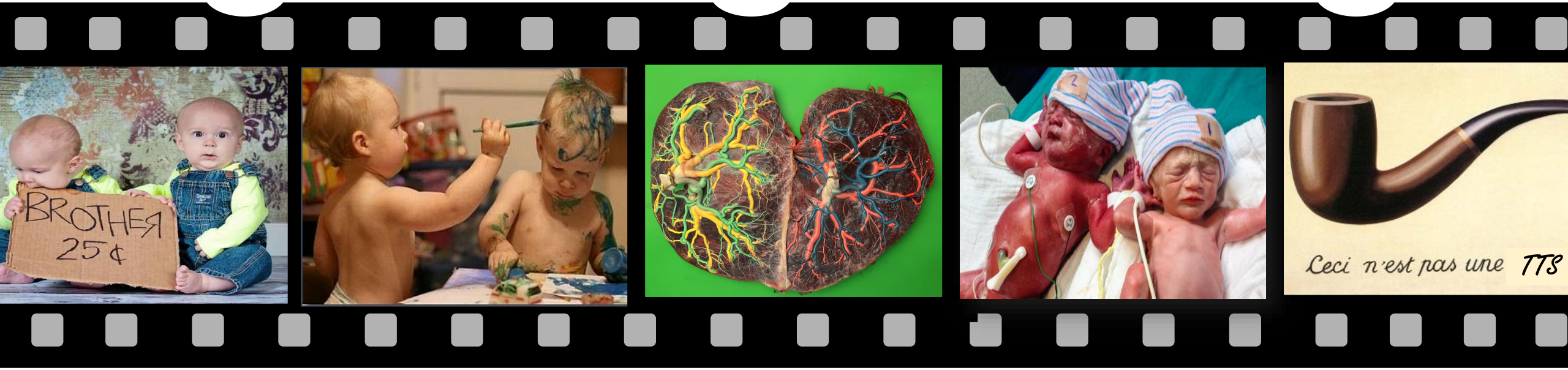
Ceci nest pas une TTS:

A twins guide for neonatologists



Prof. Enrico Lopriore, Head of Dept. of Neonatal Intensive Care Unit

Leiden University Medical Center, The Netherlands

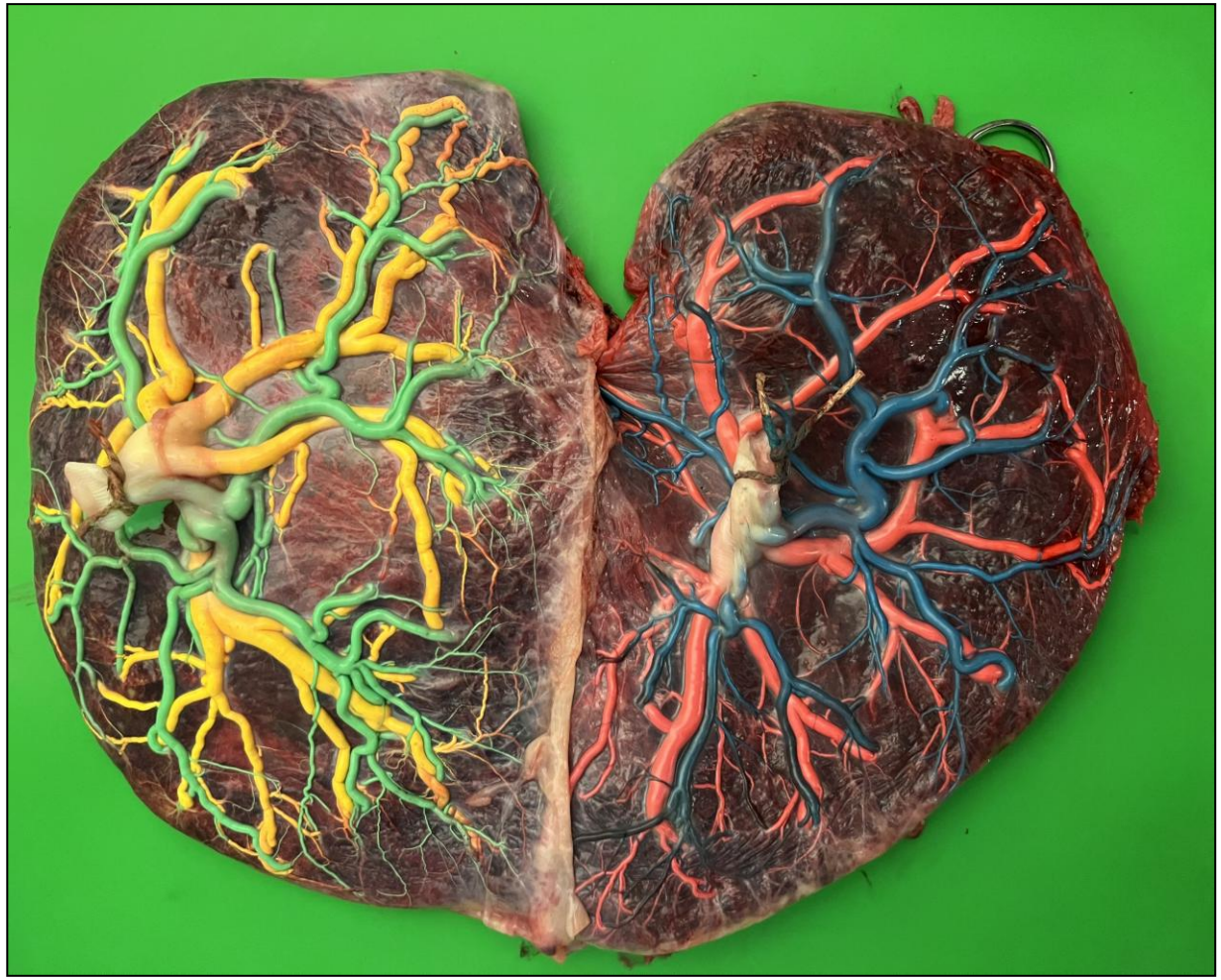
Brussel 2025


ANNECY
PRIX DU JURY
ANNECY
PRIX FONDATION GAN
À LA DIFFUSION
un film d'Alain Ughetto
INTERDiT
aux chiens et aux Italiens
avec les voix d'Ariane Ascaride et Alain Ughetto
Musique de Nicola Piovani

