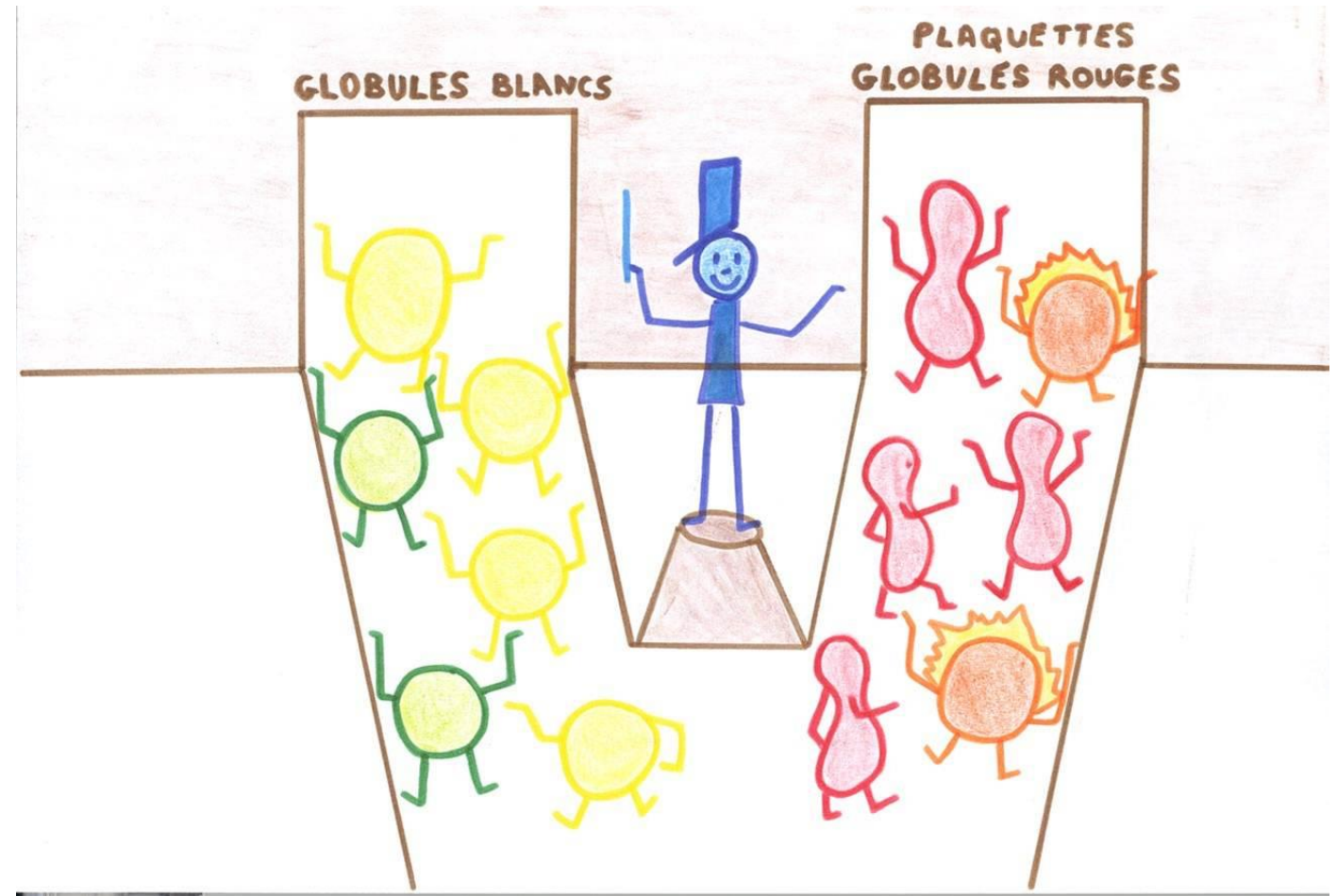


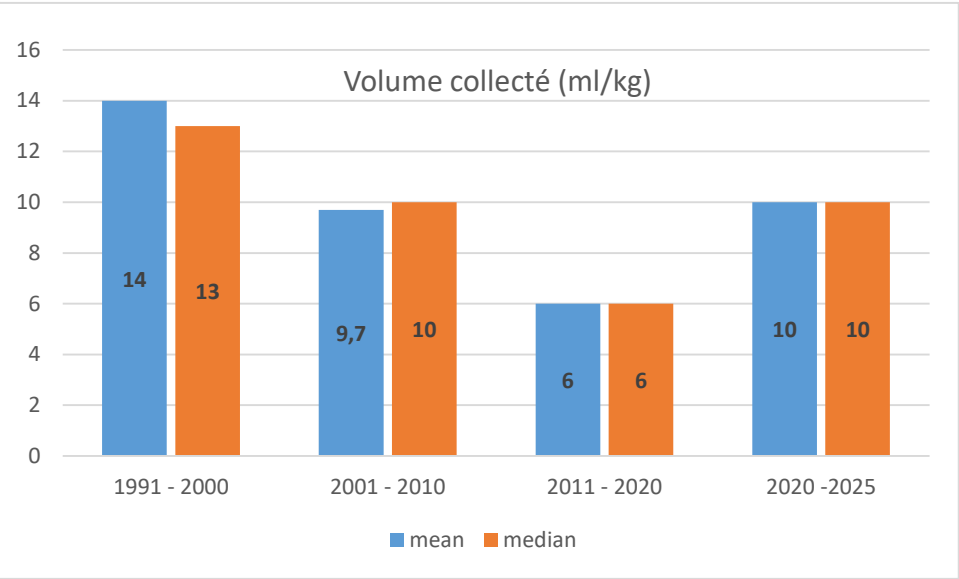
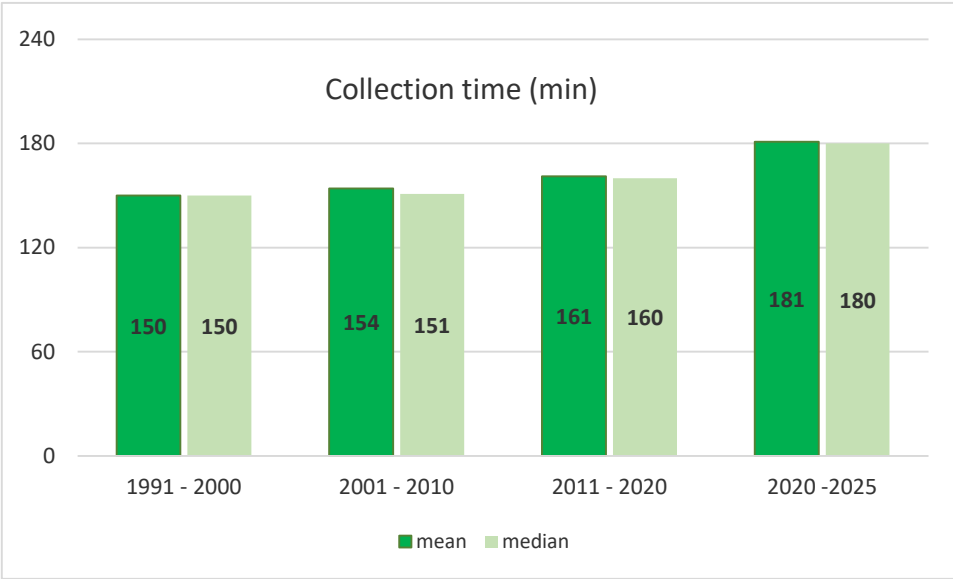
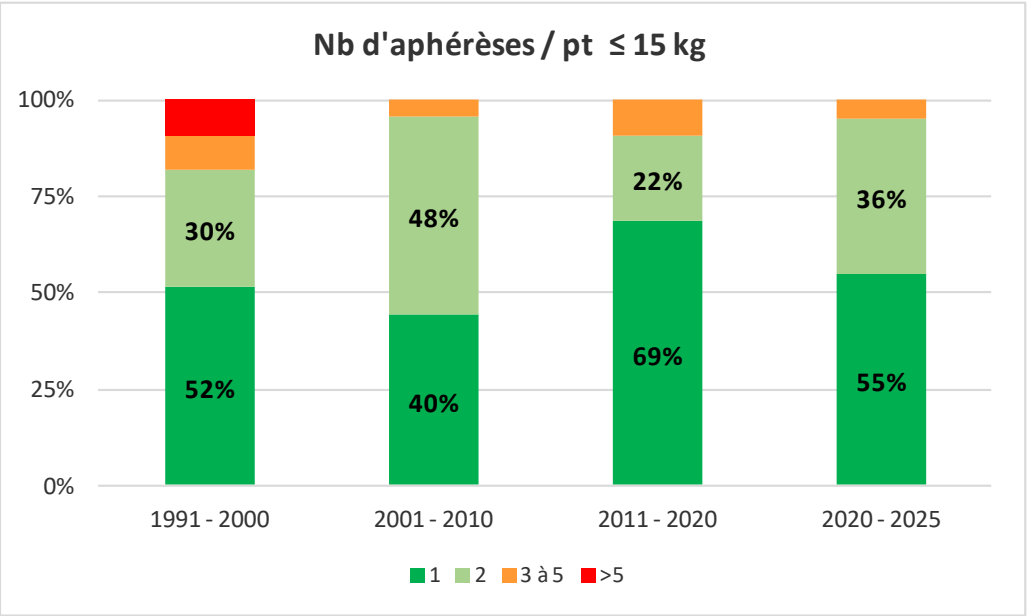
Fig. 1. Required Hb level to start MNC collection depending on percentage proportion of patient's total blood volume extracted from the extracorporeal circuit. TBV = patient's total blood volume. The body weights indicated correspond to the indicated ECV/TBV when using the COBE Spectra manual program (ECV, 287 mL). TBV was calculated as 70 mL per kg body weight. These values are indicative and must be considered in relation to the patient's condition. Kanold J. Merlin E, *Transfusion* 2007

