

Techniques de transfusion in utero

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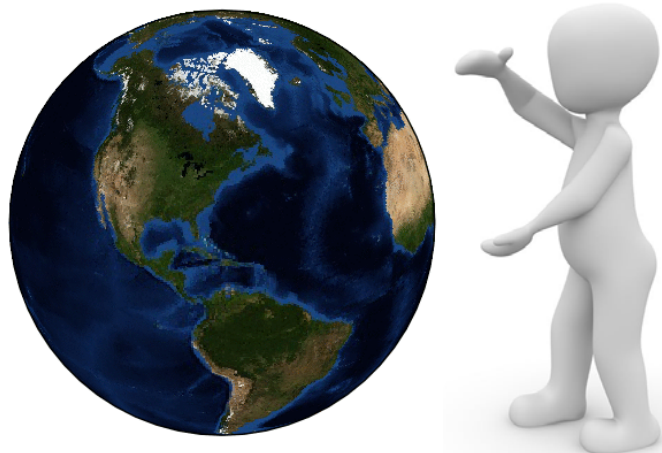
4^{ème} Journée « Yves Brossard »
d'hémobiologie fœtale et néonatale



Comment je fais...une transfusion in utero ?

How I do...an intrauterine transfusion?

L. Guilbaud ^{a,*,b}, E. Maisonneuve ^{a,b}, P. Maurice ^{a,b}, F. Dhomb
A. Mailloux ^e, A. Cortey ^{a,b}, J.-M. Jouannic ^{a,b,c}



Monitoring and management of hemolytic disease of the fetus and newborn based on an international expert Delphi consensus

Hiba J. Mustafa, MD; Enaja V. Sambatur, MD; Alireza A. Shamshirsaz, MD;
Sonia Johnson, MD; Kenneth J. Moise Jr, MD; Ahmet A. Baschat, MD;
E. J. T. (Joanne) Verweij, MD; Ali Javinani, MD; Mark D. Kilby, MD, DSc; Enrico Lopriore, MD;
Rebecca Rose, MD; Roland Devlieger, MD; Saul Snowise, MD; Ulrich J. Sachs, MD;
Asma Khalil, MD, MSc; On behalf of the HDFN Delphi Working Group[†]

Nov. 7, 2024. ajog.org

Practice patterns amongst fetal centers performing intrauterine transfusions (PACT): An international survey study

Roopali Donepudi ^{a,*}, Eugenia Antolin ^b, Francisca Molina ^{c,d}, Nicolas Sananes ^{e,f},
Asma Khalil ^{g,h}, Nimrah Abbasi ⁱ, M.A. Sánchez-Durán ^j, Kurt Hecher ^k, Isabella Fabietti ^l,
Jean-Marie Jouannic ^m, Javier U. Ortiz ⁿ, Antoni Borrell ^o, Yuval Gielchinski ^p,
Magdalena Sanz Cortes ^a

European Journal of Obstetrics and Gynecology 274 (2022) 171–174

Variations in antenatal management and outcomes in haemolytic disease of the fetus and newborn: an international, retrospective, observational cohort study

Derek P de Winter, Enrico Lopriore, Emilie Thorup, Olav Bjørn Petersen, Morten H Dziegiel, Karin Sundberg, Roland Devlieger, Luc de Catte, Liesbeth Lewi, Anne Debeer, Véronique Houfflin-Debarge, Louise Ghesquiere, Charles Garabedian, Kévin Le Duc, Eugenia Antolin, Nieves Mendez, James Castleman, Wing Ting Tse, Jean-Marie Jouannic, Paul Maurice, Jane Currie, Emma Mullen, Lut Geerts, Kerry Rademan, Asma Khalil, Borna Poljak, Smriti Prasad, Eleonor Tiblad, Kajsa Bohlin, Annegret Geipel, Johanna Rath, Fergal Malone, David Mackin, Yoav Yinon, Stav Cohen, Greg Ryan, Evangelia Vlachodimitropoulou, Karl-Philipp Gloning, Stefan Verlohren, Beate Mayer, Mariano Lanna, Stefano Faiola, Tanja Premru Sršen, Lilijana Kornhauser Cerar, Saul Snowise, Luming Sun, Lucas Otaño, César Hernan Meller, Ngina K Connors, Matthew Saxonhouse, Aline Wolter, Ivonne Bedei, Philipp Klaritsch, Sarah Jauch, Eduardo Teixeira da Silva Ribeiro, Fernando Maia Peixoto Filho, Raigam Jafet Martinez-Portilla, Alexandra Matias, Obdulia Alejos Abad, Juan Parra Roca, Ángel Guillermo Alcázar Grisi, Edgar Juan José Chávez Navarro, Johanna G van der Bom, Masja de Haas, EJT (Joanne) Verweij, for the DIONYSUS investigators*

Lancet Haematol 2024

Critical procedural steps in intrauterine transfusion: Delphi survey of international experts

E. MOISE^{1,2}, K. J. MOISE^{1,2}, M. NWOKOCHA², K. LOWRY^{1,2}, E. HUTSON^{1,2} and
D. P. DE WINTER^{3,4,5}, on behalf of the Delphi IUT Study Group#

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Ultrasound Obstet Gynecol 2025; 65: 78–84.

Delphi survey



Consultation d'experts

- Accord ? 70%
- Analyse statistique descriptive

Consensus collectif ?

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2024 *American Journal of Obstetrics & Gynecology*

Critical procedural steps in intrauterine transfusion: Delphi survey of international experts

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Organisation de la TIU



Survey results in 13 centers.

