Clinical implications of different methods of Apheresis

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HELLENIC HEMAPHERESIS

ASSOCIATION MEETING on 27-28th September 2024

OUTLINE

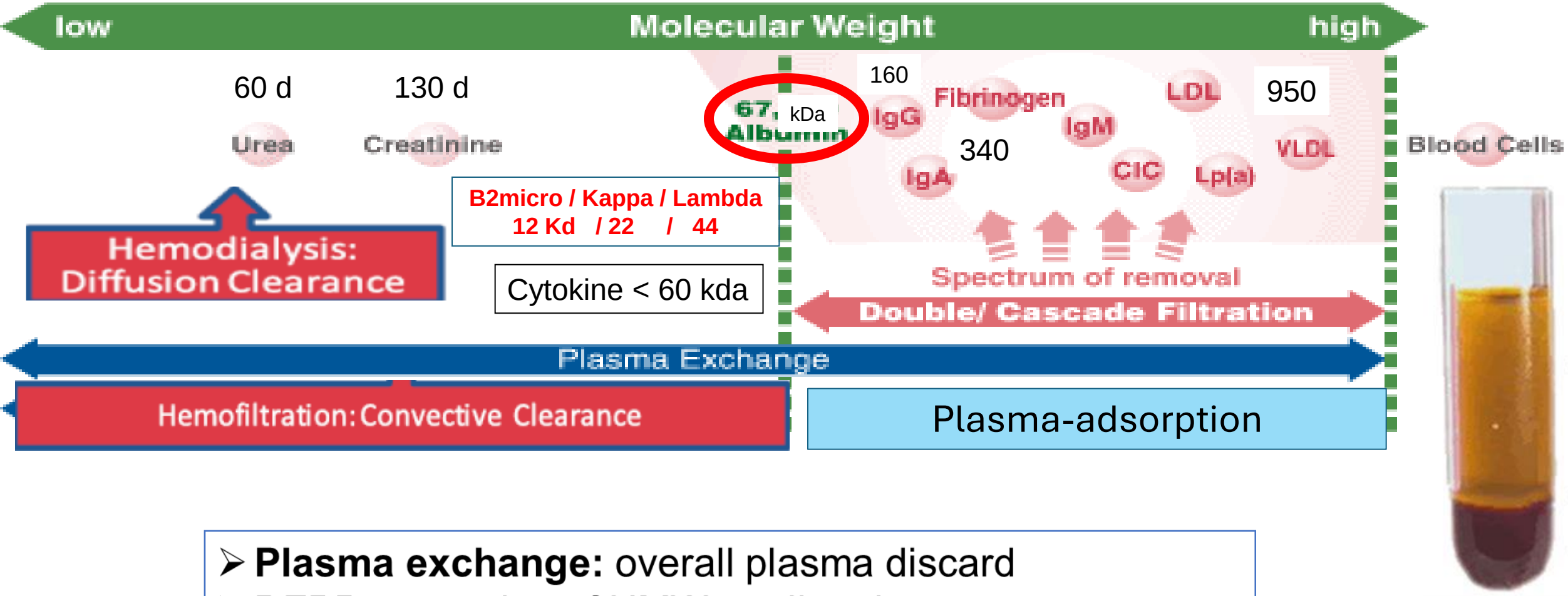
- Therapeutic Apheresis: Methods & Modalities
- Clinical implications

THERAPEUTIC APHERESIS METHODS

- **NON SELECTIVE:** *THERAPEUTIC PLASMA EXCHANGE* (TPE) (1960)
- **SEMI SELECTIVE:** *DOUBLE FILTRATION PLASMAPHERESIS* (DFPP) (1980)
- **SELECTIVE:** *PLASMA ADSORPTION* (PA) (1990)

THE MOLECULES REMOVE ARE DIFFERENT ACCORDING TO METHODS

METHOD OF BLOOD PURIFICATION BASED ON MOLECULAR SIZE



- **Plasma exchange:** overall plasma discard
- **DFPP:** epuration of HMW > albumin
- **Plasmadsorption:** specificity of protein epuration