Priming should be performed when the separator's extracorporeal volume exceeds 50% of the patient's blood volume. In other cases, the decision to prime should be made on a case-by-case basis, taking into account the child's general condition and the anticipated duration of the procedure.

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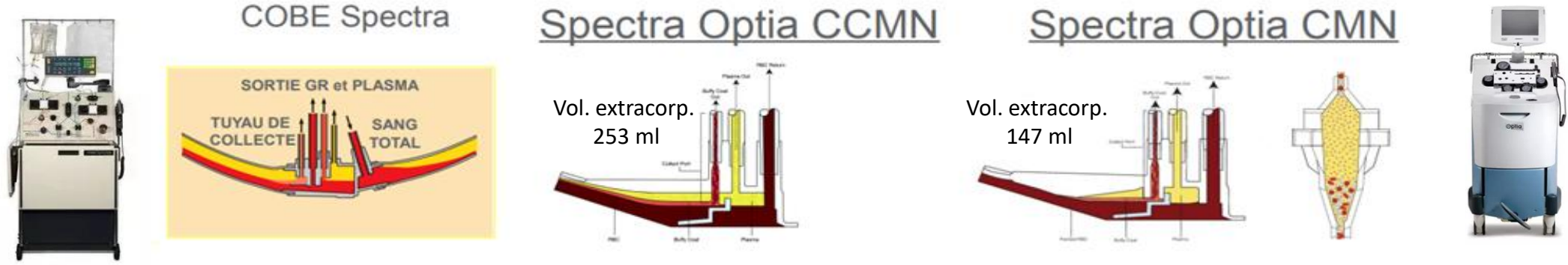
Prélèvements de CSH chez l'enfant ≤ 15 kg 1991-2025: Collecte



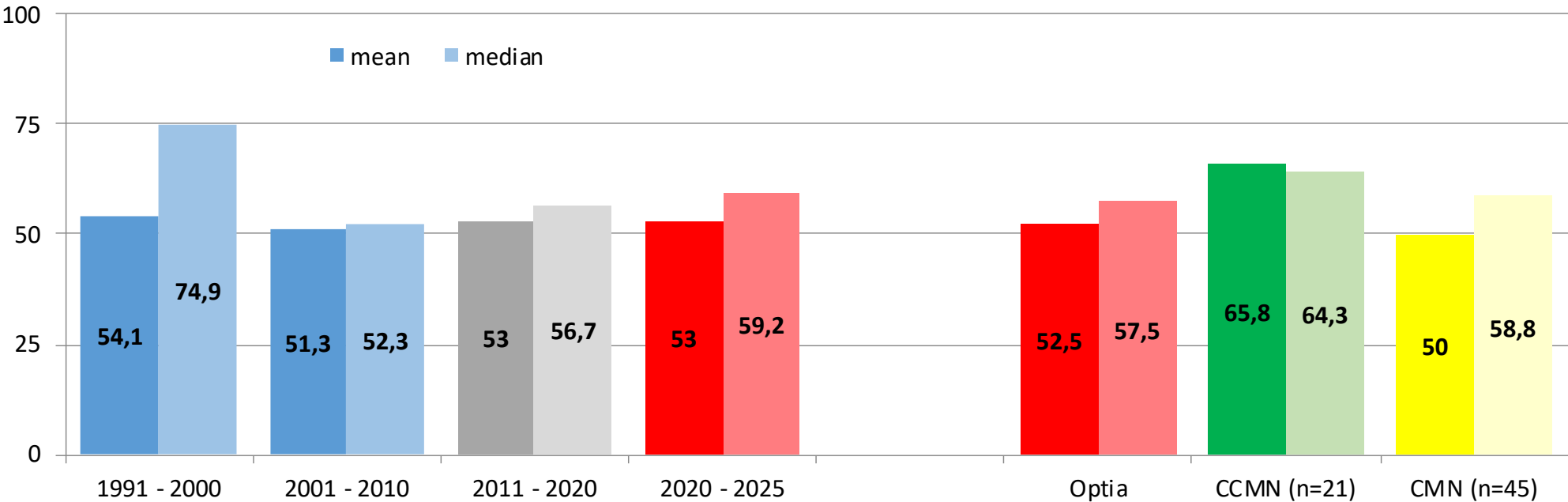
Prélèvements de CSH chez l'enfant ≤ 15 kg 1991-2025: Collecte

TABLE 1 Patients' characteristics and process data for leukapheresis in children weighing ≤ 15 kg (n = 365) and ≤ 8 kg (n=30)

		Age (yrs)	Body weight (kg)	Blood volume (ml)	Venous access	Hb (g/dl) before LP	Ht (%) before LP	Blood priming	Blood / ACD ratio	Nb of pt's blood volumes processed/LP	Volume collected (mL/kg)	Collection time (min)	CD34 ⁺ cells collected / 1 pt'BV processed
≤ 8 kg	n=30	0.8 0.4-1.3	7.5 5.8-8.0	536 400-591	vp A = 26.6% vp R = 26.6% vp A/R = 16.6%	13.2 9.1-14.8	35.5 24.6-43.2	77%	11.0 10-13.1	2.5 1.0-4.1	12.4 4.1-43.1	133 70-241	2.5 0.02-19.6
≤ 15 kg	n = 356	2.5 0.4-7.0	12 5.8-15	980 400-1588	vp A = 38.7% vp R = 34.5% vp A/R = 10.9%	12.7 7.5-16.6	34.0 22.9-49.2	39%	11.2 9.5-15.3	2.1 0.4-6.0	10.4 1.3-43.1	152 39-315	2.0 0.02-30
Optia fin 2011													
≤ 15 kg	n = 66	2.3 0.4-6.6	12 6.6-15	840 470-1200	vp A = 62.1% vp R = 36.3% vp A/R = 34.8%	13.4 9.9-16.2	37.8 28-47	18%	11.3 9.4-15.3	2.2 0.8-3.9	7.5 1.3-18.7	167 71-241	2.34 0.04-20.5



Rendements d'aphérèse (% CD34+) pour les ≤ 15 kg



Pas de corrélation établie entre le nb de CD34+ ou le nb de WBC dans le sang et le rendements d'aphérèse (CD34+) ni pour CCMN ni pour CMN

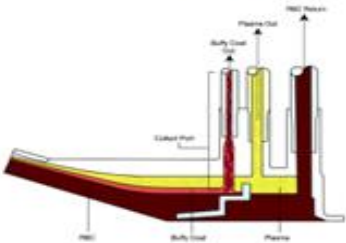
Prélèvements de CSH chez l'enfant ≤ 15 kg 1991-2025: [Collecte](#)