Location of transfusion	Ultrasound clinic	4 (30.8%)
	Operating room	7 (53.8%)
	Room next to OR	1 (7.7%)
	OR if viable gestation	1 (7.7%)

Sterile operating room ✓

Donepudi et al. EJOG 2022
Moise et al. Ultrasound 2025

Anesthésie fœtale ✓

IV > IM
Curares
Vecuronium
Rocuronium
Atracurium

Zwiers et al. Ultrasound 2017
Moise et al. Ultrasound 2025

Anesthésie maternelle ✓

Anesthésie locale ou locale associée à une sédation maternelle (80-88%)

Lidocaïne

Hiba et al. AJOG 2024
Moise et al. Ultrasound 2025



Tocolytiques ?

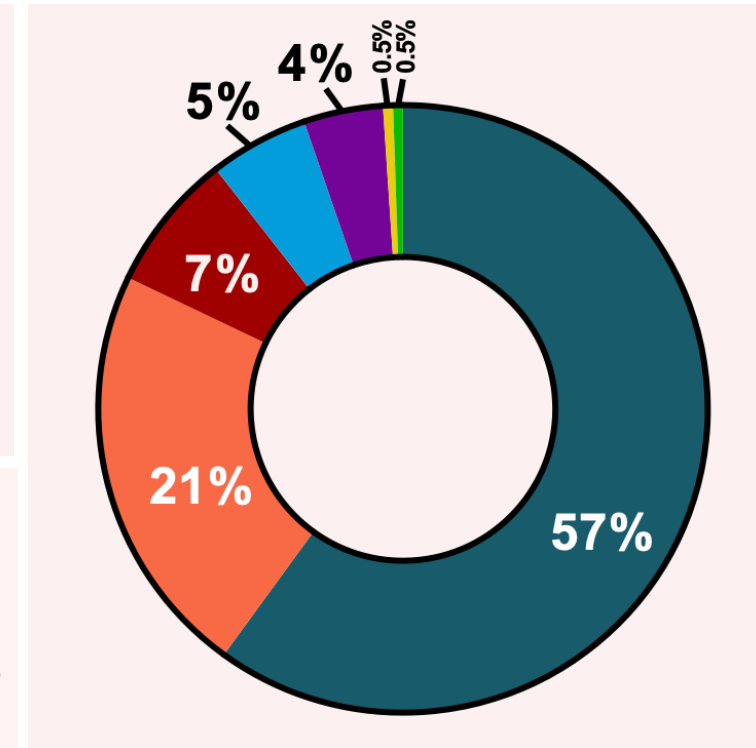
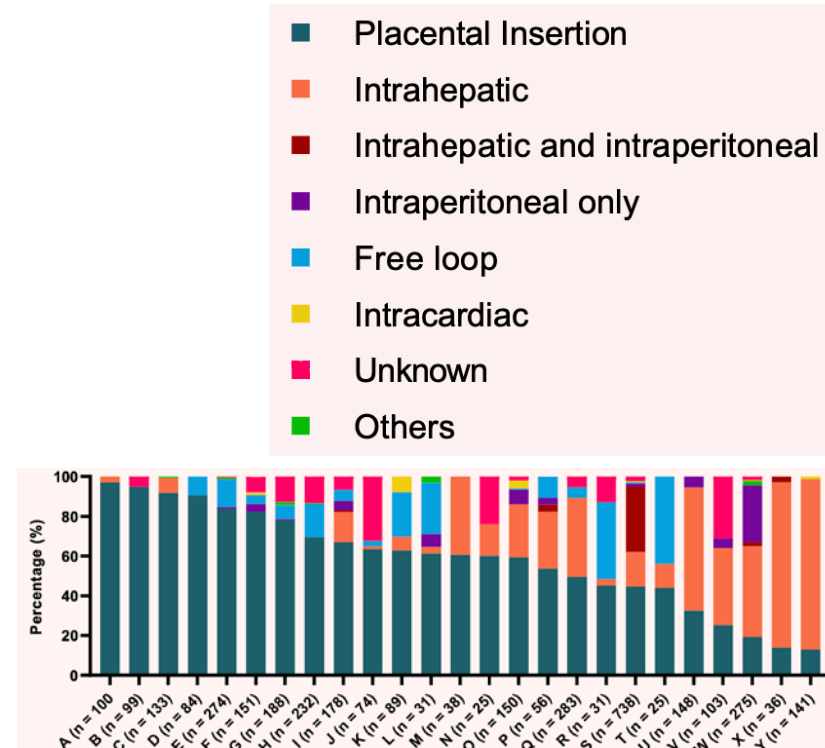
Antibiotiques ?

La cible foetale



22 pays – 31 centres
2006 – 2021
3691 transfusions in utero

De Winter et al. Lancet Hematology 2024



Which vessel do you typically target for intravascular transfusions (rank high to low)?

UV at placental site > intrahepatic UV > free loop UV

22 (44.9)

UV at placental site > free loop UV > intrahepatic UV

16 (32.7)