Conventional Apheresis Therapies: A Review

David M. Ward[1,2,3*]

Journal of Clinical Apheresis 26:230–238 (2011)

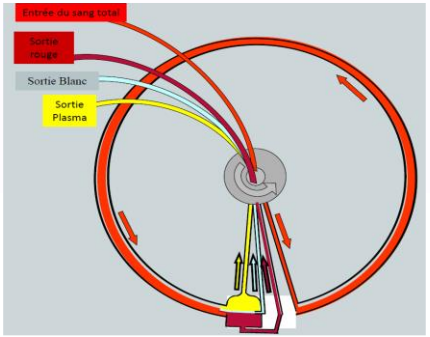
THERAPEUTIC PLASMA EXCHANGE

Centrifugal TPE

- Citrate (usually)
- Lower blood flow rate
- Peripheral veins or central line
- Process ~1.5 x blood volume
- Plasma extraction ~80%

Membrane TPE

- Heparin (usually)
- Higher blood flow rate
- Central venous line
- Process ~3 x blood volume
- Plasma extraction ~30%



Blood Flow: 60 to 120 ml/mn

Clinical implications for THERAPEUTIC APHERESIS

➢ **Modalities depend on:**

- Molecules you want to Remove *(Disease)*
- The need of specific fluid to infuse (FFP, HSA) *(Treatment)*

➢**Modalities depend on technical choice :**

- Human Albumin availability
- Type of vascular access
- Organizational aspects (Time session, care..) and cost

Guidelines on the Use of Therapeutic Apheresis in Clinical Practice – Evidence-Based Approach from the Writing Committee of the American Society for Apheresis: The Eighth Special Issue 2023

Journal of Clinical Apheresis ASFA WILEY

Anand Padmanabhan[1] | Laura Connelly-Smith[2] | Nicole Aqui[3] | Rasheed A. Balogun[4] | Reinhard Klingel[5] | Erin Meyer[6] | Huy P. Pham[7] | Jennifer Schneiderman[8] | Volker Witt[9] | Yanyun Wu[10] | Nicole D. Zantek[11] | Nancy M. Dunbar[12] |

DOI: 10.1111/1744-9987.13749

GUIDELINES

Therapeutic Apheresis and Dialysis WILEY

The Japanese Society for Apheresis clinical practice guideline for therapeutic apheresis 2021

Takaya Abe[1] | Hidenori Matsuo[1,2] | Ryuzo Abe[1] | Shinji Abe[1] |

CATEGORY: I first line, **II** second line therapy / **GRADE 1-2: R**ecommandation based on evidence

DFPP = no FDA authorization

In Japan authorization for TPE, DFPP, PA procedures

Disease/condition	Indication	Procedure	Category	Grade
Transplantation, kidney, ABO incompatible	Desensitization, living donor	TPE/IA	I	1B
	Antibody mediated rejection	TPE/IA	II	1B

Disease	Therapeutic tool	Grade	Category
ABO-incompatible kidney transplantation	PE, DFPP, IAPP	1C	I

➢ Europe No Guidelines, EEC authorization, variation for reimbursement

INDICATION OF FFP INFUSION

COMPARISON OF PLASMA EXCHANGE WITH PLASMA INFUSION IN THE TREATMENT OF THROMBOTIC THROMBOCYTOPENIC PURPURA

GAIL A. ROCK, PH.D., M.D., KENNETH H. SHUMAK, M.D., NOEL A. BUSKARD, M.D., VICTOR S. BLANCHETTE, M.D., JOHN G. KELTON, M.D., RAMA C. NAIR, PH.D., ROBERT A. SPASOFF, M.D., AND THE CANADIAN APHERESIS STUDY GROUP*

- 16 centers in canada (1982), N=50 pts
- **TPE + Fresh Frozen Plasma > FFP/ mortality**