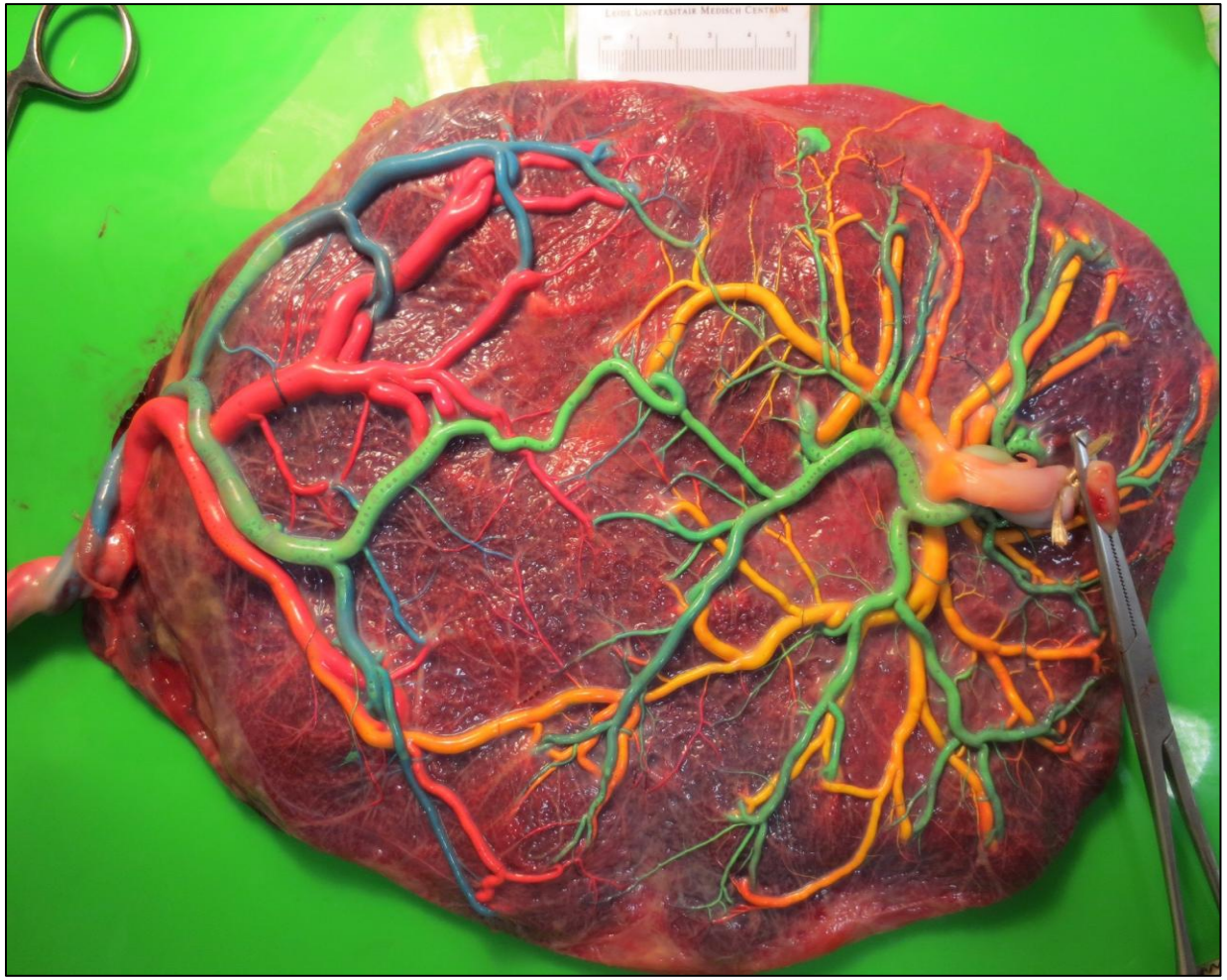
No conflict of interest

No disclosures

Dichorionic twins



Monochorionic twins



Monochorionic twins:

Different subgroups