Intrahepatic UV > UV at placental site > free loop UV

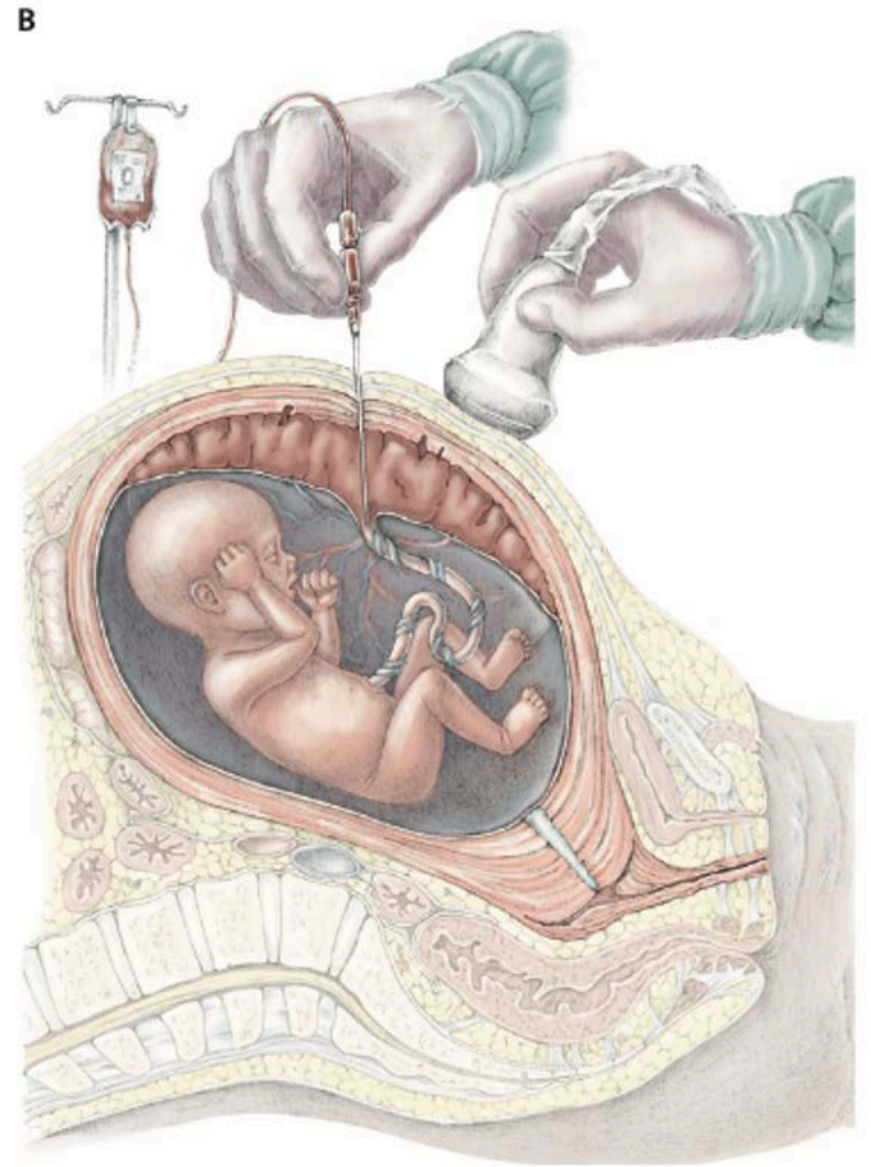
10 (20.4)

Intrahepatic UV > free loop UV > intrahepatic UV

1 (2.0)