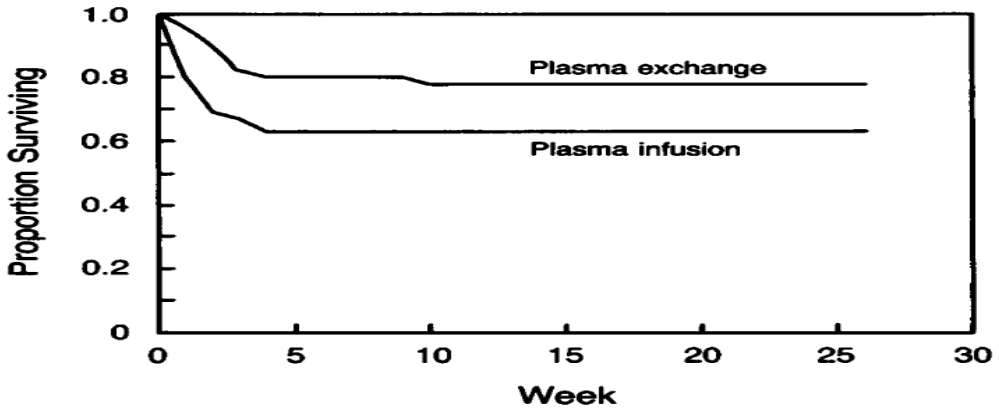
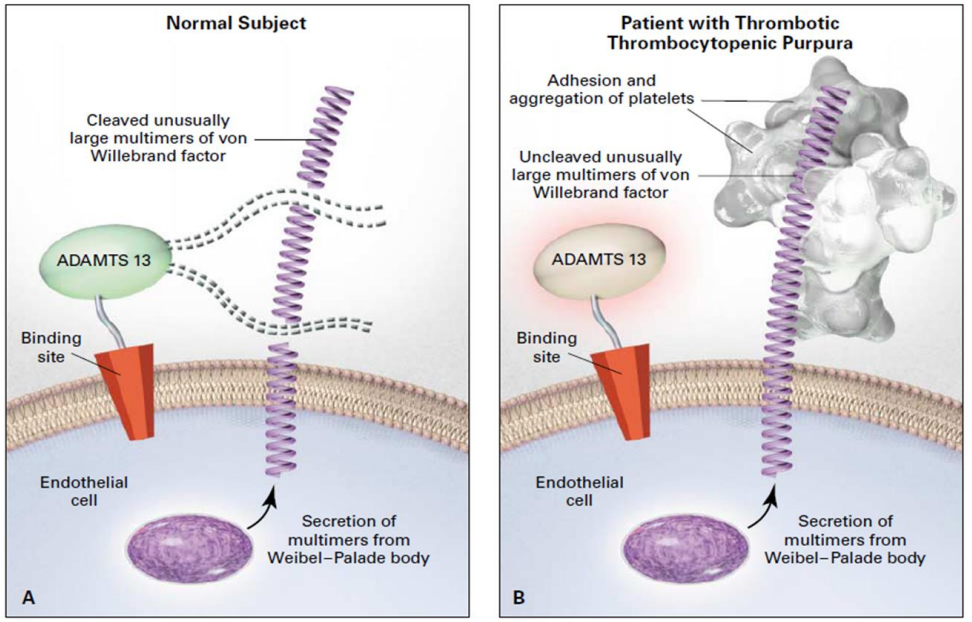


Figure 1. Survival of Patients with Thrombotic Thrombocytopenic Purpura.
The survival curves differ significantly (P = 0.036 by the Breslow–Gehan test).

TTPai



- **Daily TPE** to
  1 **Infused FFP** (Adams13)
  2 **Remove ab-ADAMS13/** multimers vwF

- **New Drugs**
  - Rituximab (Am J hematol 2016)
  - Caplacizumab (Hercule, NEJM 2019)
  - Adams13 Recombinant

Received: 5 October 2019 | Revised: 14 January 2020 | Accepted: 23 January 2020
DOI: 10.1111/1744-9987.13477

ORIGINAL ARTICLE

Therapeutic Apheresis and Dialysis
WILEY

Use of double filtration plasmapheresis for the treatment of acquired thrombocytopenic thrombotic purpura