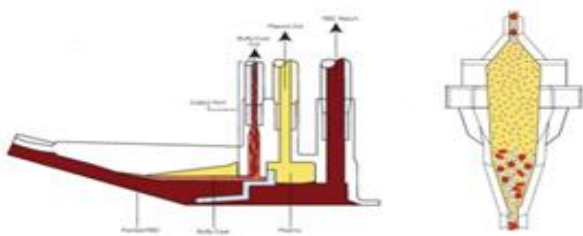
COBE Spectra



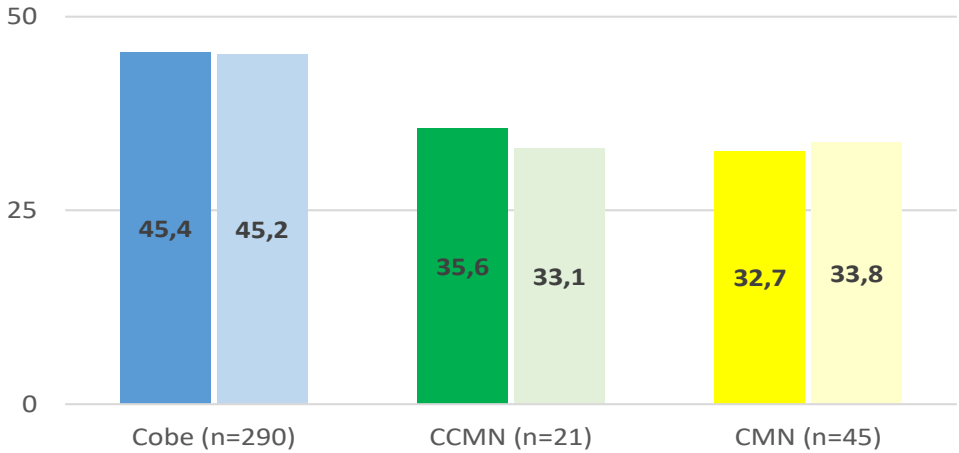
Spectra Optia CCMN



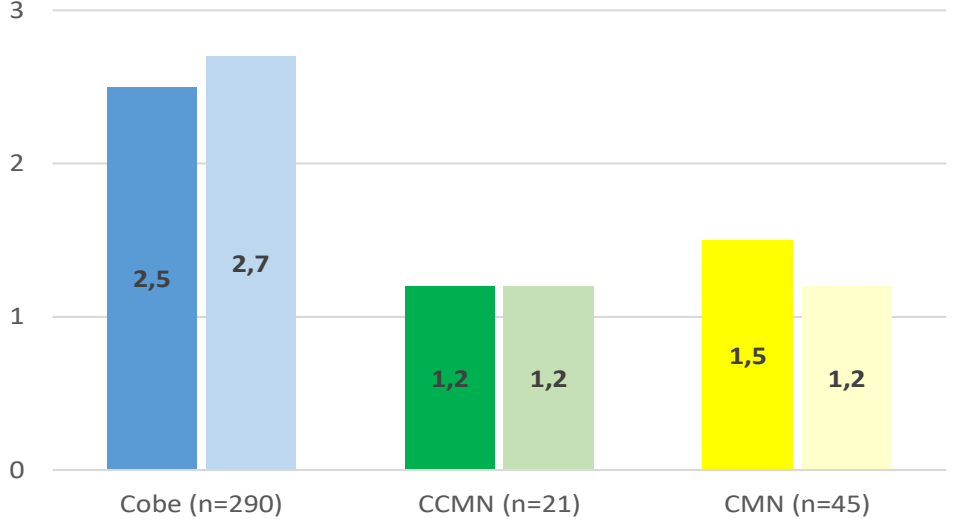
Spectra Optia CMN



Perte de plaquettes (%) / seance chez ≤ 15 kg



Perte Hb (g/dl) / seance chez ≤15 kg



Prélèvements de CSH chez l'enfant ≤ 15 kg 1991-2025 : Aphérèses pour les CAR

Patients' characteristics and process data for CAR-T collections in children weighing ≤ 15 kg

Age (yrs)	Body weight (kg)	Blood volume (ml)	Venous access	Hb (g/dl)	Ht (%)	CD3 ⁺ cells 10 ⁹ /L	Blood priming	Optia	Nb of pt's blood volumes processed/LP	Volume collected (mL/kg)	Collection time (min)	CD3 ⁺ cells collected 10 ⁹	Rendement CD3+ (%)	Perte	
				before LP		plaquettes (%)								Hb (g/dL)	
0.8	7,7	560	Femoral double	12.6	34	0.39	oui	ccmn	4.1	21.6	172	0.8	83.5	95	-2.7
0.8	7.7	560	Femoral double	13.8	39.5	0.59	oui	ccmn	2.5	12.9	117	0.3	30.3	47	-0.9
0.8	7.8	560	Femoral double	12.9	36.2	0.63	oui	cmn	4.1	24.4	209	1.7	120.4	68	-1
2.3	11	770	Femoral double	13.4	40.3	2.35	non	ccmn	2.0	9.6	159	2.3	63.5	51	4.7



Technique for PBSC harvesting in children of weight under 10 kg

Z Kořístek¹, J Štěřba², D Havranová³ and J Mayer¹

¹Department of Internal Medicine – Hematooncology, Masaryk University Hospital, Brno, Czech Republic; ²Department of Pediatric Oncology, Masaryk University Hospital, Brno, Czech Republic; and ³Tissue Bank, Masaryk University Hospital, Brno, Czech Republic **Bone Marrow Transplantation (2002) 29**, 57–61

Table 2 Mobilization and cell yields

UPN	No. of cycles	Pre-harvest, 1st day		Pre-harvest, 2nd day		Pre-harvest, 3rd day		Collected CD34 ⁺ cells ×10 ⁶	Collected CD34 ⁺ cells ×10 ⁶ /kg	Collected CFU-GM ×10 ⁴ /kg
		CD34 per μl	WBC ×10 ⁹ /l	CD34 per μl	WBC ×10 ⁹ /l	CD34 per μl	WBC ×10 ⁹ /l			
00018	9 (2+4+3) ^a	104	1.16	440	7.33	1059	32.10	159.9	26.8	ND
00096	13 (4+5+4) ^a	172	5.22	344	22.90	391	39.10	155.3	18.0	34.3
01030	3 (3) ^a	2370	56.70	—	—	—	—	289.4	32.2	53.6

3 pts : 6kg 8,6kg 9 kg
50 ml (8 ml/kg) of blood/cycle
Buffy coat
Plasma and RBC reinfused to the patient

3 to 13 cycles (60 min/cycle) performed in 1 to 3 days

18-32 CD34+ x 10⁶/kg

Prélèvements de CSH chez l'enfant ≤ 15 kg 1991-2025 : "Aphérèse" sans aphérèse

Enfant AK 12 kg

	<u>Avant</u>		<u>Après</u>	
CD34+	479 x 10⁶/L			Rendement : 100%
Hb	14.1 g/dL	→	12.2 g/dL	perte 1.9 g
Ht	40.5%	→	34.2 %	
WBC	76.9 x 10 ⁹ /L	→	69.4 x 10 ⁹ /L	
PLT	656 x 10 ⁹ /L	→	619 x 10 ⁹ /L	perte 5.6%

Prélèvement de 140 ml (12 ml/kg) de sang dans une poche de PMO (solution avec l'héparine)

Compensation volumétrique (RBC+ sérum phy)