Moise et al. Ultrasound 2025

Transfusion intravasculaire à l'insertion placentaire (57%) **Transplacentaire**

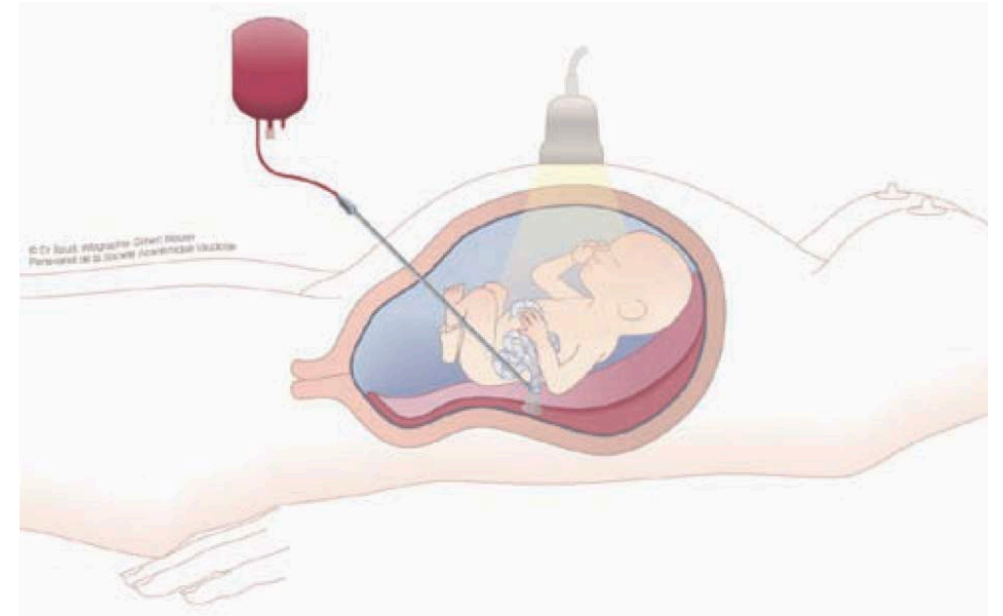


De Winter et al. Lancet Hematology 2024

Transfusion intravasculaire à l'insertion placentaire **Transamniotique**

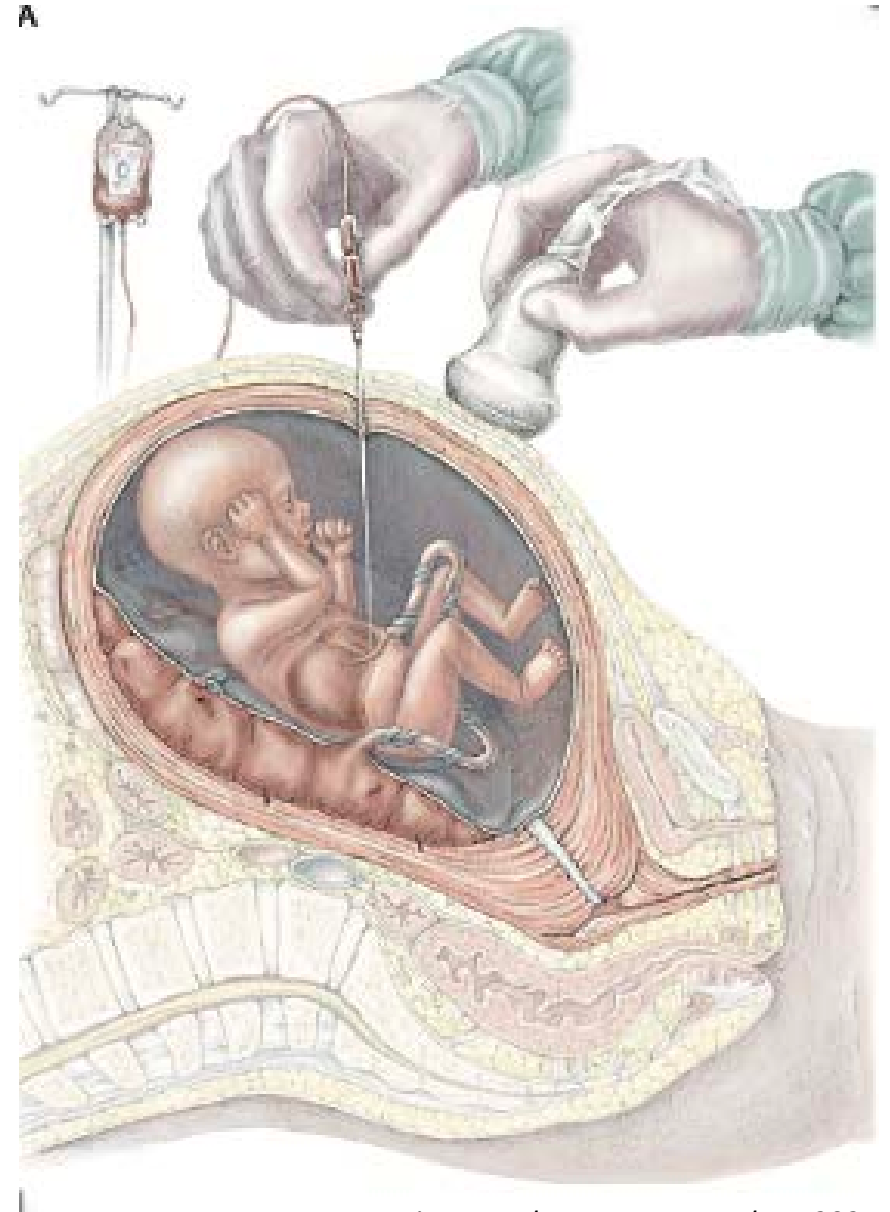
Limites :

- 3^e trimestre
- Parvovirus B19



Lepigeon, Rev Med Suisse 2013

Transfusion intravasculaire de la veine ombilicale intra-hépatique (21%)



De Winter et al. Lancet Hematology 2024

Insertion placentaire vs VOIH

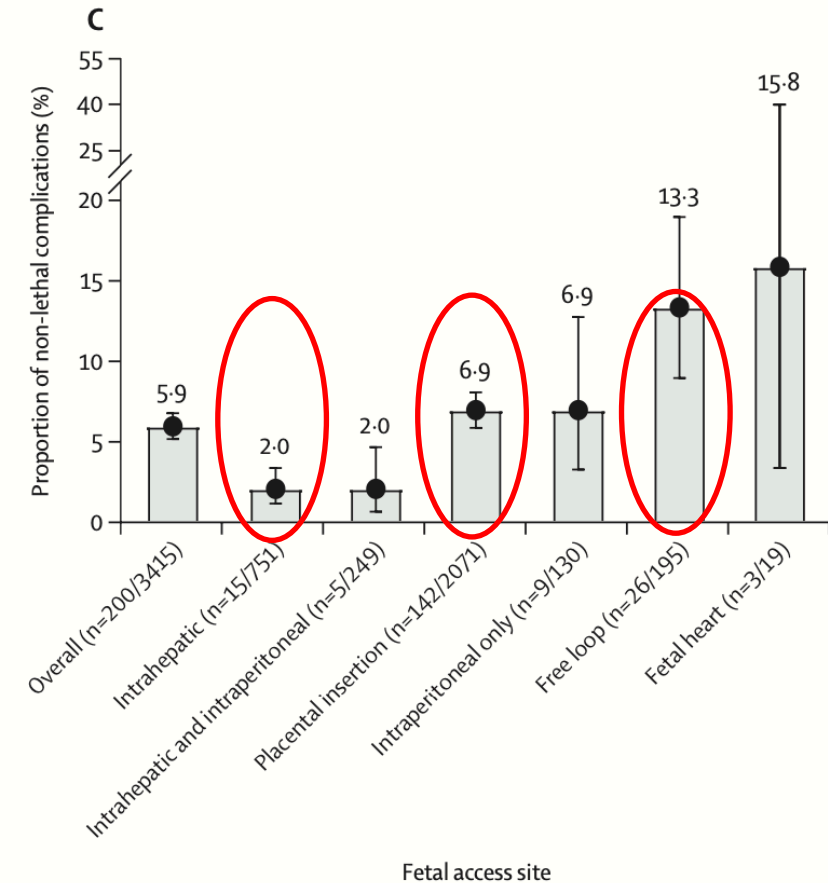


Table 3 Univariate analysis of characteristics of 34 intrauterine intravascular blood transfusions (IUTs) that were followed by severe procedure-related (PR) complications, compared with 1644 remaining procedures in 589 fetuses with anemia caused by red-cell alloimmunization