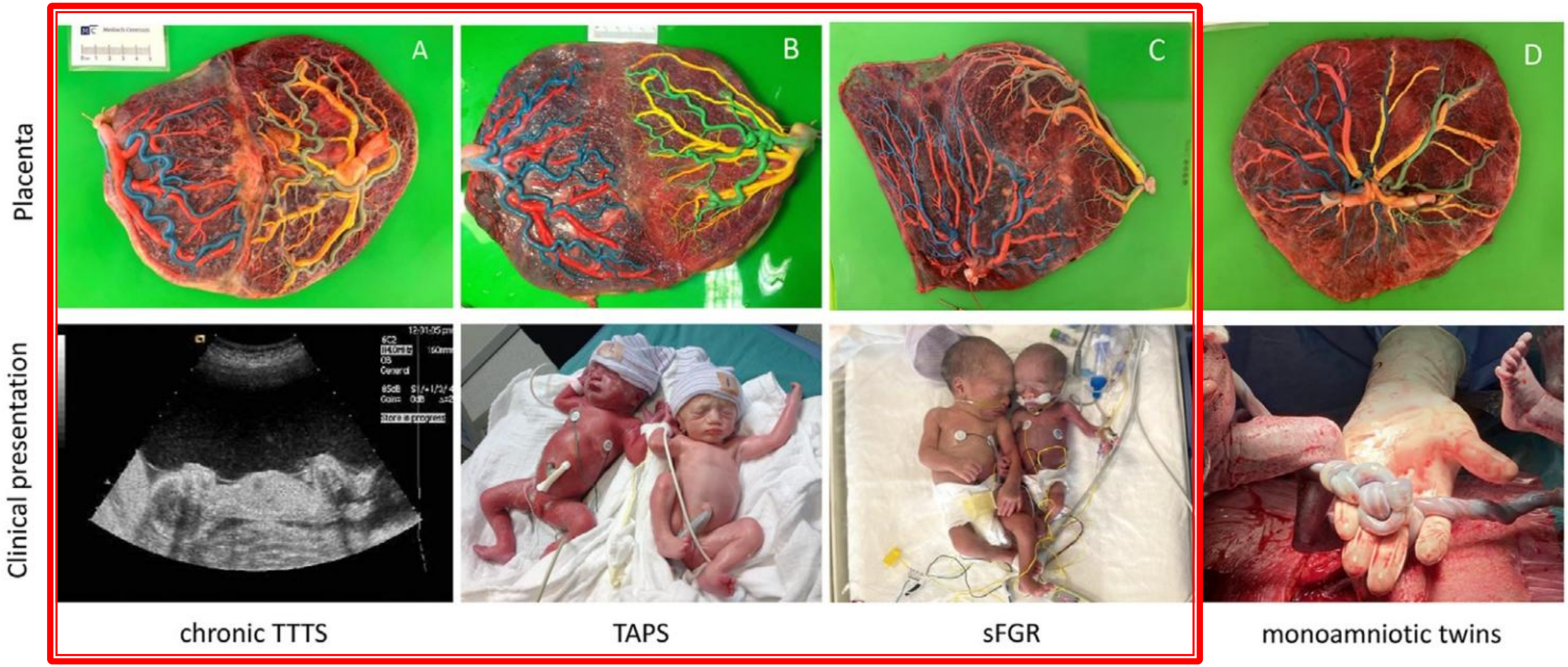
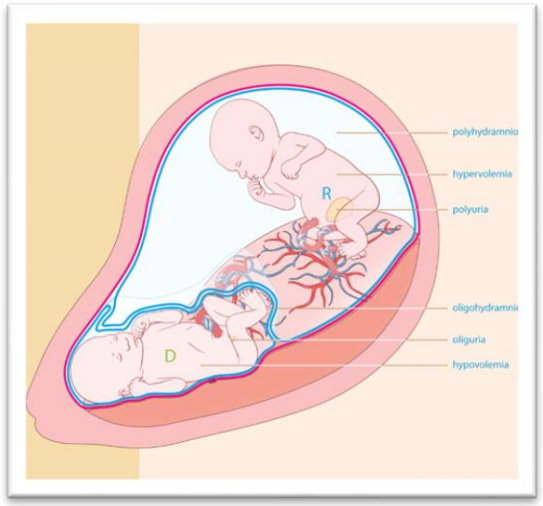
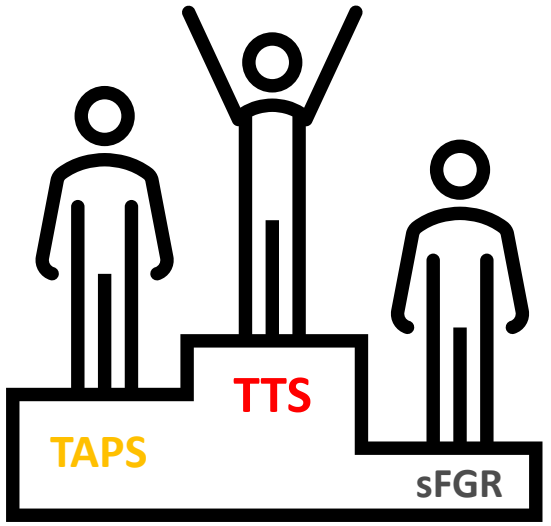
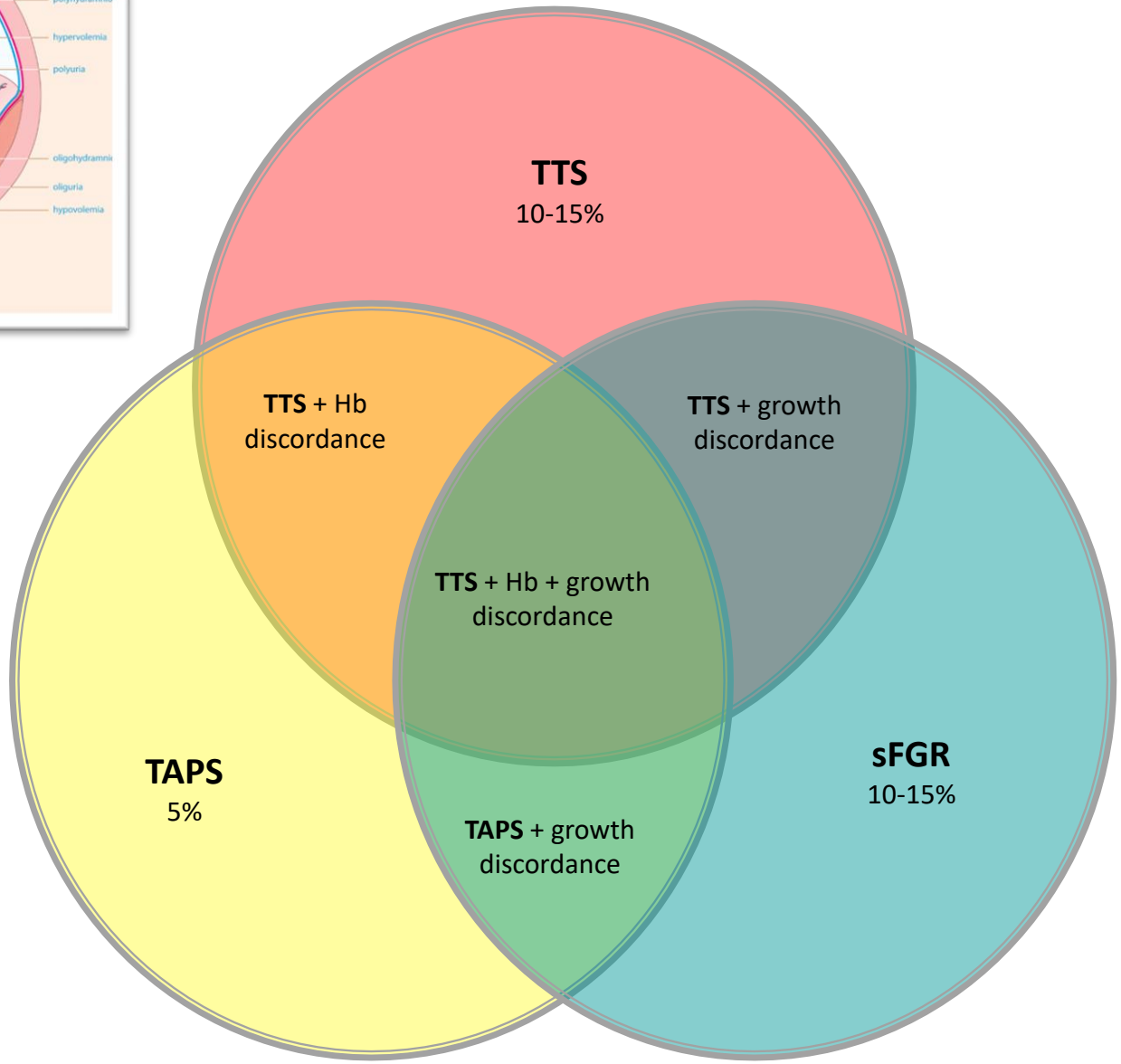
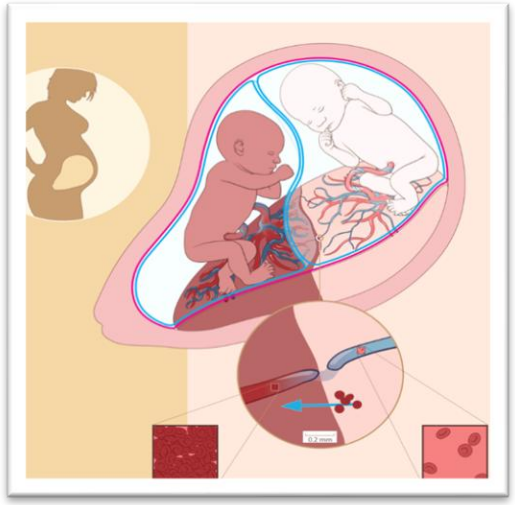