Durée 55 min

Collecte CD34+ : **5,67 x 10⁶/kg**

Ht produit 26%

Pas de transformation

Congélation azote

Décongélation : CD34+ viables : **2,23 x 10⁶/kg**

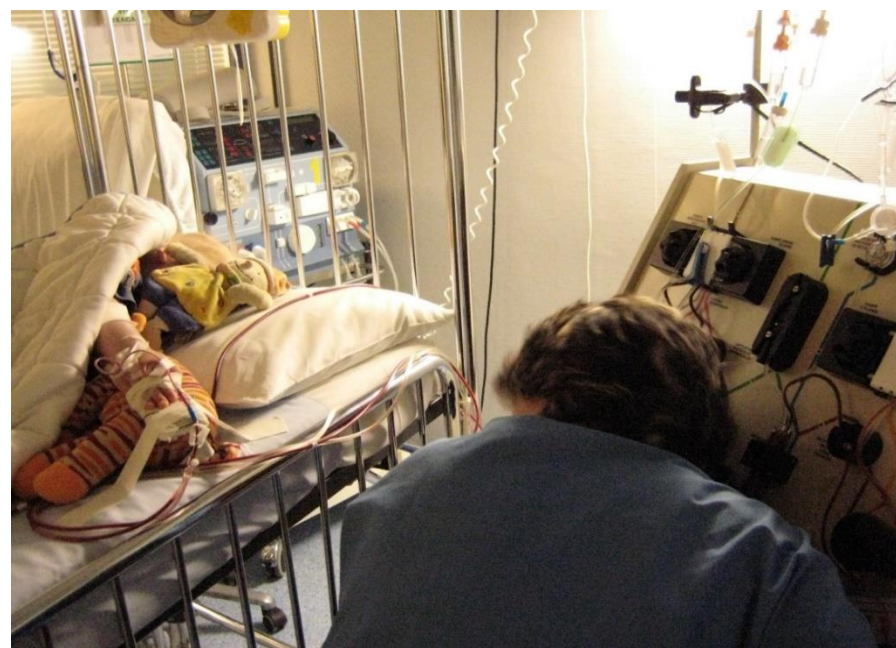
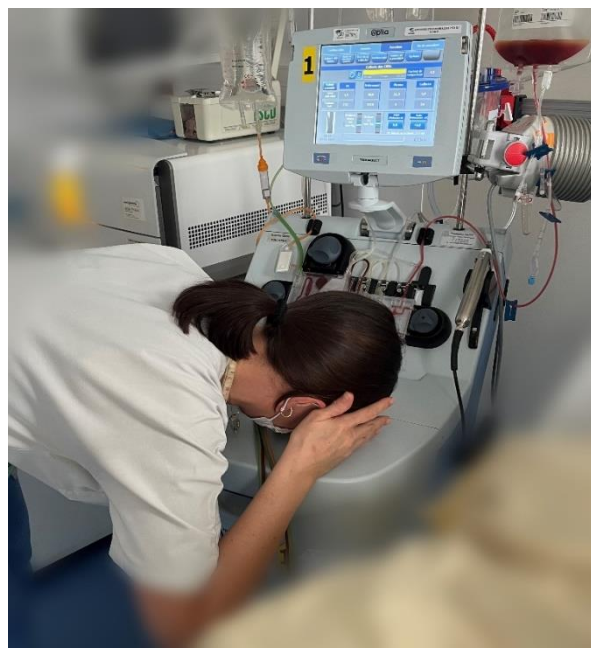
CD34+ > 400 x 10⁶/L : 3% de pts ≤ 15 kg

Le secret d'une collecte réussie ?





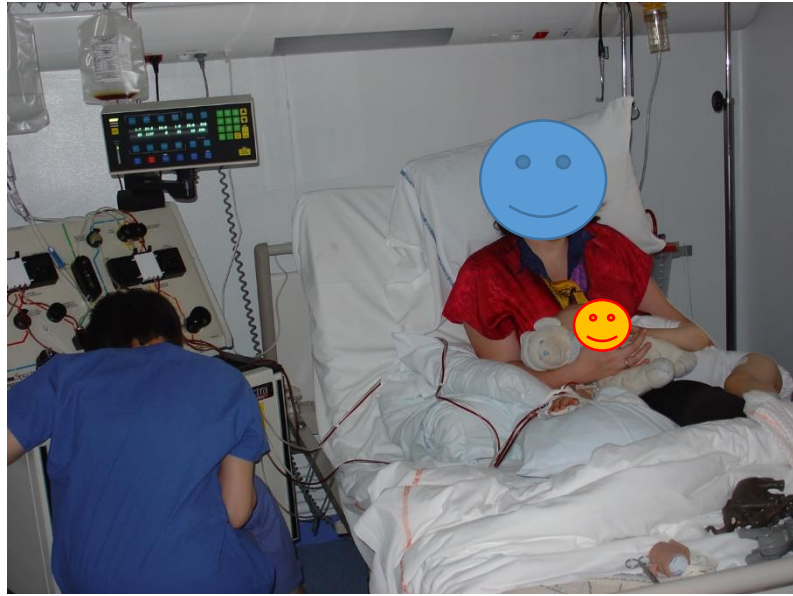
A collection team experienced in both paediatric care and apheresis is mandatory, with a “**one-for-the-child, one-for-the-separator**” approach for the smallest patients and a paediatrician available nearby.



Prélèvements de CSH chez l'enfant 1991-2025

- historique et environnement
- indications
- mobilisation
- voies d'abord
- amorçage/transfusion
- collecte
- **support**

Prélèvements de CSH chez l'enfant ≤ 15 kg 1991-2025 : Le rôle de parents



Prélèvements de CSH chez l'enfant ≤ 15 kg 1991-2025 : Le rôle de parents



Cytaphérèses pédiatriques (atelier SFGM-TC)

Christian Chabannon ^{1,15}, Malek Benakli ^{2,15}, Kamelia Alexandrova ³, Carole Coze ⁴, Jean-Hughes Dalle ⁵, Christine Giraud ⁶, Phuong Huynh ⁷, Tarik Kanouni ^{8,9}, Justyna Kanold ¹⁰, Isabelle Lesieur ¹¹, Aurélie Levavasseur ^{11,12}, Ibrahim Yakoub-Agha ¹³, Etienne Baudoux ¹⁴

Pour citer cet article : Chabannon C, et al. Cytaphérèses pédiatriques (atelier SFGM-TC). Bull Cancer (2024), <https://doi.org/10.1016/j.bulcan.2023.12.008>

Peripheral blood stem cell collection in children with extremely low body weight (≤ 8 kg). What have we learned over the past 25 years and where are the limits?

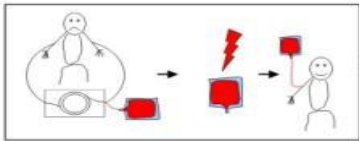
Victoria Grèze^{1,2,3} | Nadège Rouel^{1,2} | Emmanuelle Rochette^{1,2}

Etienne Merlin^{2,3,4} | Pascale Halle¹ | Dominique Plantaz⁵ |

François Deméocq⁴ | Justyna Kanold^{1,2,3,4}

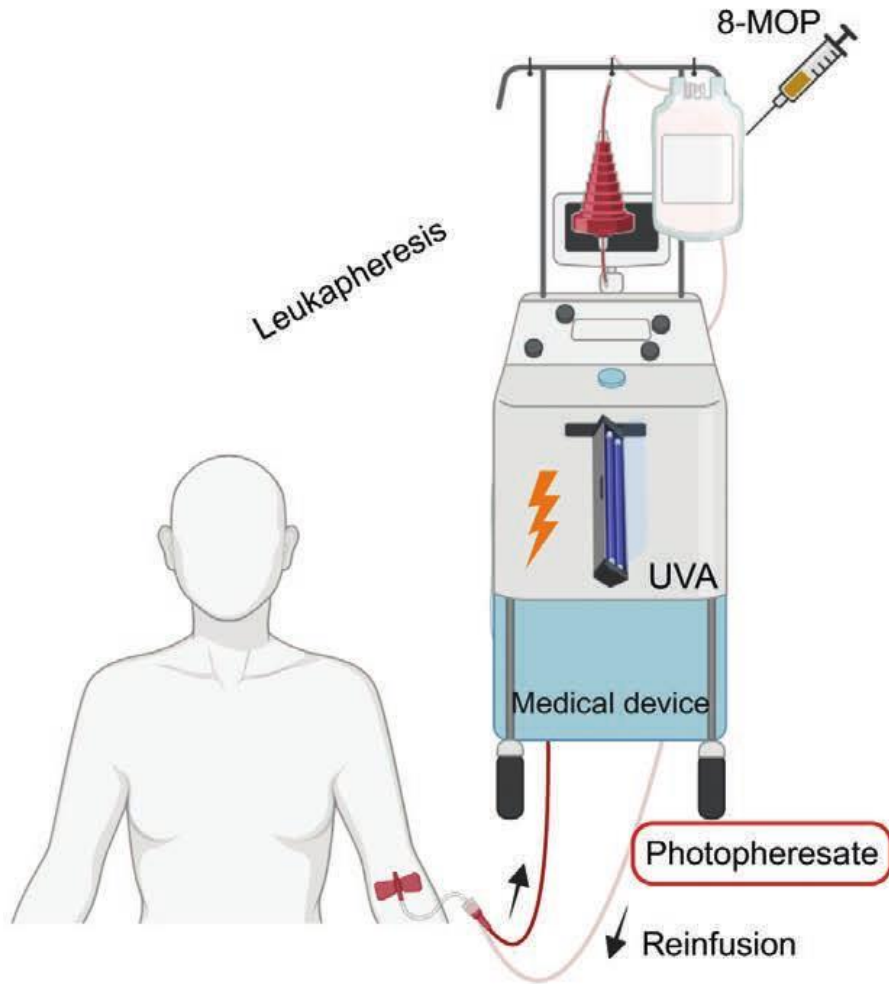


J Clin Apher. 2020;3:10.