Femie Chauvel[1] | Pascal Reboul[1] | Sylvain Cariou[1] | Cédric Aglae[1] | Sophie Renaud[1] | Rémi Trusson[2] | Florian Garo[1] | Pedram Ahmadpoor[1] | Camelia Prelipcean[1] | Emilie Pambrun[1] | Olivier Moranne[1]

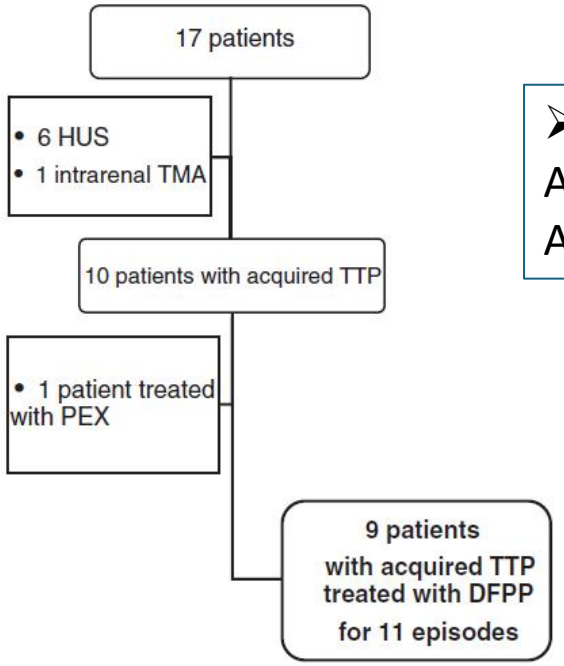


FIGURE 1 Study flow chart

➢ **Future**
Adamts13 recombinant
Apadamtase® infusion ?

ACUTE LIVER FAILURE

Research Article

High-volume plasma exchange in patients with acute liver failure: An open randomised controlled trial

Fin Stolze Larsen[1,*], Lars Ebbe Schmidt[1], Christine Bernsmeier[2], Allan Rasmussen[3], Helena Isoniemi[4], Vishal C. Patel[2], Evangelos Triantafyllou[2], William Bernal[2], Georg Auzinger[2], Debbie Shawcross[2], Martin Eefsen[1], Peter Nissen Bjerring[1], Jens Otto Clemmesen[1], Krister Hockerstedt[4], Hans-Jørgen Frederiksen[5], Bent Adel Hansen[1], Charalambos G. Antoniades[2,6,†], Julia Wendon[2,†]

[1]*Department of Hepatology, Rigshospitalet, Copenhagen, Denmark;* [2]*Institute of Liver Studies, King's College Hospital, London, United Kingdom;* [3]*Department of Surgery and Liver Transplantation C, Rigshospitalet, Copenhagen, Denmark;* [4]*Transplantation and Liver Surgery Clinic, Helsinki University Hospital, Finland;* [5]*Department of Anaestesia AN-2041, Rigshospitalet, Copenhagen, Denmark;* [6]*Section of Hepatology, St. Mary's Hospital, Imperial College London, London, UK*

ASFA Guidelines

Standard-Volume Plasma Exchange Improves Outcomes in Patients With Acute Liver Failure: A Randomized Controlled Trial