Characteristic	IUT with PR complication* (n = 34)	Remaining IUTs (n = 1644)	OR (95% CI)	P
Procedure access site				
Liver	6 (17.6)	546 (33.2)	0.4 (0.2–1.0)	0.065
Placental cord insertion	11 (32.4)	787 (47.9)	0.5 (0.3–1.1)	0.083
Transamniotic 'free loop'	10 (29.4)	270 (16.4)	2.1 (1.0–4.5)	0.060
Artery	4 (11.8)	20 (1.2)	10.8 (3.5–33.6)	0.001
Intraperitoneal	0 (0)	13 (0.8)	—	1.000
Other†	3 (8.8)	8 (0.5)	19.8 (5.0–78.2)	0.001
Unsuccessful IUT	3 (8.8)	30 (1.8)	5.2 (1.5–18.0)	0.027

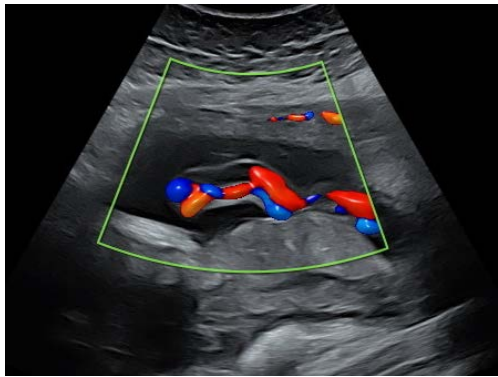
Data are given as *n* (%) or median (range). *Procedures followed by fetal distress resulting in emergency Cesarean section within 24 h or fetal death. †Number of SDs from median concentration for gestational age (GA). ‡Unknown vessel, heart, chorionic vein. OR, odds ratio.

Zwiers et al. Ultrasound 2017



De Winter et al. Lancet Hematology 2024

Transfusion intravasculaire en cordon libre (5%)



Cordon libre
≠



Insertion placentaire transamniotique

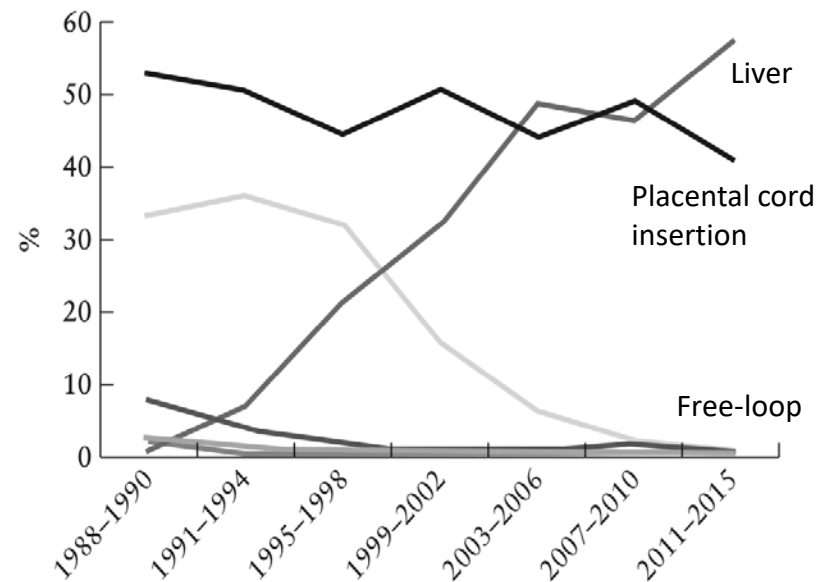
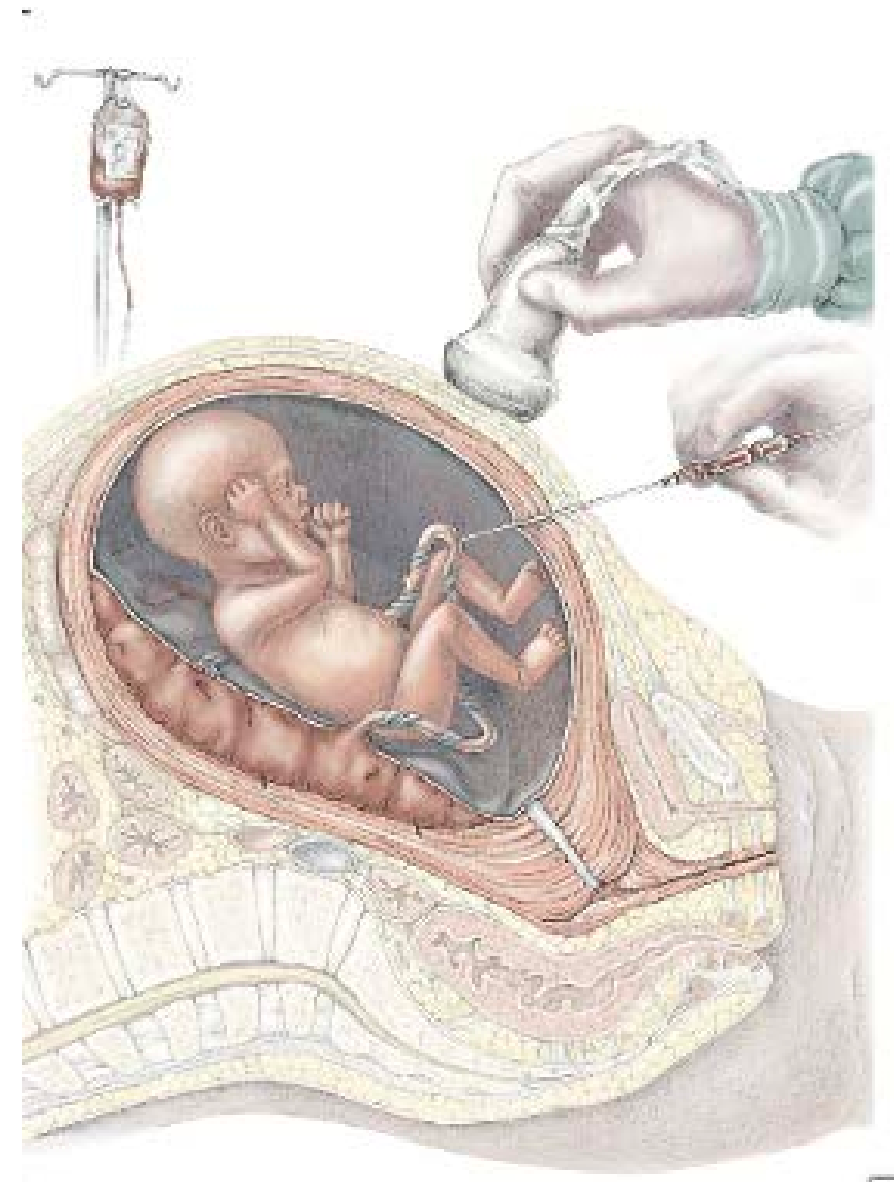