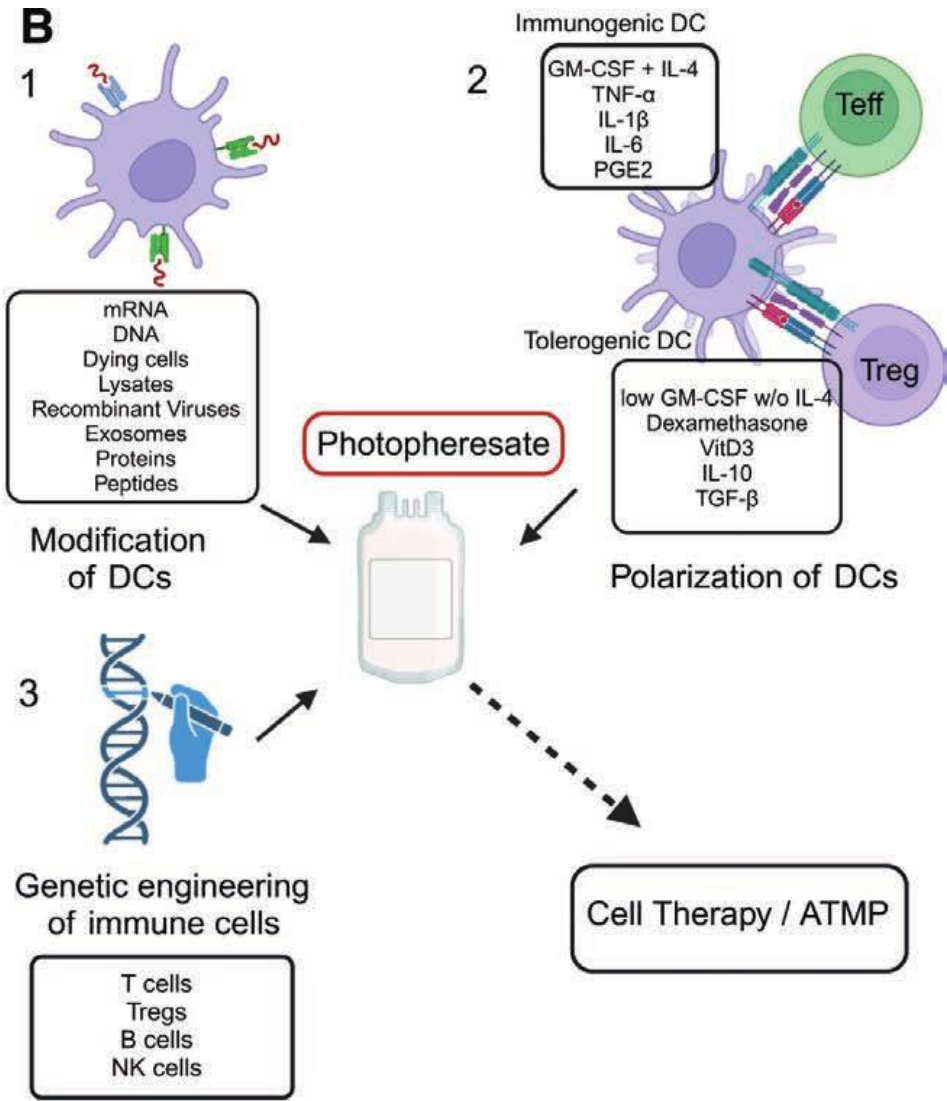
Extracorporeal Photochemotherapy

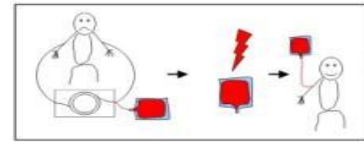
A



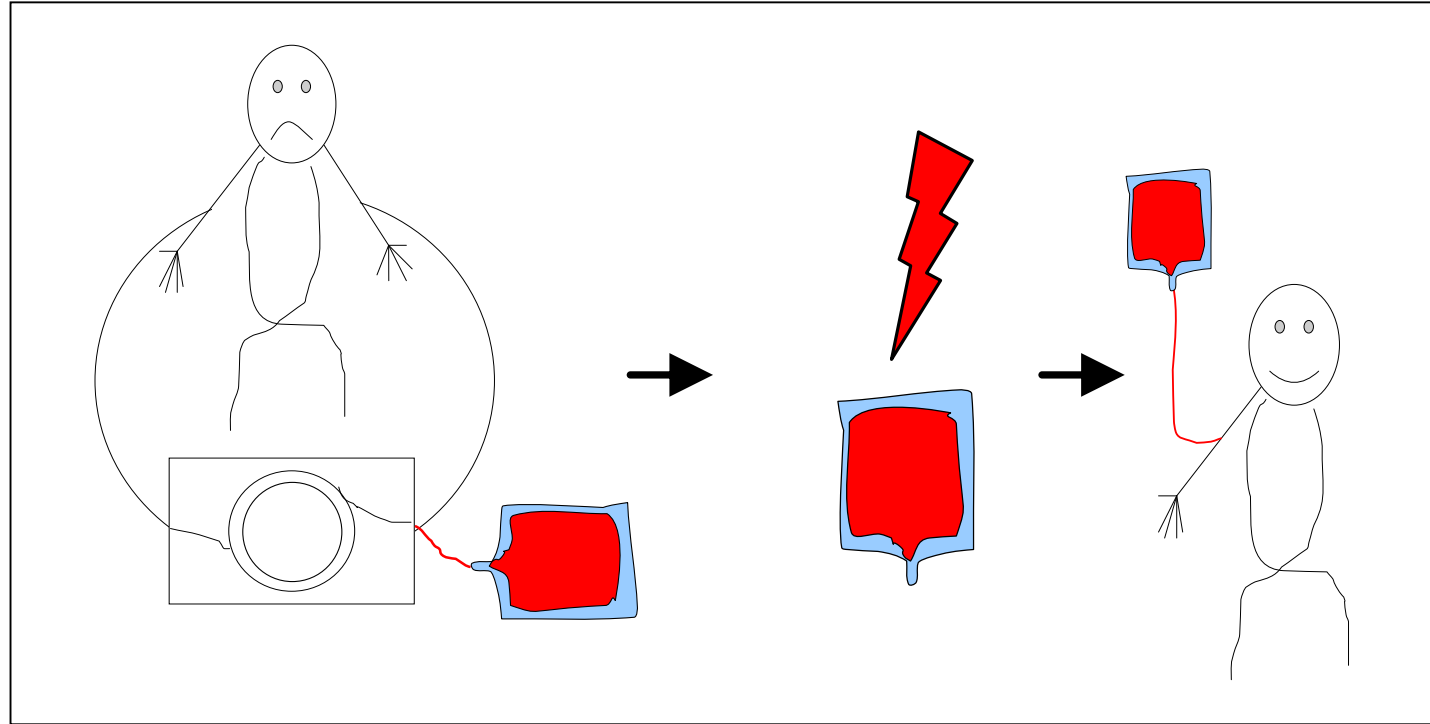
Extracorporeal photopheresis = Therapeutic intervention

B

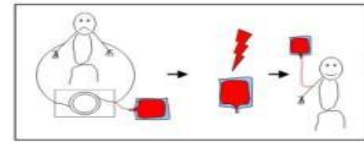




Extracorporeal Photochemotherapy



Collection des CMN ➔ **Photosensibilisation (psoralène)** ➔ **Irradiation (UVA:2 J/cm²)** ➔ Re-injection/«transfusion»



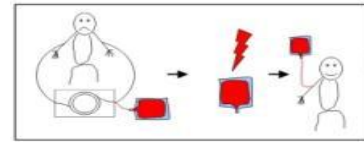
Why ECP (in paediatric practice) is difficult?

- Thin (damaged) veins
- Small body weight and small whole blood volume
- Relatively large extracorporeal volume of cell separators



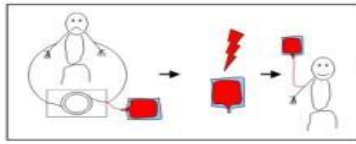
- Metabolic and hematologic problems
- Psychological tolerance

Needs of a sophisticated training in (paediatric) apheresis



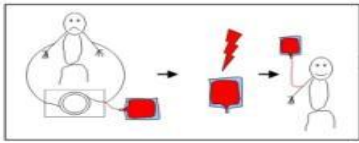
Why ECP (in paediatric practice) is difficult?