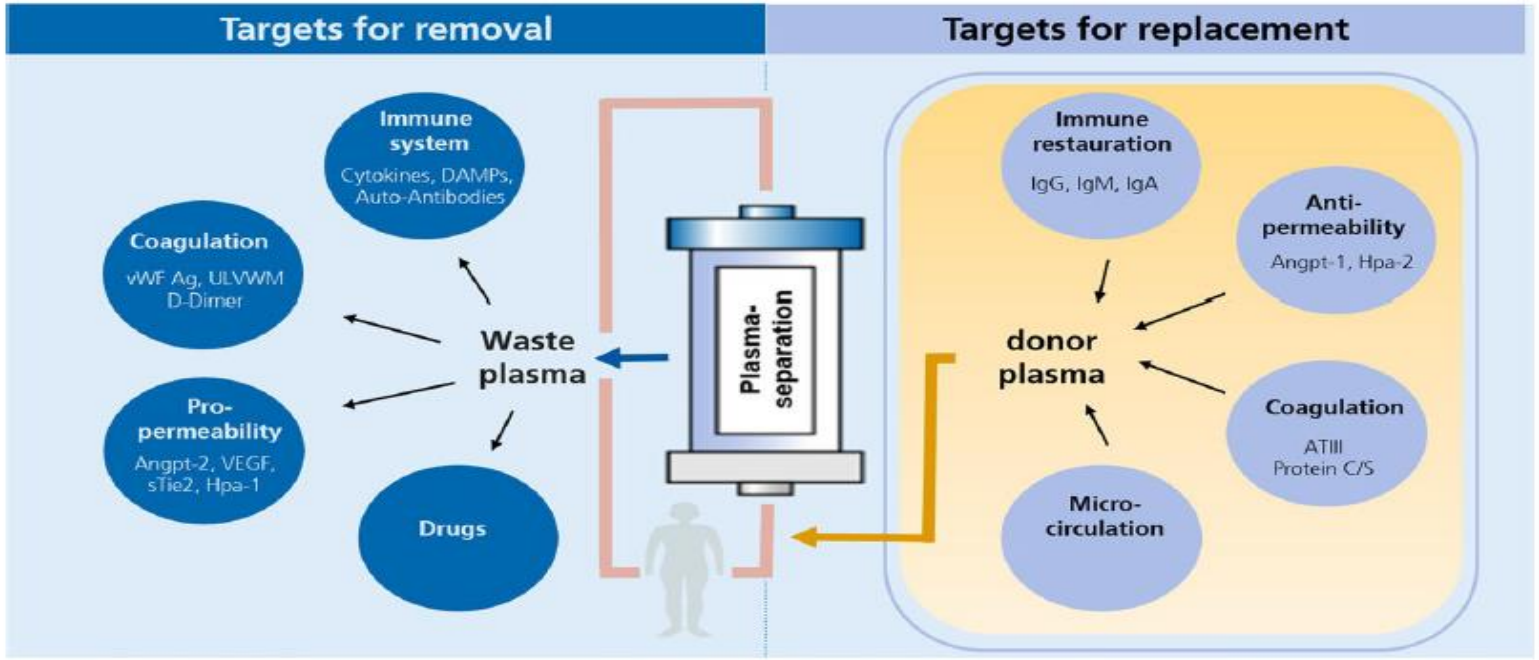
Clinical Gastroenterology and Hepatology 2022;20:e831–e854

Rakhi Maiwall,* Meenu Bajpai,‡ Akanksha Singh,* Tanvi Agarwal,§ Guresh Kumar,‖ Ankit Bharadwaj,‖ Nidhi Nautiyal,§ Harsh Tevethia,* Rakesh Kumar Jagdish,* Rajan Vijayaraghavan,* Ashok Choudhury,* Rajendra Prasad Mathur,¶ Ashini Hidam,§ Nirupama Trehan Pati,§ Manoj Kumar Sharma,* Anupam Kumar,§ and Shiv Kumar Sarin*

Japanes Guidelines

Replacement fluid in Guidelines = FFP

THERAPEUTIC APHERESIS IN SEVERE SEPSIS ?



David *et al. Intensive Care Medicine Experimental* (2023) 11:26

INDICATION OR SHORTAGE OF ALBUMIN

Letter

With single plasma exchange, a better understanding of the potential clinical effects of albumin replacement is required

Olivier MORANNE (1,2), Jean-Paul CRISTOL (3,4)

Blood Purification

Effects of hypoproteinemia on fluid volumes and arterial pressure

1983

R. DAVIS MANNING, JR., AND ARTHUR C. GUYTON
Department of Physiology and Biophysics, University of Mississippi School of Medicine, Jackson, Mississippi 39216

RESEARCH ARTICLE

Journal of Clinical Apheresis ... ASFA WILEY

Feasibility, safety, and tolerability of two modalities of plasma exchange with albumin replacement to treat elderly patients with Alzheimer's disease in the AMBAR study

Mercè Boada[1,2] | Dobri Kiprov[3] | Fernando Anaya[4] | Oscar L. López[5] | Laura Núñez[6] | Javier Olazarán[7,8] | José Lima[9] | Carlota Grifols[6] | Miquel Barceló[6] | Regina Rohe[3] | Cristina Prieto-Fernández[10] |

- **Indication Human Serum Albumin**
- Therapeutic activity ?
- Shortage ?