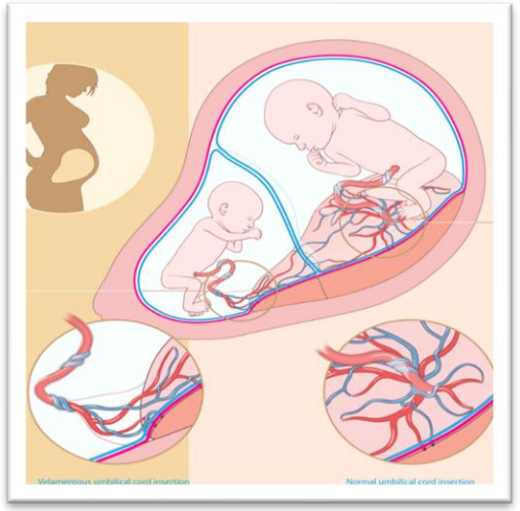
Fig. 1. An overview of MC twin placentas after colored dye injection and twin pairs per complication; (A) TTTS, (B) TAPS, (C) sFGR, and (D) MA twins with an example of an umbilical cord knot.


polyhydramnio
hypervolemia
polyuria
oligohydramnio
oliguria
hypovolemia
R
D

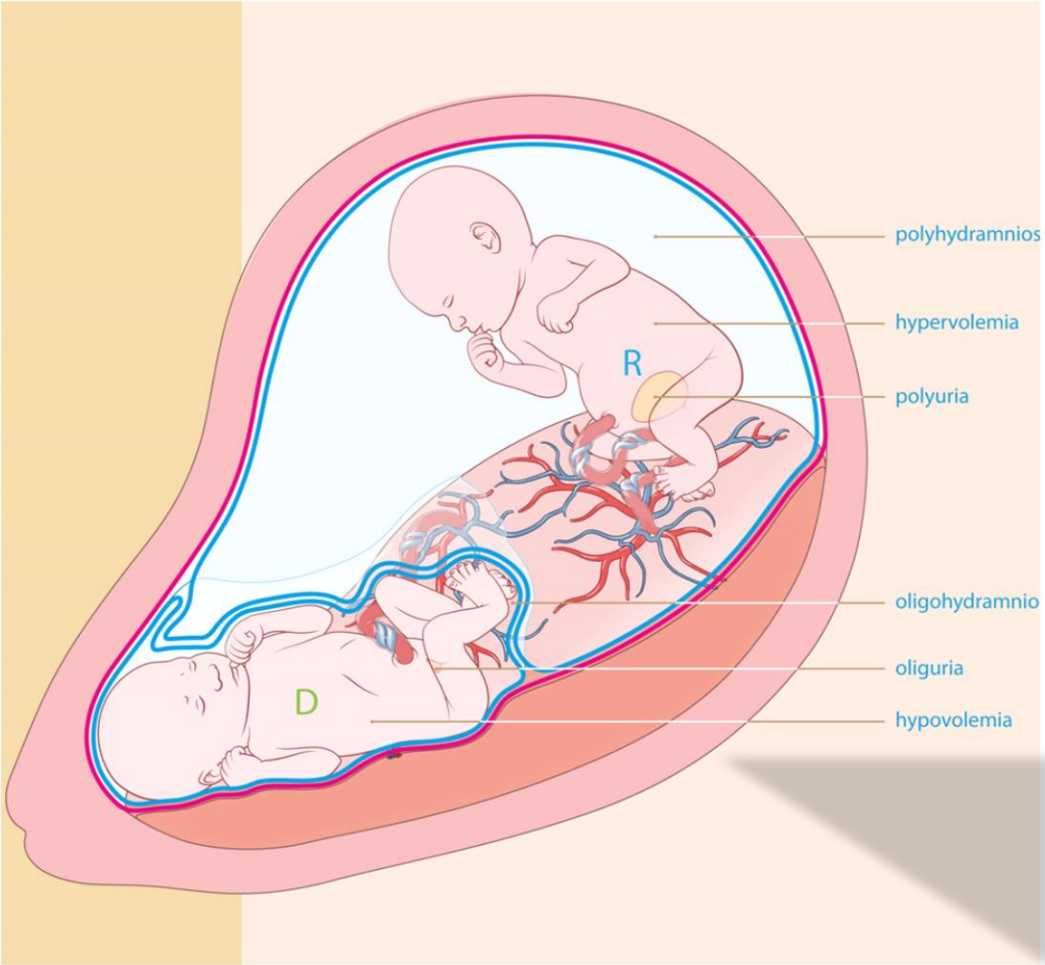

TTS
TAPS
sFGR

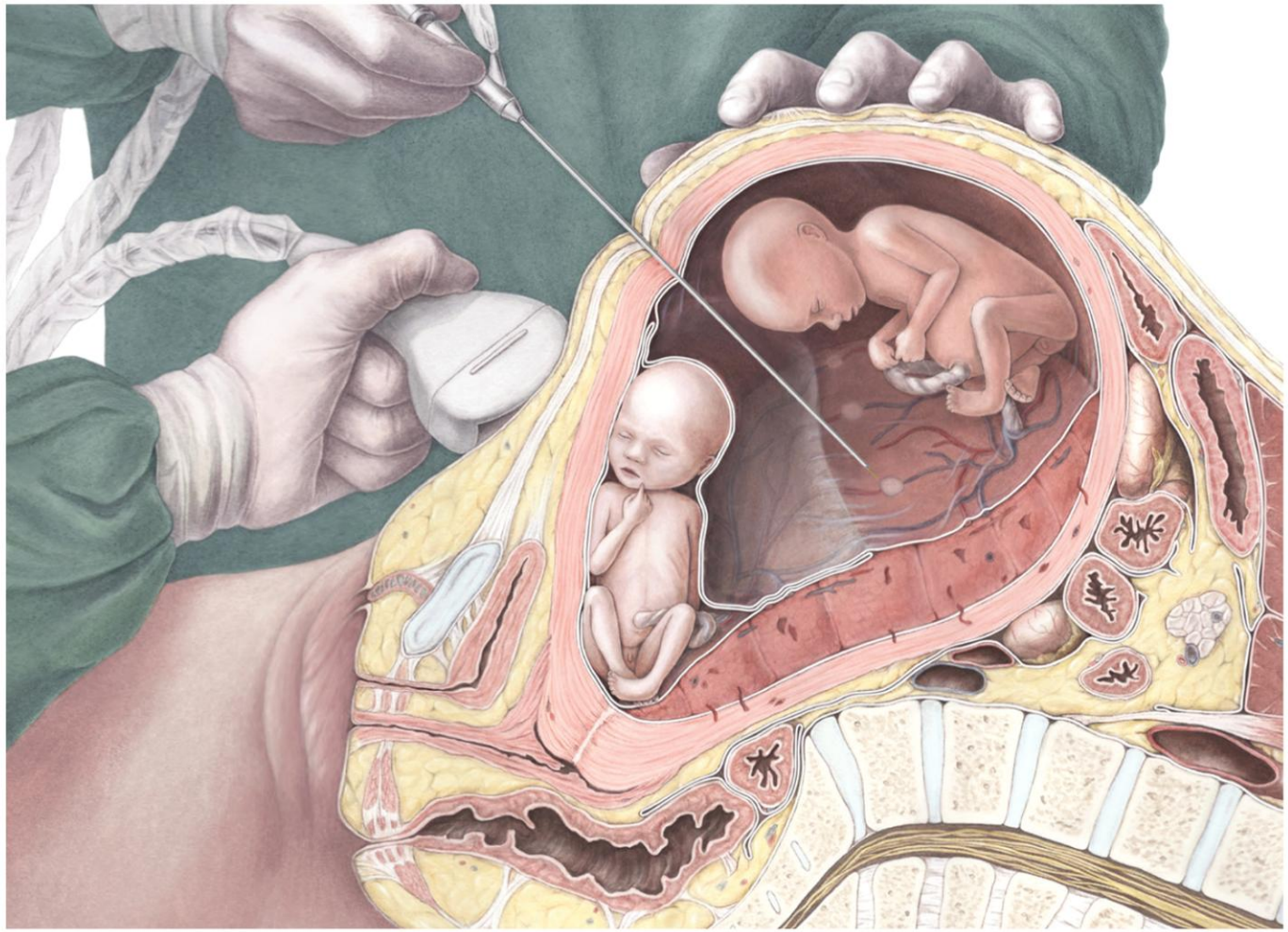

TTS
10-15%
TTS + Hb discordance
TTS + growth discordance
TTS + Hb + growth discordance
TAPS
5%
TAPS + growth discordance
sFGR
10-15%

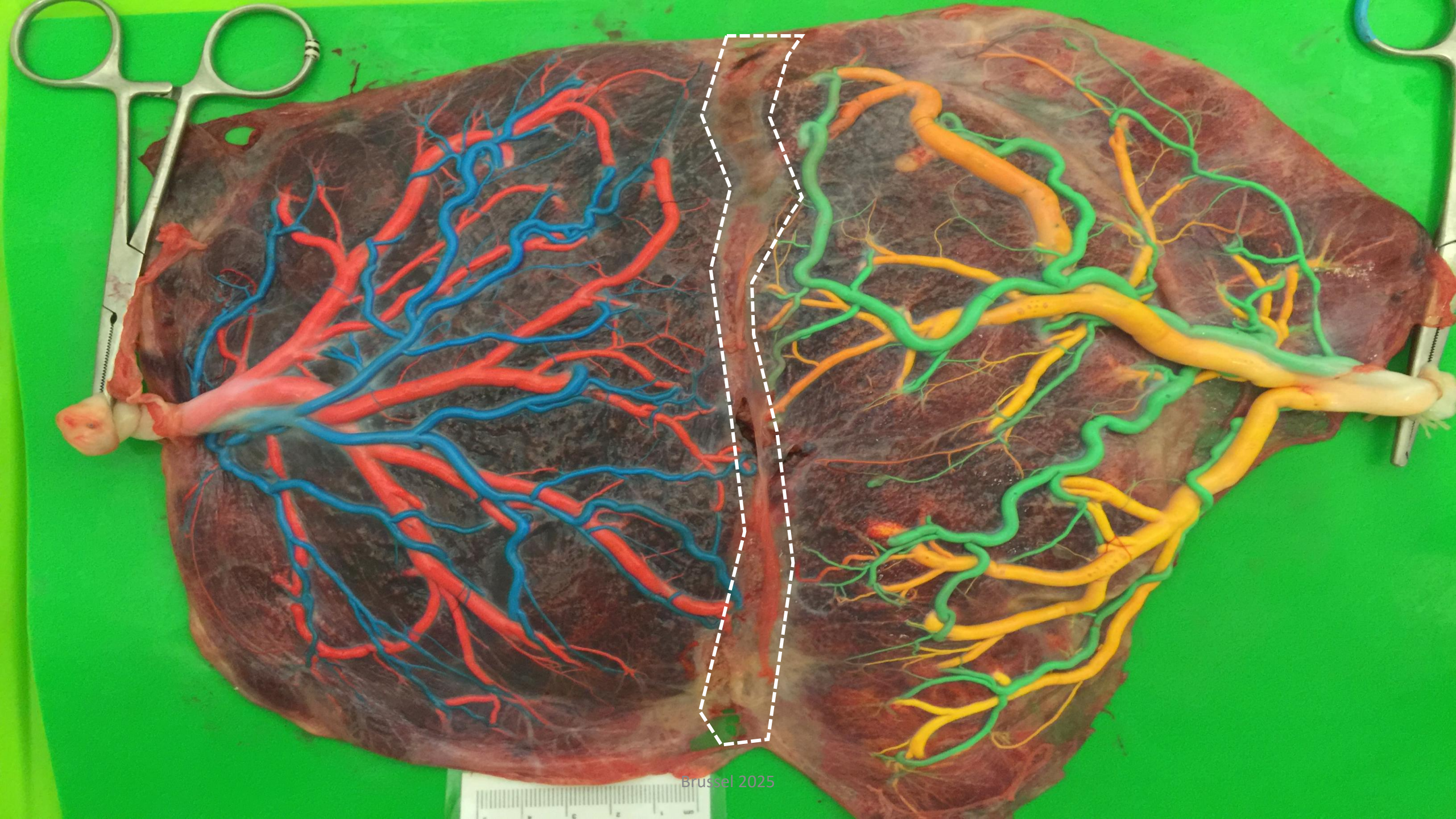




What should neonatologists know about
Twin-to-twin Transfusion Syndrome (TTS)



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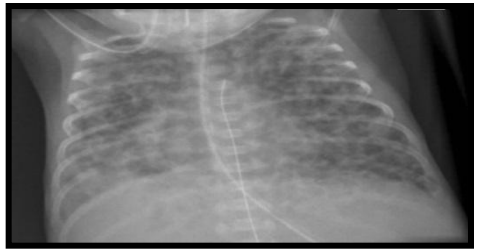
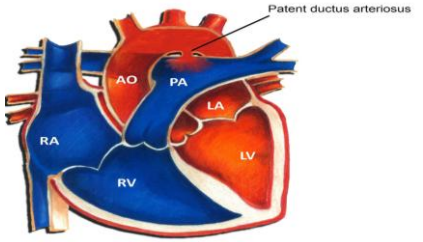
Prematurity in TTS