Twenty year s' experience of extracor poreal photopheresis in low body weight paediatric patients

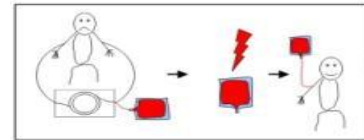
Joris Bonnet^{1,2,3,4}, Alexandre Armand^{1,2,3}, Victoria Grèze^{1,2,3,4}, Emmanuelle Rochette^{1,2}, Nadège Rouel^{1,2}, Pascale Halle⁴, Etienne Merlin^{2,3,4} and Justyna Kanold^{1,2,3,4,*}
Trends in Photochemistry & Photobiology



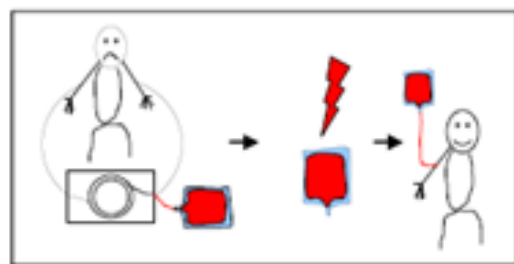
< 2016

327 ECP collections concerned 19 paediatric patients under 25 kg

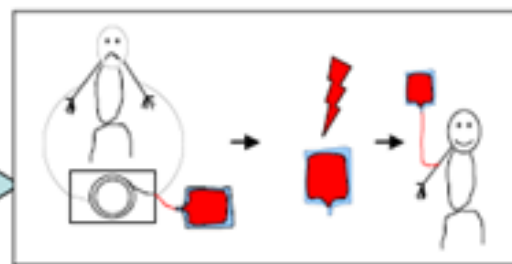
Venous access		Dose (J/kg)		Time (h)		Number of collections		Number of patients							
Out	In	Dose (J/kg)		Time (h)		Number of collections		Number of patients							
		D = 8	D = 3	D = 8	D = 3	D = 8	D = 3	D = 8	D = 3						
		KT = 50	KT = 17	KT = 50	KT = 17	KT = 50	KT = 17	KT = 50	KT = 17						
		PV = 20	PV = 58	PV = 20	PV = 58	PV = 20	PV = 58	PV = 20	PV = 58						
P < 0.001	D = 37	KT = 7	KT = 7	PV = 37	PV = 24	D = 7	KT = 68	VP = 70	D = 52	KT = 125	PV = 127	D = 59	KT = 118	PV = 125	
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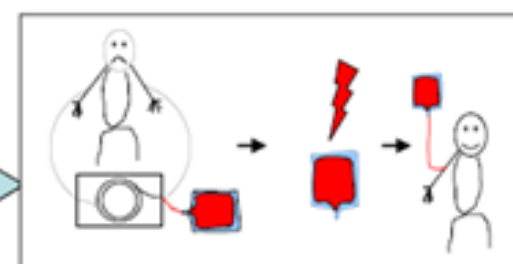
Monday 9h-13h



Wednesday 9h-13h



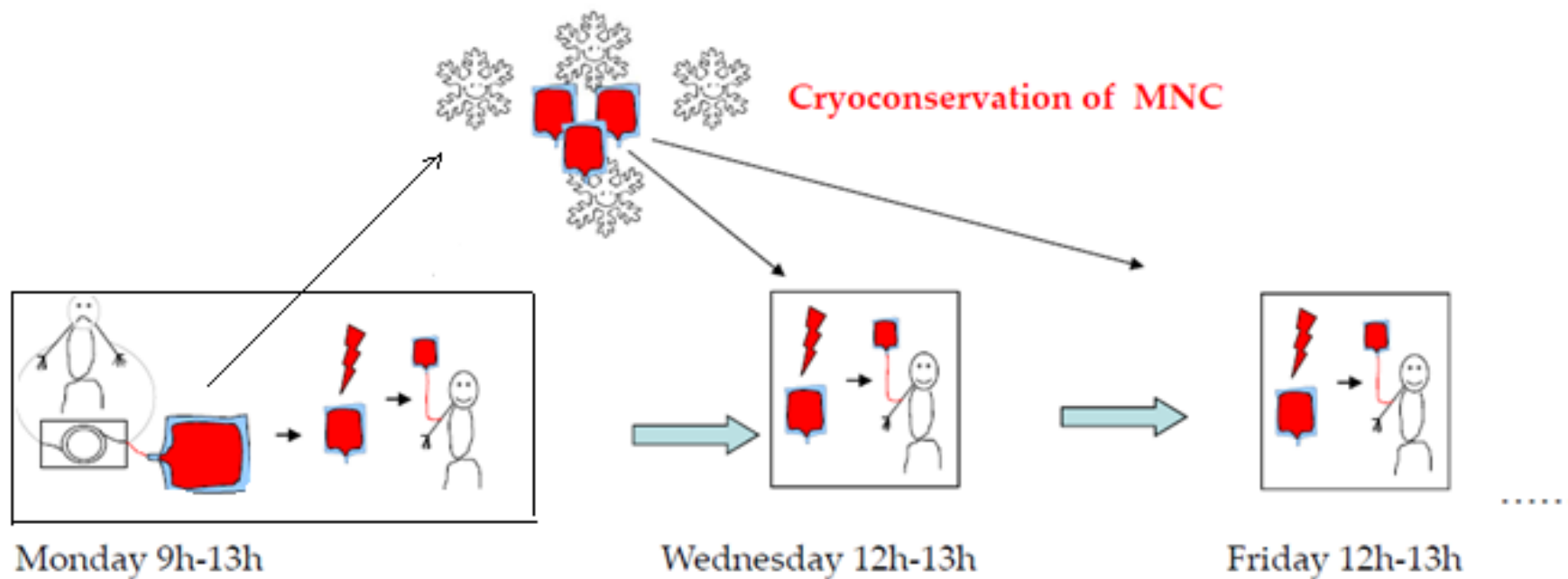
Friday 9h-13h



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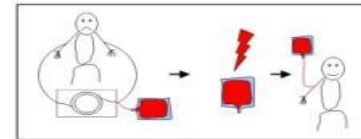


E. Merlin



CRYO ECP - results

CRYO-ECP



TRANSPLANTATION AND CELLULAR ENGINEERING

Use of cryopreserved autologous cells for extracorporeal photochemotherapy: clinical applications

Etienne Merlin, Florence Jacomet, Michel D'Incan, Pascale Halle, Marc Berger, Virginie Gandemer, Christophe Piguet, Pierre Souteyrand, François Deméocq, and Justyna Kanold

TRANSFUSION Volume 51, June 2011

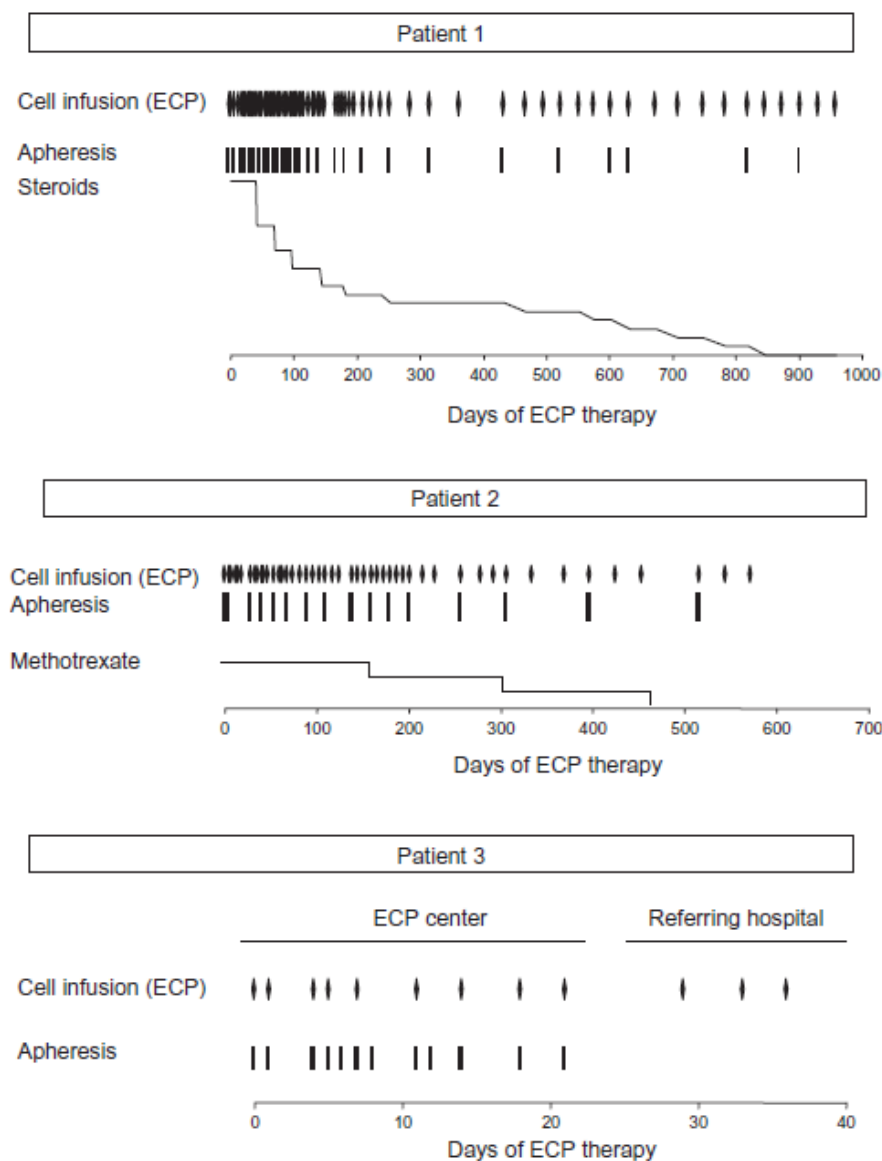
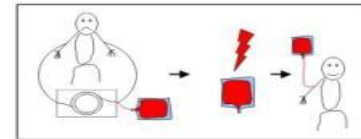