- **Remove Human Albumin TPE > DFPP > IA**

AUTO IMMUN DISEASE

Long-Term Outcome of Anti–Glomerular Basement Membrane Antibody Disease Treated with Plasma Exchange and Immunosuppression

Jeremy B. Levy, MA, PhD, MRCP; A. Neil Turner, PhD, FRCP; Andrew J. Rees, MSc, FRCP, FMedSci; and Charles D. Pusey, MSc, FRCP, FRCPath

Ann Intern Med. 2001;134:1033-1042

ASFA Guidelines

Disease/condition	Indication	Procedure	Category	Grade
Anti-glomerular basement membrane disease	Diffuse alveolar hemorrhage	TPE	I	1C
	Dialysis-independence	TPE	I	1B
	Dialysis-dependence, no diffuse alveolar hemorrhage	TPE	III	2B

Japanes Guidelines

Disease	Therapeutic tool	Grade	Category
Anti-GBM RPGN (dialysis-independent, dialysis-dependent, complicated with alveolar hemorrhage) (DFPP)	DFPP	2C/2C/2C	I/I/III
Anti-GBM RPGN (dialysis-independent, dialysis-dependent, complicated with alveolar hemorrhage) (IAPP)	IAPP	2C/2C/2C	I/I/III
Anti-GBM RPGN (dialysis-independent, dialysis-dependent, complicated with alveolar hemorrhage) (PE)	PE	1B/2B/1C	I/III/I

LETTER TO THE EDITOR

Journal of Clinical Apheresis ASFA WILEY

Manipulating the complement system via Therapeutic plasmapheresis: Is there any therapeutic role?

Pedram Ahmadpoor[1]
Olivier Moranne[1,2]

[1]*Service Nephrologie Dialyse Apherese, Hopital Universitaire de Nimes, Nimes, France*
[2]*IDESP UMR INSERM, Montpellier, France*

LIPIDAPHERESIS
DYSLIPIDEMIA

DIFFERENT LIPIDAPHERESIS METHOD

	DFPP (%)	Thermo-filtration (%)	HELP (%)	DALI (%)	DSA (%)	Immunoadsorption (%)
LDL cholesterol	56–62	61	55–61	53–76	49–75	62–69
HDL cholesterol	25–42	6	5–17	5–29	4–17	9–27
Lipoprotein(a)	53–59	61	55–68	28–74	19–70	51–71
Triglycerides	37–49	56	20–53	29–40	26–60	4–49
Fibrinogen	52–59	42	51–58	13–16	17–40	15–21

- **Modality of choice according to**
  - objectiv of protein to remove (LDL, LpA and/or Fibrinogen)
  - **« Be careful « with adsorption and risk of allergy with ACEi**

GUIDELINES ASFA / JAPAN DYSLIPIDEMIA

ASFA 2023

Disease/condition	Indication	Procedure	Category	Grade
Familial hypercholesterolemia	Homozygotes	LA	I	1A
	Heterozygotes	LA	II	1A
	All patients	TPE	II	1B
Lipoprotein(a) hyperlipoproteinemia	Progressive atherosclerotic cardiovascular disease	LA	II	1B