Figure 1 Trends in procedure access sites for intrauterine intravascular blood transfusion between January 1988 and January 2015. —, liver (plus intraperitoneal); —, placental cord insertion; —, transamniotic venous; —, arterial (cord insertion or transamniotic); —, intraperitoneal; —, unknown vessel, heart, chorionic vein.

Zwiers et al. Ultrasound 2017



De Winter et al. Lancet Hematology 2024

Transfusion intrapéritonéale (4%)

Intravasculaire > Intrapéritonéale
Terme précoce, anasarque

Donepudi et al. Fetal Diag Ther 2024

Volume de transfusion

10 ml à 20 SA

5-10 ml < 20 SA

(5 ml à 15 SA puis 1 cc par SA)

Répéter la procédure à une semaine

Hiba et al. AJOG 2024

Donepudi et al. Fetal Diag Ther 2024

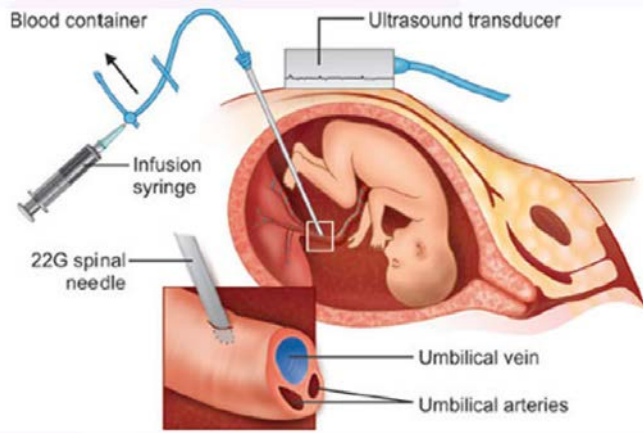


De Winter et al. Lancet Hematology 2024

Quel type d'aiguille ?

Items assessed in Delphi questionnaires	Round in which item was included	
	1 (N=78)	2 (N=70)
Needle gauge choice should differ depending on GA at the procedure	47/78 (60.3)	42/70 (60)
22 gauge needle		
<20 wk	21/47 (44.7)	
<22 wk	10/47 (21.3)	
<24 wk	7/47 (14.9)	
<26 wk	3/47 (6.4)	
<28 wk	6/47 (12.8)	
20 gauge needle should be used following the 22–24 wk, while 22 gauge prior	30/47 (63.8)	57/70 (81.4)
18 needle gauge should not be used in IUT	36/47 (76.6)	

Hiba et al. AJOG 2024



Aiguille de 22 G avant 22 - 24 SA
Aiguille de 20 G après 22 - 24 SA

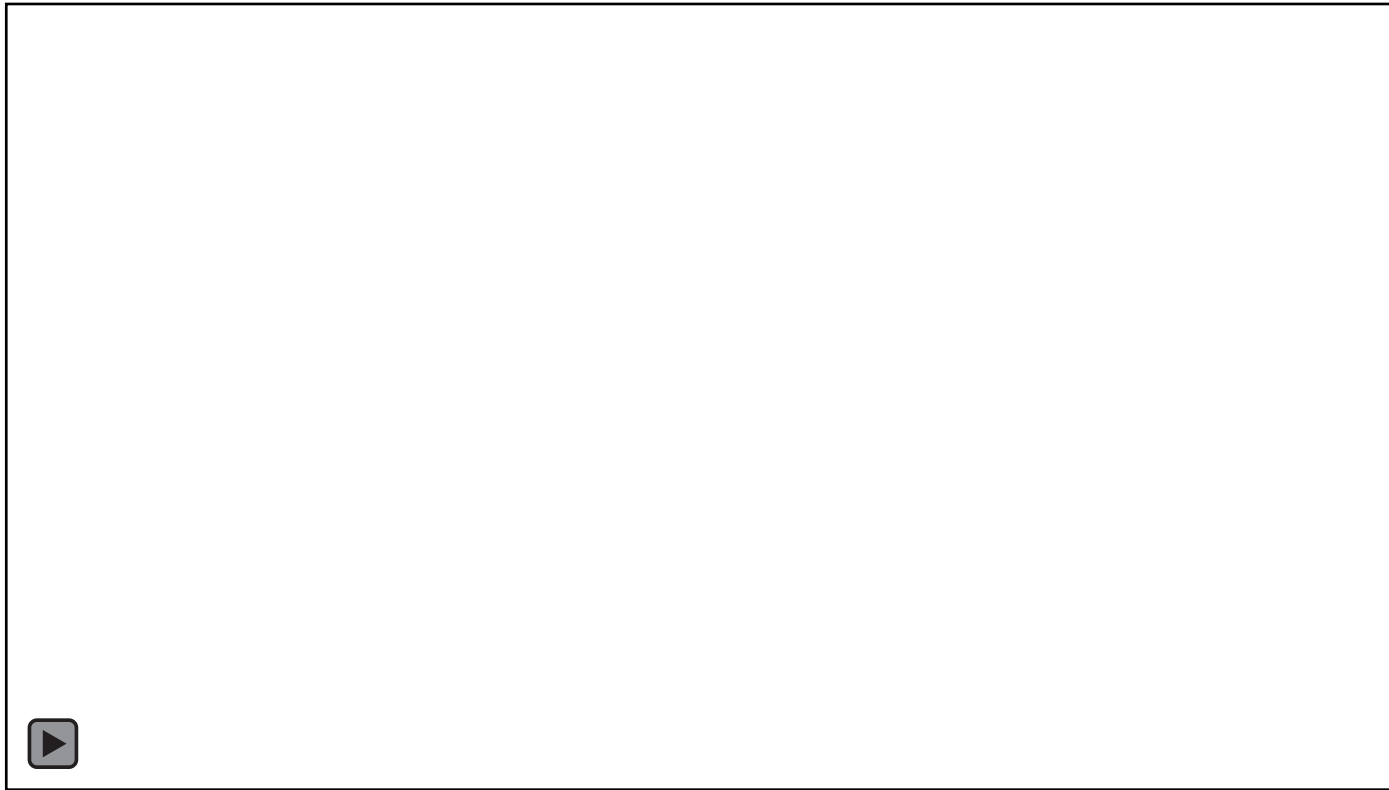
Aiguille d'amniocentèse`
 20 G (ø 0.81mm)
 120 mm