Fig. 1. Scheme illustrating cryo-ECP.



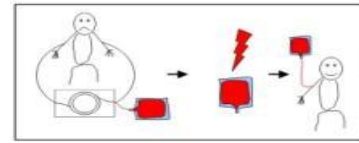
CRYO ECP - results

	Patients	CRYO ECP		
GvH	24*	266	NR 8/24	<i>Merlin 2012 Pochon 2017</i>
Pulmonary rejection	3*	28	2/3 drugs-sparing effect	
Sezary	3	18	3/3 PR	
Renal rejection	1	4	?	
Lichen planus	1	4	?	
Juvenile dermatopolymyositis	1*	81	CR	<i>Merlin 2012</i>
Juvenile localized scleroderma	1*	52	CR	<i>Merlin 2012</i>
TOTAL	19 enfants*	453		

Duré de la congélation (jours)	13	(3-119)
CD3+ congelées (10 ⁷ /kg)		
par aphérèse	2.2	(0.1-28)
par fraction	2.3	(0.1-6.0)
Nb de fractions congelées/aphérèse	1	(1- 5)
CD3+ reinjectées (10 ⁷ /kg)	2.1	(0.2-6.1)

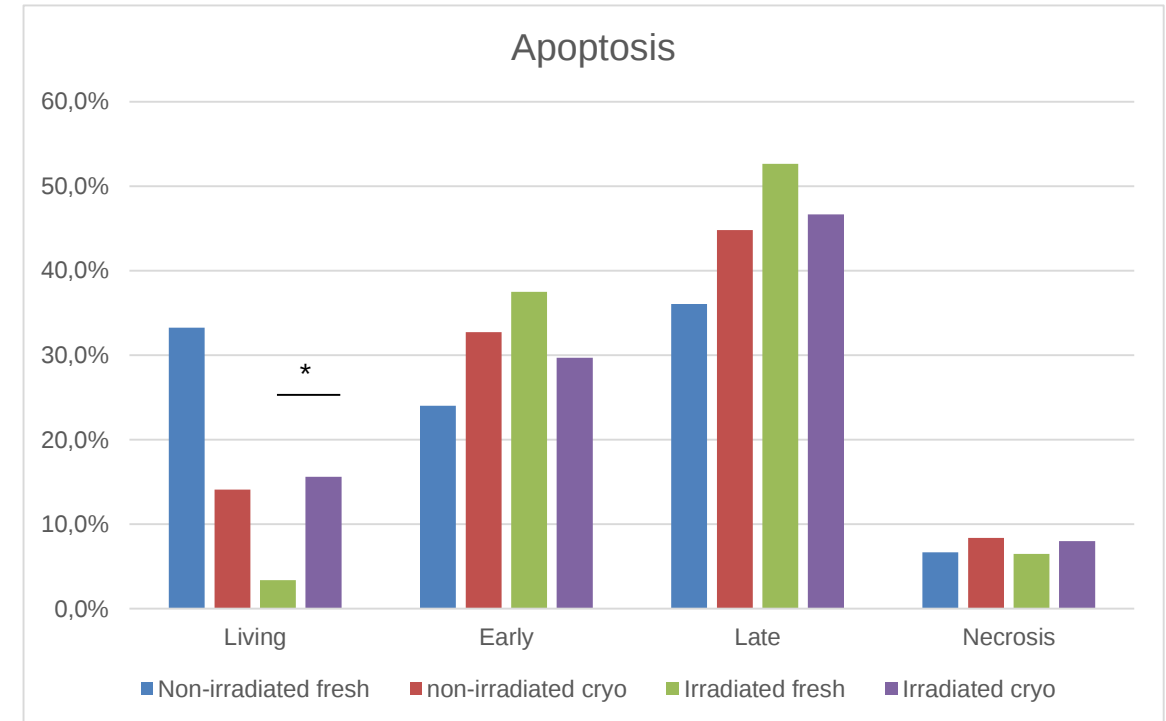
CRYO ECP - results

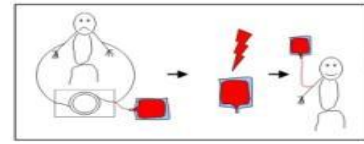
CRYO-ECP



IMPACT OF CRYOPRESERVATION ON DIFFERENT LYMPHOCYTE POPULATIONS.

	FRESH (10^7 /kg)	CRYO (10^7 /kg)	P value
NO IRRADIATION			
TH1	0.62 [0.24 - 1.27]	0.27 [0.02 - 0.47]	NS
TH2	0.62 [0.45 - 0.86]	0.73 [0.42 - 1.02]	NS
TREG	0.20 [0.08 - 0.45]	0.15 [0.08 - 0.21]	NS
NAIVE LYMPHOCYTES	0.42 [0.12 - 0.61]	1.43 [0.43 - 2.66]	0.043
ALLOREACTIVE LYMPHOCYTES	1.39 [0.33 - 2.77]	0.63 [0.29 - 1.17]	NS
B CELL	1.85 [0.94 - 3.07]	1.47 [0.82 - 2.09]	NS
MONOCYTES			
– CLASSICAL	0.07 [0 - 0.22]	0.08 [0.00 - 0.13]	NS
– INTERMEDIATED	0.36 [0.01 - 0.94]	0.45 [0.31 - 0.66]	
– UNCLASSICAL	0.33 [0.03 - 0.74]	0.14 [0.04 - 0.28]	
– DC	0.24 [0.01 - 0.05]	0.32 [0.17 - 0.66]	
IRRADIATION			
TH1	0.72 [0.33 - 1.33]	0.21 [0.01 - 0.32]	0.043
TH2	0.41 [0.27 - 1.21]	0.48 [0.18 - 0.82]	NS
TREG	0.13 [0.03 - 0.28]	0.14 [0.05 - 0.21]	NS
NAIVE LYMPHOCYTES	0.51 [0.11 - 1.23]	1.50 [0.53 - 3.01]	0.043
ALLOREACTIVE LYMPHOCYTES	1.09 [0.27 - 2.03]	0.46 [0.36 - 0.54]	NS
B CELL	2.05 [1.06 - 3.88]	1.51 [0.79 - 2.21]	NS
MONOCYTES			
– CLASSICAL	0.07 [0 - 0.266]	0.08 [0.23 - 0.10]	NS
– INTERMEDIATED	0.53 [0.047 - 0.920]	0.047 [0.28 - 0.71]	
– UNCLASSICAL	0.03 [0.003 - 0.071]	0.16 [0.03 - 0.29]	
– DC	0.37 [0.060 - 0.950]	0.29 [0.16 - 0.33]	

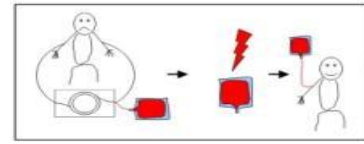




What are the advantages of CRYO ECP ?