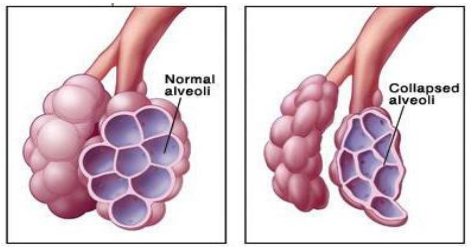
Neonatal morbidity in TTS

CLD



PDA



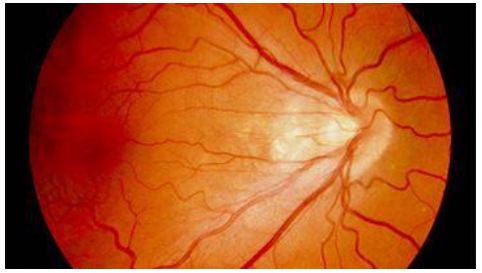


RDS

prematurity

NEC

IVH/PVL



ROP

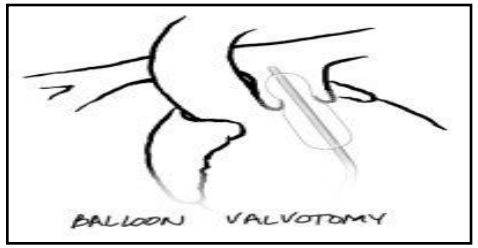
Additional neonatal morbidity in TTS

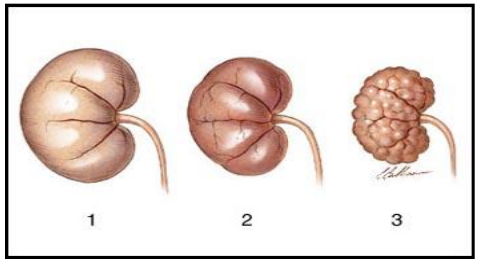
DONOR

RECIPIENT

IUGR *(30-50%)*

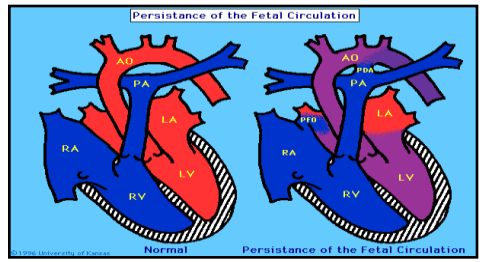
RVOTO *(4-11%)*





Renal failure *(0-10%)*

additional morbidity



PPHN *(5%)*

Post-laser TAPS *(10%)*

Amniotic bands *(2%)*

Courtesy of liesbeth lewi

Ischemic limb *(1%)*

Cardiac failure and morbidity in recipients in *non-lasered* TTS

Twin Research and Human Genetics (2022), 1–5
doi:10.1017/thg.2022.5

CAMBRIDGE UNIVERSITY PRESS

Article

Neonatal Outcome in Twin-to-Twin Transfusion Syndrome *Not* Treated with Fetoscopic Laser Surgery

Elina A. Lopriore[1], Femke Slaghekke[2], E. Joanne Verweij[2], Monique C. Haak[2], Annemieke J. M. Middeldorp[2] and Enrico Lopriore[1]

children

MDPI

Article

Neonatal Hemodynamic Characteristics of the Recipient Twin of Twin-To-Twin Transfusion Syndrome Not Treated with Fetoscopic Laser Surgery

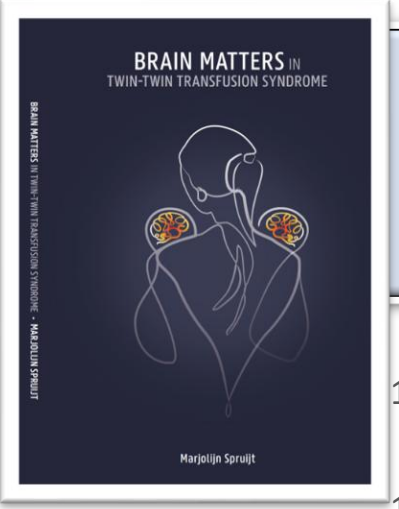
Edouard Chambon [1], Taymme Hachem [1], Elodie Salvador [1], Virginie Rigourd [1], Claire Bellanger [1], Julien Stirnemann [2,3], Elsa Kermorvant-Duchemin [1,3], Pierre Tissieres [4,5], Yves Ville [2,3] and Alexandre Lapillonne [1,3,*]

	no-laser (n=88)	**laser** (n=176)
Cerebral injury	18%	5%
NEC	9%	1%
Mortality	14%	3%

Cardiac failure: 15/42 (36%)

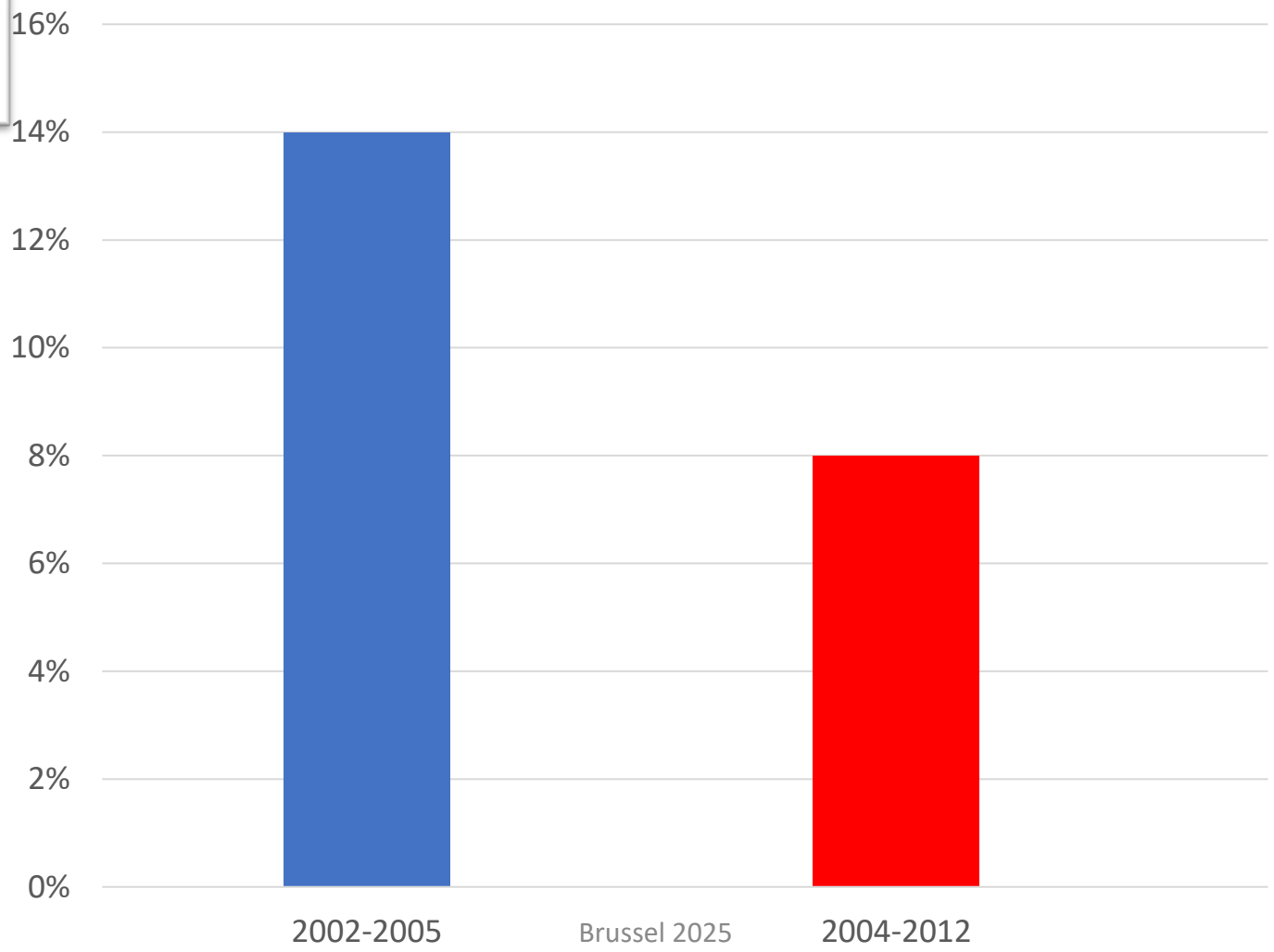
- *High RR*
- *Ventricular hypertrophy*

Mortality: 6/15 (40%)