Aiguille de rachianesthésie
 Jusqu'à 25 - 27 G (ø 0,45 mm)
 Entre 88 et 148 mm

Double aiguille de BT/PVC
 Double aiguille 18 G (ø 1,02 mm)
 et 21 G (ø 0,72 mm) - 200 mm

Quel type d'aiguille ?

Transfusion in utero à la double aiguille



Double aiguille de BT/PVC
Double aiguille 18 G (\varnothing 1,02 mm)
et 21 G (\varnothing 0,72 mm) - 200 mm

Quel type d'aiguille ?

Transfusion in utero à la double aiguille

CNRHP
Nov 2022 – Fév 2024
17 TIU chez 9 foetus
16 - 20 SA

Patient	Maternal BMI (kg/m ²)	Gravidity (G) Parity (P)	IUT #	Placental insertion site	Hydrops at first IUT	GA at IUT (weeks)	Initial Hb (g/dl)	Final Hb (g/dl)	Procedure-related complication	Outcome (GA at delivery, weeks)
1	19.0	G2 P0	1	Posterior	Yes	18.3	5,7	12,7	None	TOP (21.6)†
2	30.0	G10 P9	1	Anterior	Yes	16.1	2,1	12,7	None	Alive (27.4)*
			2	Anterior	No	17.4	9,1	12	None	
			3	Anterior	No	18.1	3,7	11,7	None	
			4	Anterior	No	19.4	7,7	14,2	Bradycardia	
3	28.6	G2 P1	1	Anterior	No	17.2	5,4	12	None	Alive (35.6)*
			2	Anterior	No	19.0	5,4	13,8	None	
4	18.3	G2 P1	1	Posterior	Yes	19.2	3,3	10,8	None	Alive (40.4)
5	17.8	G2 P1	1	Anterior	Yes	19.5	4,9	12,8	None	Alive (41.0)
6	24.1	G3 P2	1	Anterior	No	18.0	7,3	17,3	None	Alive (38.4)
7	31.2	G3 P2	1	Anterior	Yes	19.4	1,7	8,4	None	Alive (37.2)
			2	Anterior	Yes	20.0	5,1	13,1	None	
8	20.6	G4 P1	1	Anterior	Yes	16.2	5,6	13,7	None	Alive (-)
			2	Anterior	Yes	17.1	5,6	12,9	None	
			3	Anterior	Yes	17.5	5,4	18,8	None	
9	20.3	G3 P2	1	Anterior	Yes	18.4	3,3	10	None	Alive (-)
			2	Anterior	Yes	19.4	6,1	11,2	None	

Abbreviations : #, number; BMI, body mass index before pregnancy; GA, gestational age; Hb, Hemoglobin; IUT, in utero transfusion; TOP, termination of pregnancy

† TOP secondary to persistent hydrops; * Cesarean section for abnormal fetal heart rate

Choix du culot globulaire

Sélection du CGR

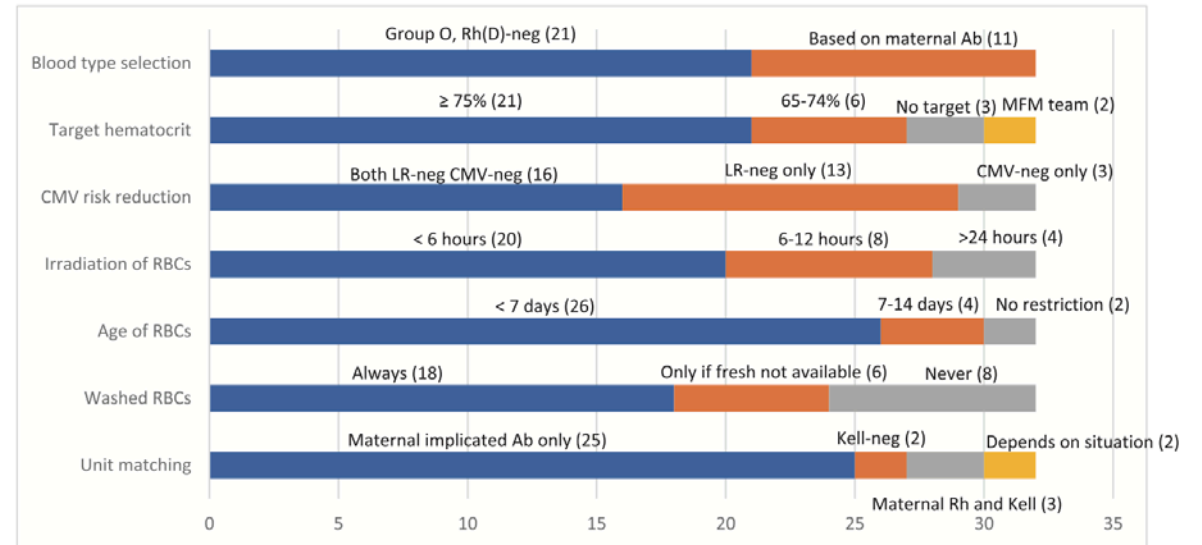
Phénotypé (idéalement respectant le phénotype maternel étendu)