Reduced the number of apheresis while maintaining the rate of reinjections

- Improve treatment conditions **YES**
- Expand ECP indications **YES**
- Treat patients in centers not equipped for ECP **NO**
- Standardize cell product **NO**



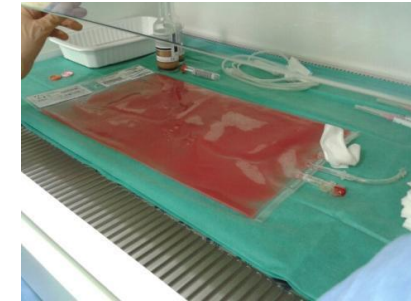
What are the limitations of CRYO ECP ?

Règlementaires et administratives :

- Autorisation ANSM / pathologie
- JACIE ?

Techniques et logistiques:

- Temps labo: (congélation/lavages/décongélation) x N
- Stockage des poches
- GHS aphérèse vs HDJ pour une réinjection simple et encore.....

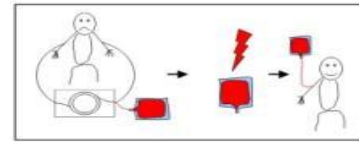


Intellectuelles

- Indications : **patient ?** pathologie ?
- Combien de cellules par fraction ?
- Combien de fractions par aphérèse ?
- Quel délais de stockage max ? Réinjections de «vieux lymphocytes» ?
- Quel test ? (PHA est compliqué sur les cellules décongelées)

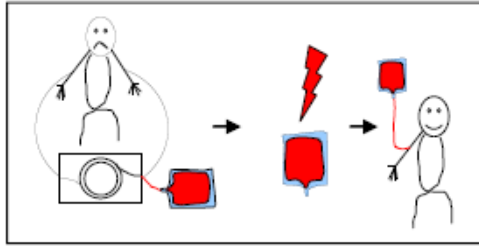
How to set up future trials ?

CRYO-ECP

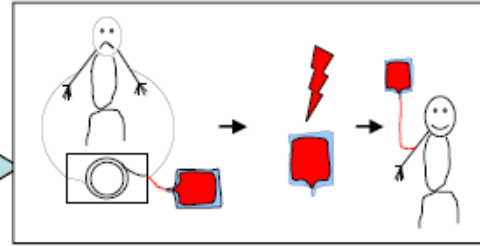


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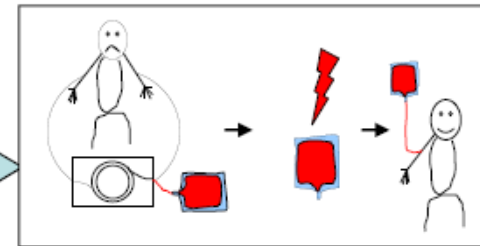
Monday 9h-13h



Wednesday 9h-13h

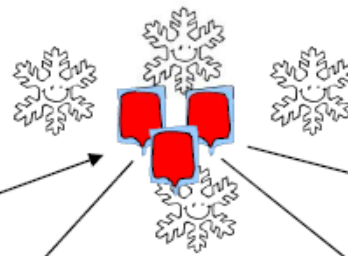


Friday 9h-13h

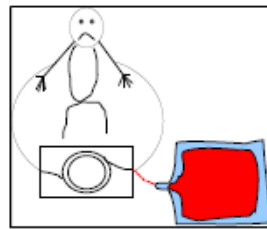


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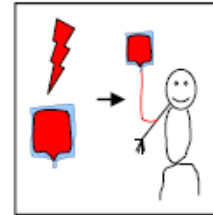
Tomorrow :



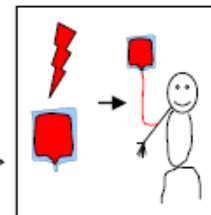
Cryoconservation of MNC



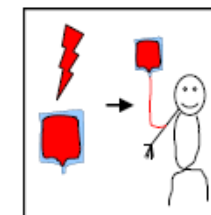
Monday 9h-12h



Tuesday 12h-12h



Wednesday 12h-13h



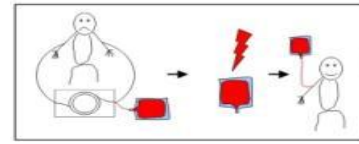
Friday 12h-13h

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Cryopreservation as an Alternative Approach for Applying Photopheresis Products to Treat Graft-Versus-Host Disease (GVHD) Among Pediatric Patients in Developing Countries

Leila Jafari¹ | Pooya Ashkevari¹ | Sarina Ansari¹ | Mona Delkhah¹ | Yalda Karamlou² | Nika Asephi¹ | Homa Kashani^{3,4} | Rashin Mohseni¹ | Hamid Farajifard¹ | Mohamad Taha Salmanifard¹ | Fahimeh Jafari¹ | Maryam Behfar¹ | Amir Ali Hamidieh¹  *Pediatric Transplantation, 2025*

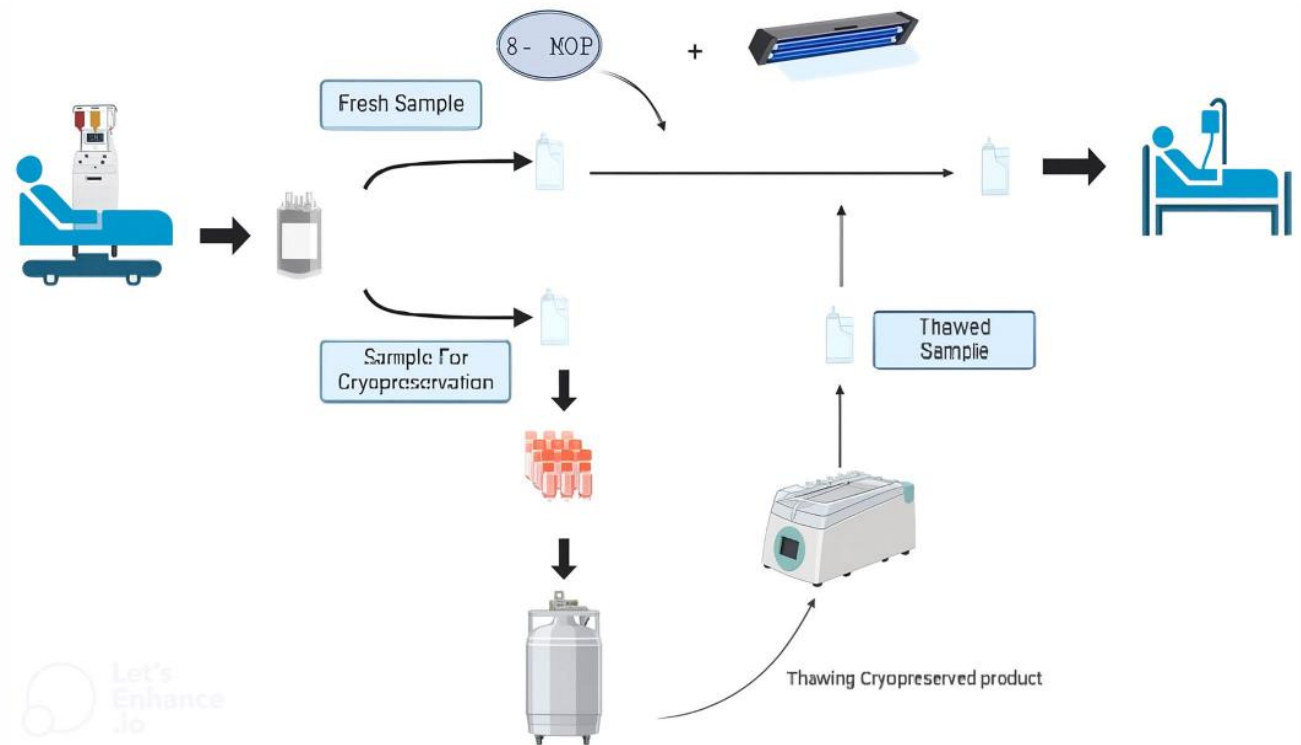
CRYO-ECP



24 children : 8 years (range: 2–16)
The CMNC OPTIA program
150 × 10⁶ WBC/kg for the cryopreservation bag.
9 months

aGvHD:
CR 12 patients (60%)
PR 8 patients (40%)

cGvHD:
CR 7 patients (46.6%).
PR 7 patients (46.6%).



aphérèse **P**édiatrique

Programmer

Préparer

Patienter

Pédiatrie (environnement)

Puéricultrices

Pyramide d'âge

Pratique

Périphériques (veines)

Prendre son temps

Passer la main

Présence

Paramètres vitaux à surveiller

Parents

Plusieurs collectes > LVL

Programme séparateur

Précautions

Les tigresses :



Merci !