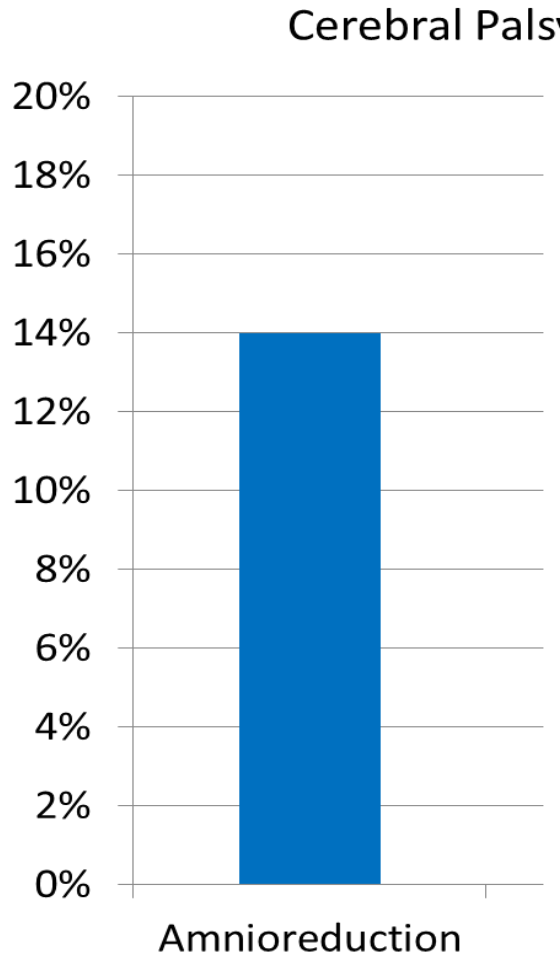


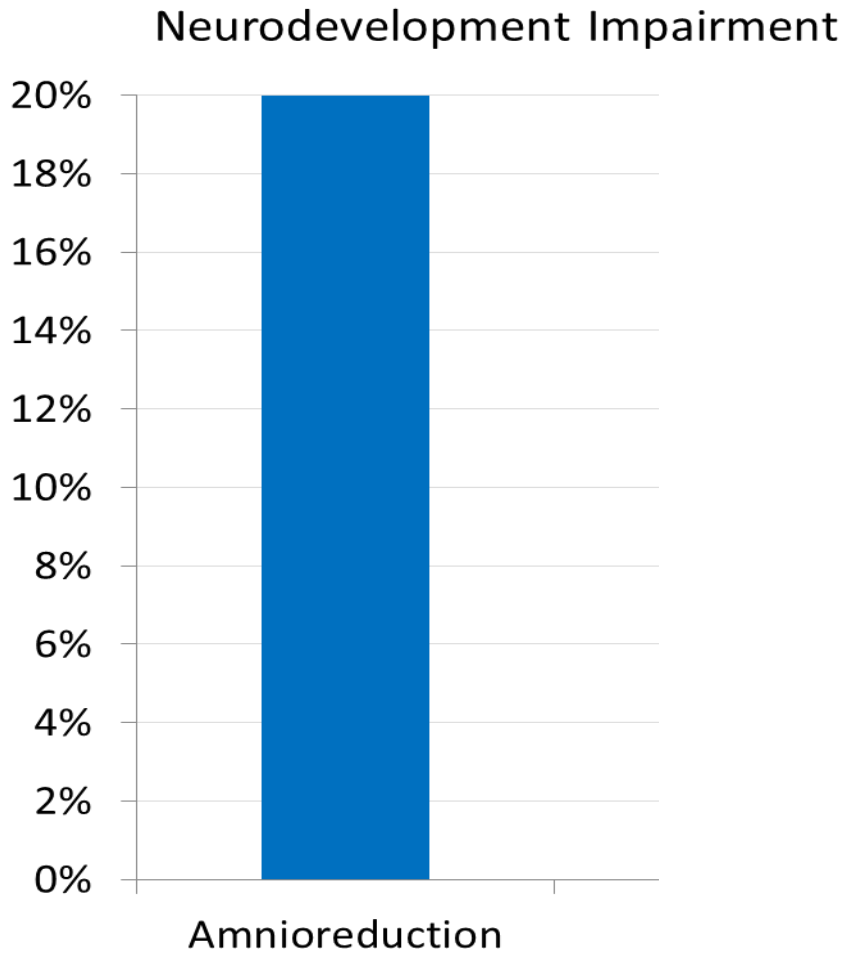
Cerebral injury in TTS after laser

Lopriore, *AJOG* 2006, Spruijt, *Obstet Gynecol* 2012, Spruijt, *UOG* 2024



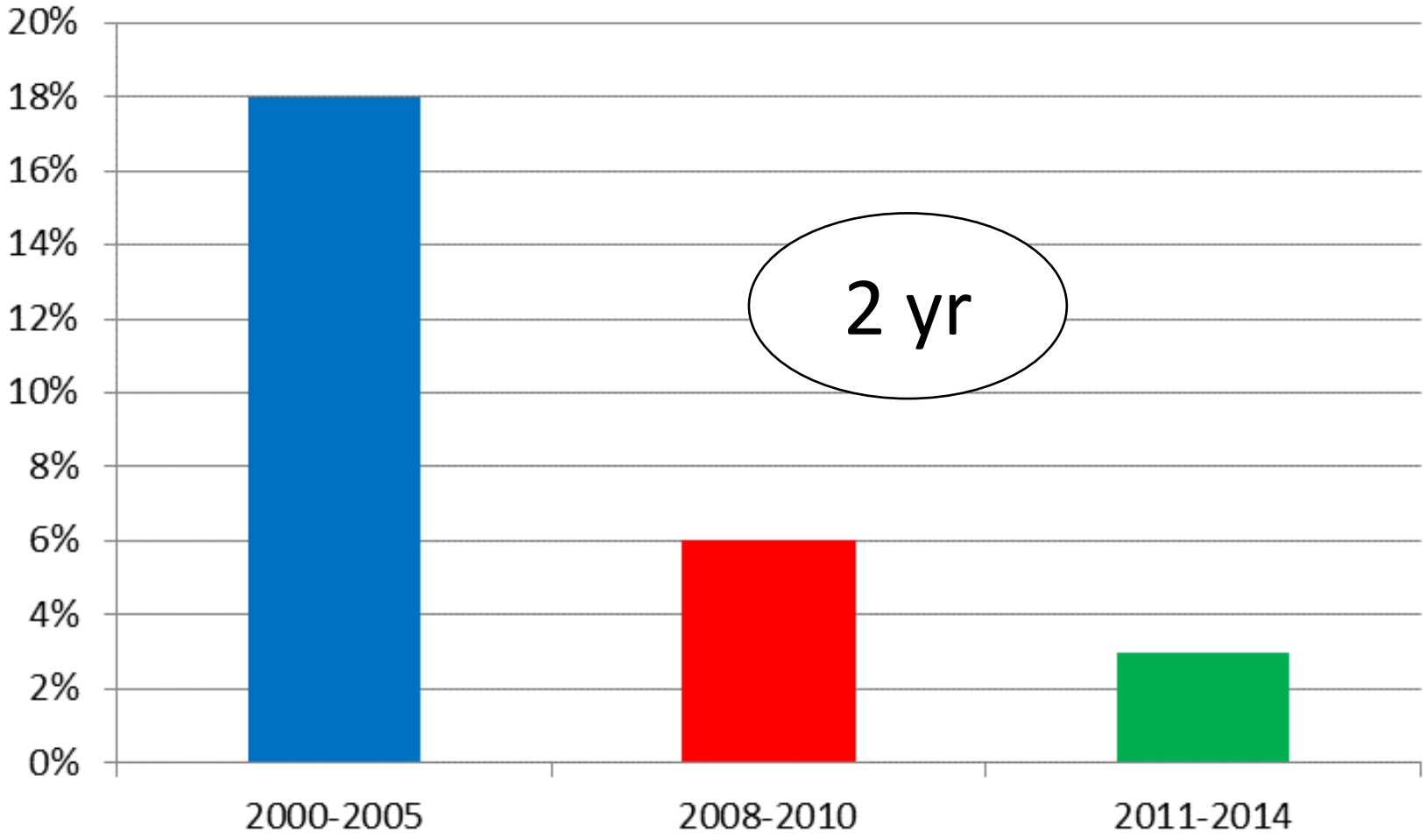
Long-term outcome in TTS:
amnioreduction *vs* laser