Compatibilisé

Frais ($\leq 5-7$ J), Irradié (< 24 h)

Concentré (hématocrite $> 70-75$ %)

Déleucocyté, CMV ?



Ab: antibody, CMV: cytomegalovirus, LR: leukocyte-reduced, MFM: Maternal-Fetal Medicine, neg: negative

FIGURE 2 RBC blood product selection and modifications as reported by various participating centers performing IUT in United States. Ab. antibody; CMV, cytomegalovirus; LR, leukocyte-reduced; MFM, Maternal-Fetal Medicine; neg, negative. [Color figure can be viewed at wileyonlinelibrary.com]

Bakhtari et al. Transfusion 2022

Quantité de sang transfusé

basée sur l'hémoglobine ou l'hématocrite fœtale

Mari et al. NEJM 2000

Zwiers et al. Hematology 2017

Hiba et al. AJOG 2024

Moise et al. Ultrasound 2025

Pas de bénéfice à la réalisation d'une exsanguinotransfusion

Garabedian et al. EJOG 2014

Guilbaud et al. EJOG 2016



Rythme des transfusions

What methodology do you utilize to decide on when to perform subsequent IUTs?

Calculated predicted decline in fetal hematologic indices	18 (36.7)
MCA-PSV Doppler	18 (36.7)
How often do you perform MCA-PSV Doppler? (weeks)	1 (1-2)
What value do you use as a threshold for performing the next IUT? (MoM)	1.55 (1.5-2.0)
Empiric intervals of time	8 (16.3)
Other§	5 (10.2)

Moise et al. Ultrasound 2025
Friszer et al. Ultrasound 2015
Hiba et al. AJOG 2024

Transfusion jusqu'à 36 SA

- Rares complications (5.7 % \geq 34 SA vs 1.7 % < 34 SA)
- 42.9% de transfusion en cordon libre

Youssefzadeh A. et al, Prenat Diag 2024

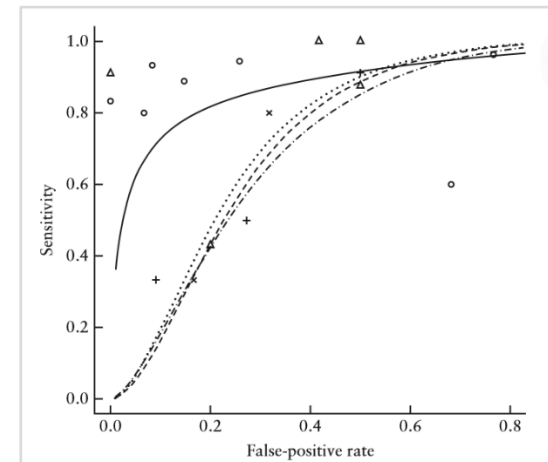


Figure 4 Hierarchical summary receiver–operating characteristics curves for prediction of severe anemia by fetal middle cerebral artery peak systolic velocity, according to number of previous intrauterine transfusions: none (O, —; $P=0.011$), one (Δ , ---; $P=0.399$), two (+, ·····; $P=0.477$) or three or more (x, - - -; $P=0.319$).

Martinez-Portilla et al. Ultrasound 2019

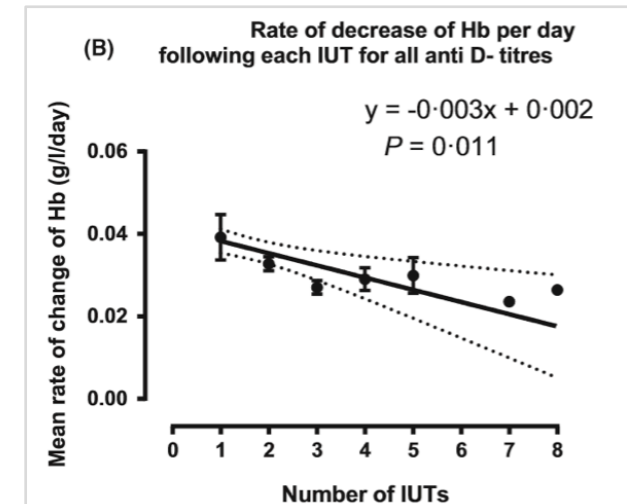


Fig 3. The relationship between the rate of change of haemoglobin (Hb) following each sequential intrauterine transfusion (IUT) in K (A) and D (B) alloimmunisation.

Vlachodimitropoulou et al. BJH 2022

Conclusion

- Consultation d'**experts** → **Consensus collectif**
- **Standardisation de la pratique** de la transfusion in utero
- **Opérateur expérimenté** (au moins 20 TIU, 10 TIU/an)
- **Expertise clinico-biologique**
- Adapté à la situation clinique
- Adapté aux préférences et aux habitudes des équipes

Merci



**4^{ème} Journée « Yves Brossard »
d'hémobiologie fœtale et
néonatale**