JAPAN 2021

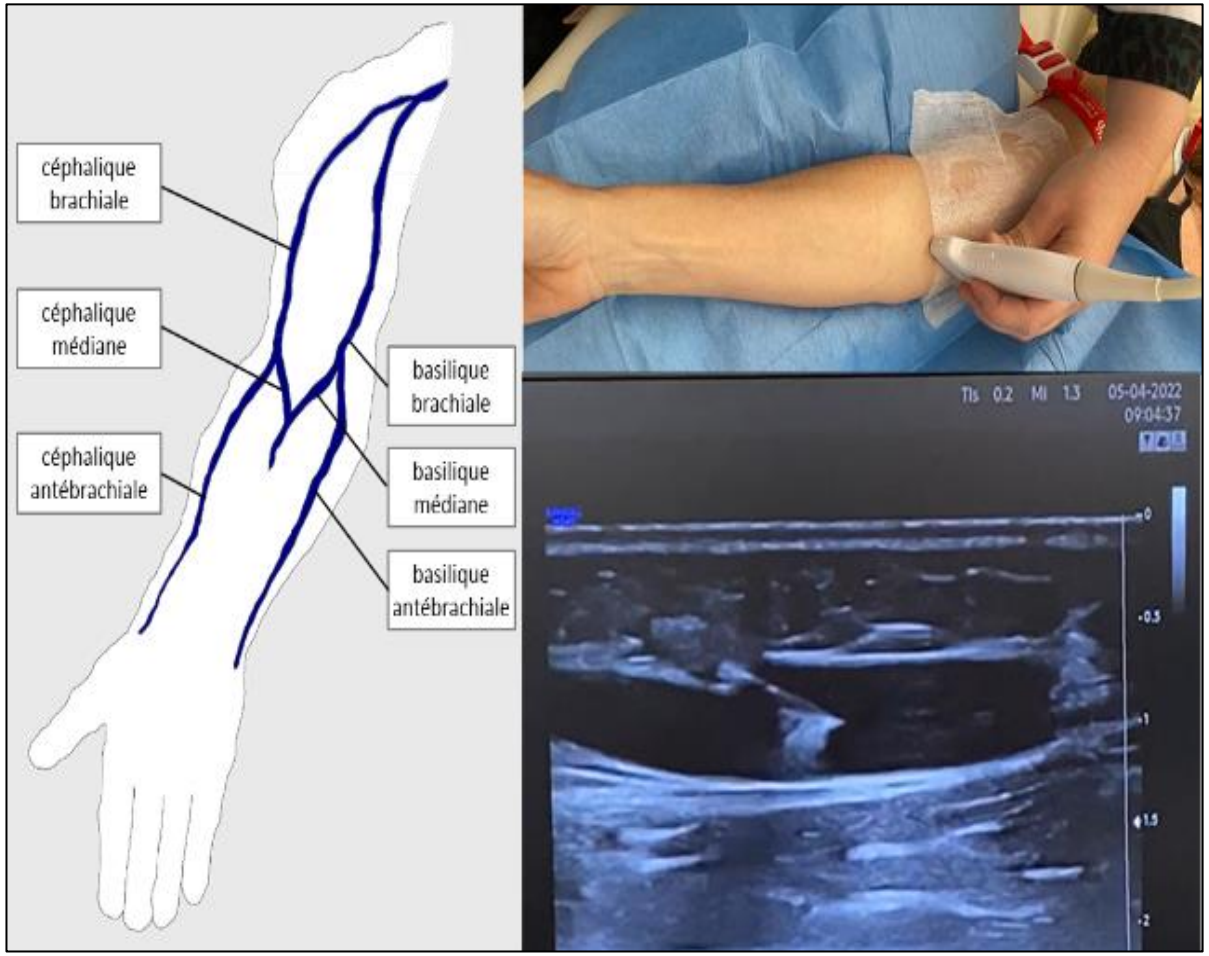
Disease	Therapeutic tool	Grade	Category
Heterozygous familial hypercholesterolemia	LDL-A, DFPP, PE	1C	II
Homozygous familial hypercholesterolemia	LDL-A	1B	I
Hyper Lp(a)-emia	LDL-A, DFPP, PE	1C	II

VASCULAR ACCESS AND TIME SESSION

Feasibility, Efficacy, and Safety of Peripheral Venous Access for Chronic Double-Filtration Plasmapheresis with Regional Citrate Anticoagulation

Blood Purif
DOI: 10.1159/000531688

Antoine Cardinale[a] Emilie Pambrun[a] Camelia Prelipcean[a] Ziyad Messikh[a]
Olivier Moranne[a, b]



CONCLUSION

- Different methods available with specific clinical indication
- Advantages and limitation of these methods based on technical and organizational aspects
- Need more evidence based medicine and according to methods