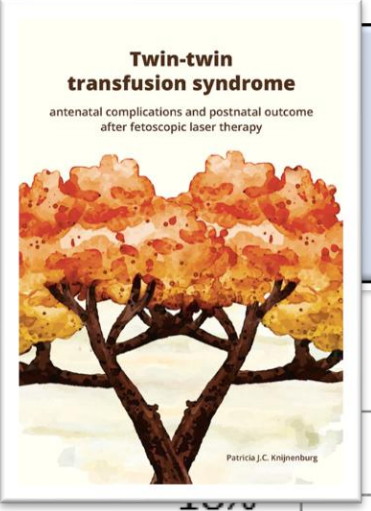


Neurodevelopmental outcome in TTS after laser

(data from Leiden) **Lopriore *AJOG* 2007, van Klink *AJOG* 2014, Spruijt *JCM* 2019**



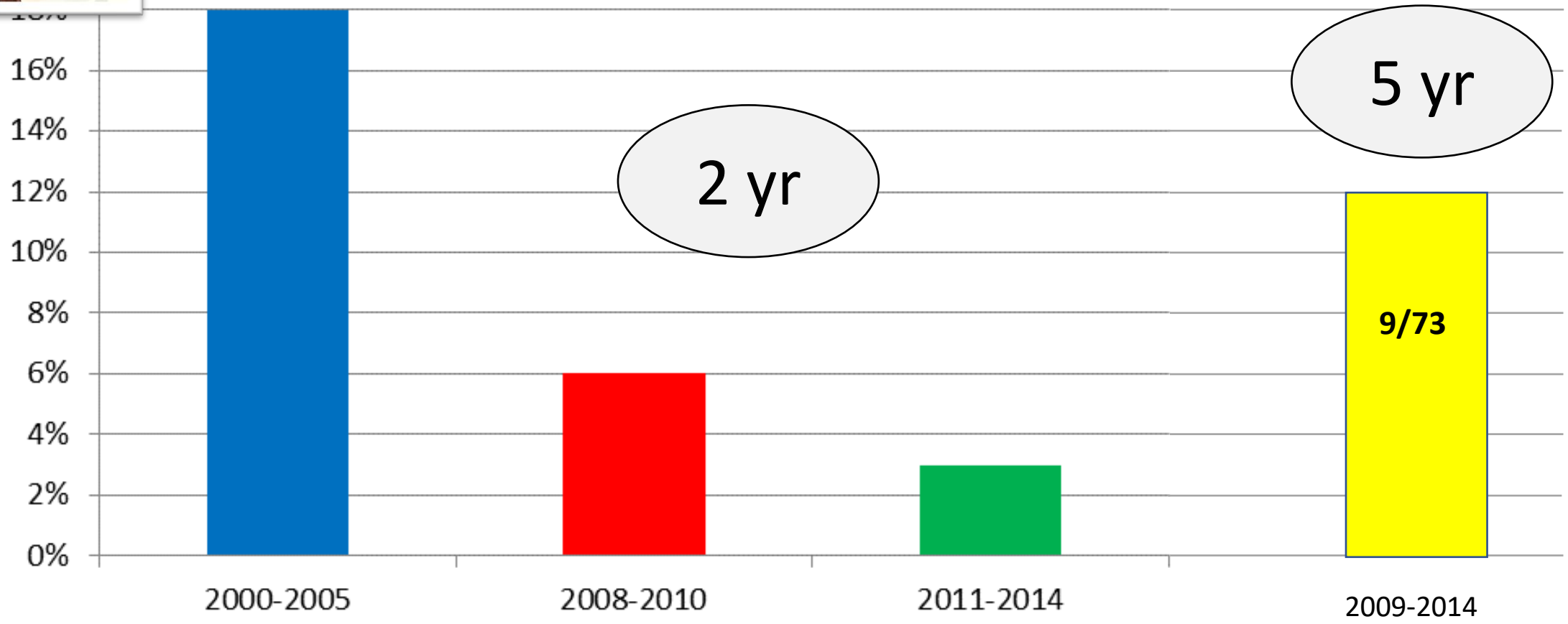
5 yr?



Long-term outcome in TTS after laser

(data from Leiden) **Knijnenburg *J Pediatr* 2021**

Growing into deficit



Risk factors for impairment in TTS

Lopriore *Obstet Gynecol 2009*, van Klink *THRG 2016*

Severe prematurity

Severe cerebral injury

Low parental education leve

Double hit: preterm + TTS

Laser surgery: learning curve!

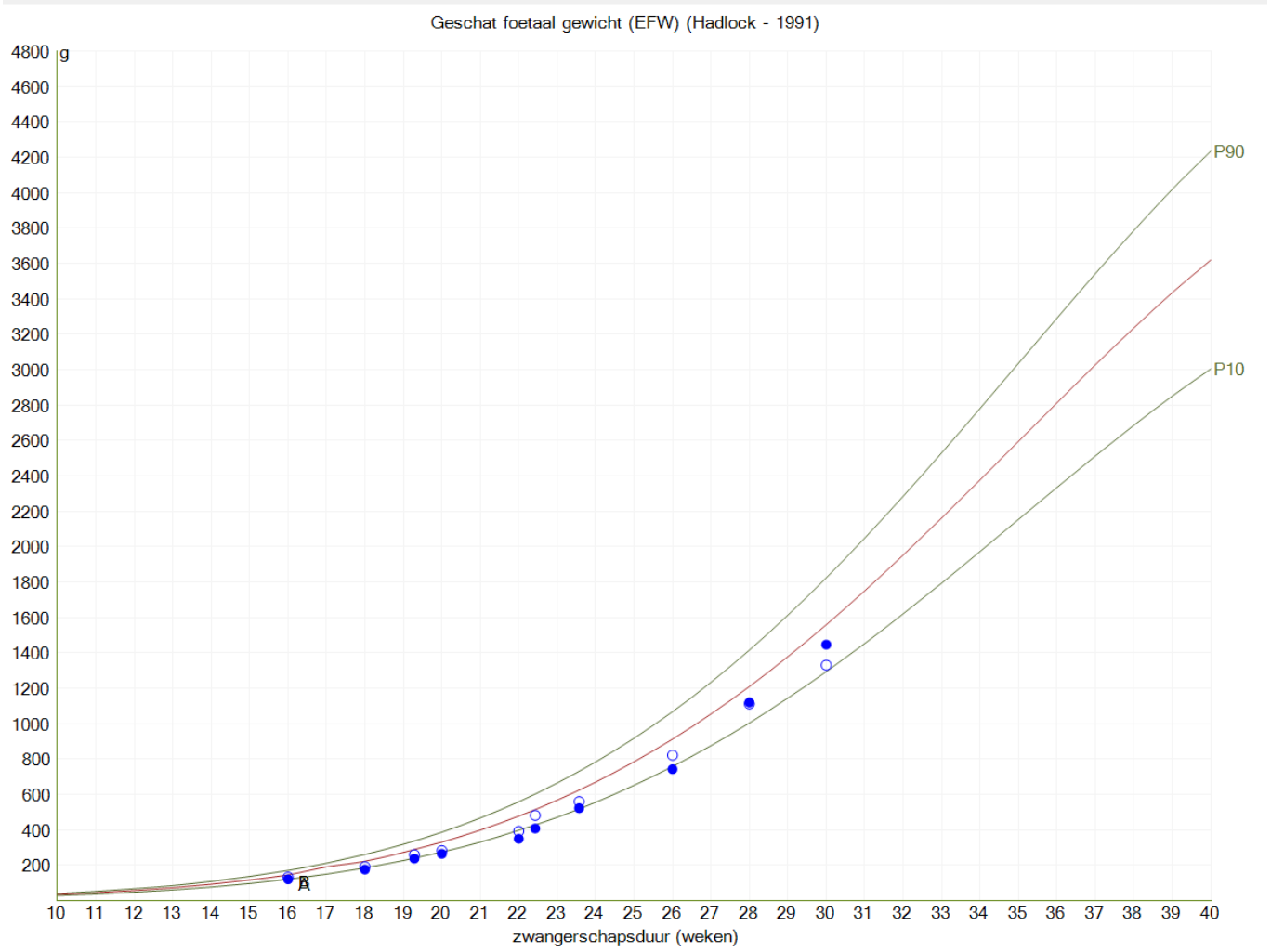




TTS case

Leiden, 2002

- G2P1
- 22^{+2} TTS Q3: laser surgery
- 30^{+5} PPROM
- 31^{+5} fetal tachycardia, chorioamnionitis?: SC



TTS case

Neonatal course

- TTS ex-recipient
- 1495 gr (p50), AS 5/8
- Hb 11.4: new donor?
- Retic 53 ‰

- TTS ex-donor
- 1555 gr (p50), AS 3/6
- Hb 20.3: new recipient?
- Retic 37 ‰

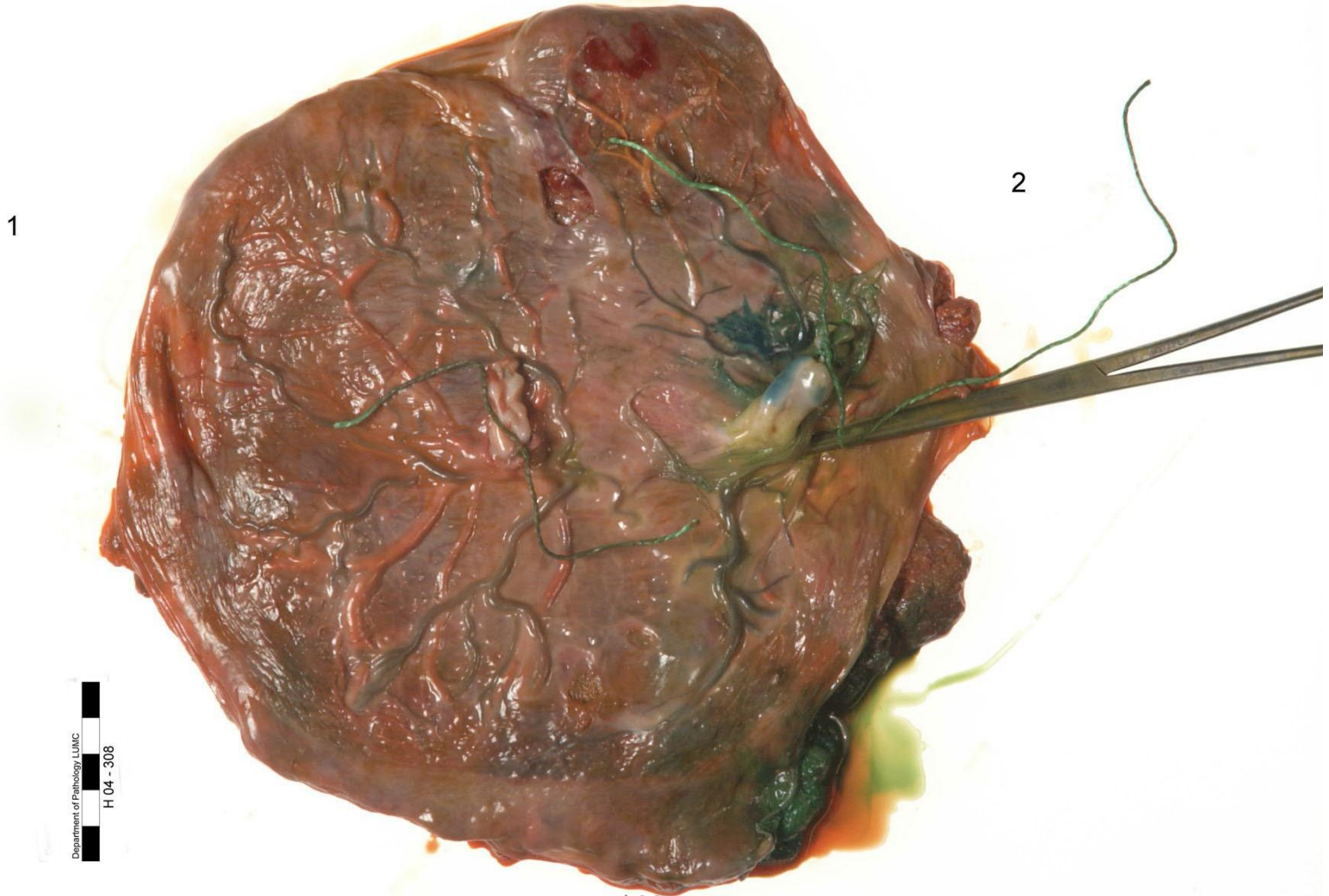
Post-laser TAPS?

- no cerebral injury

- MRI: PVL graad 2

TTS case

Placenta

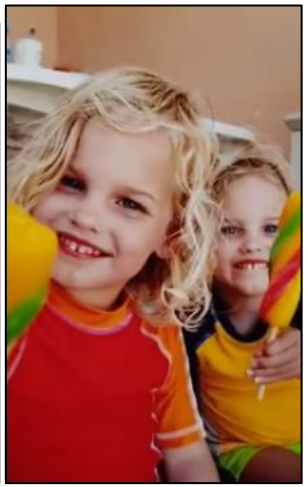


Froukje & Mensje

Long-term outcome

https://youtu.be/Y-TLDZqMHdQ?t=2499



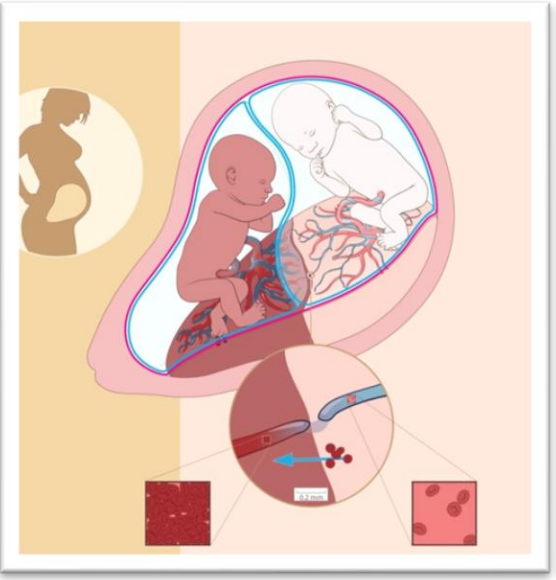


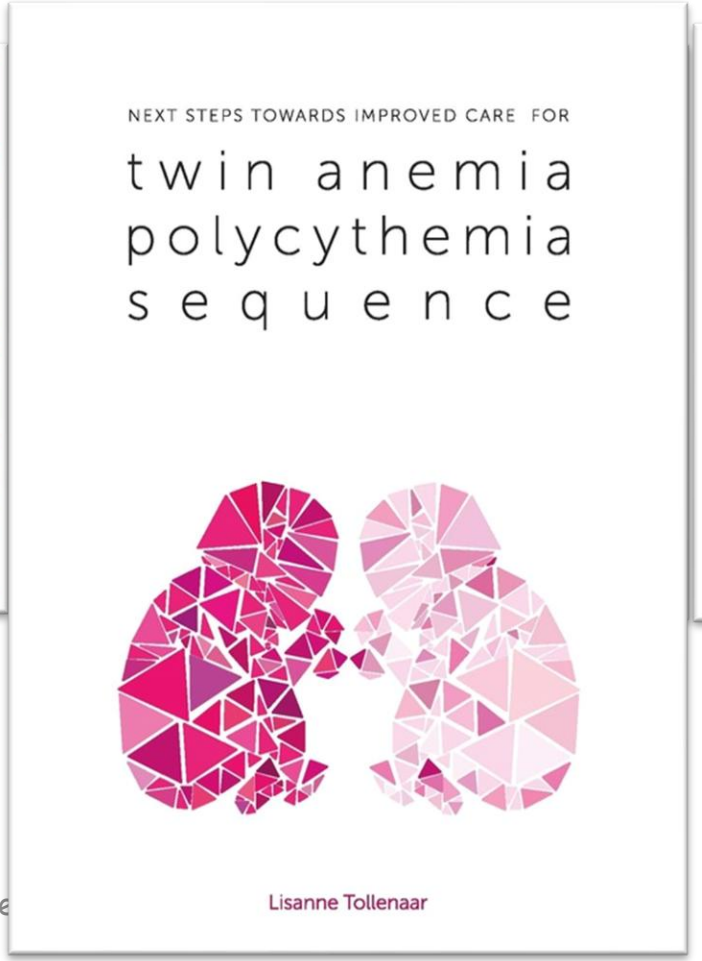

3 Take-back-to-work TTS messages

1. Beware of **neonatal mortality/morbidity**, especially after amioreduction
2. Perform **long-term follow-up** after TTS *(or any fetal surgery)*
3. Centralize laser surgery to increase exposure and improve **learning curve**

Twin Anemia Polycythemia Sequence (TAPS)

What should neonatologists know about
Twin Anemia Polycythemia Sequence (TAPS)





40-63% TAPS missed antenatally

No screening

False negative

Twin Anemia Polycythemia Sequence: Knowledge and Insights After 15 Years of Research. Tollenaar et al. Maternal-Fetal Medicine 2021; 3(1):2-6



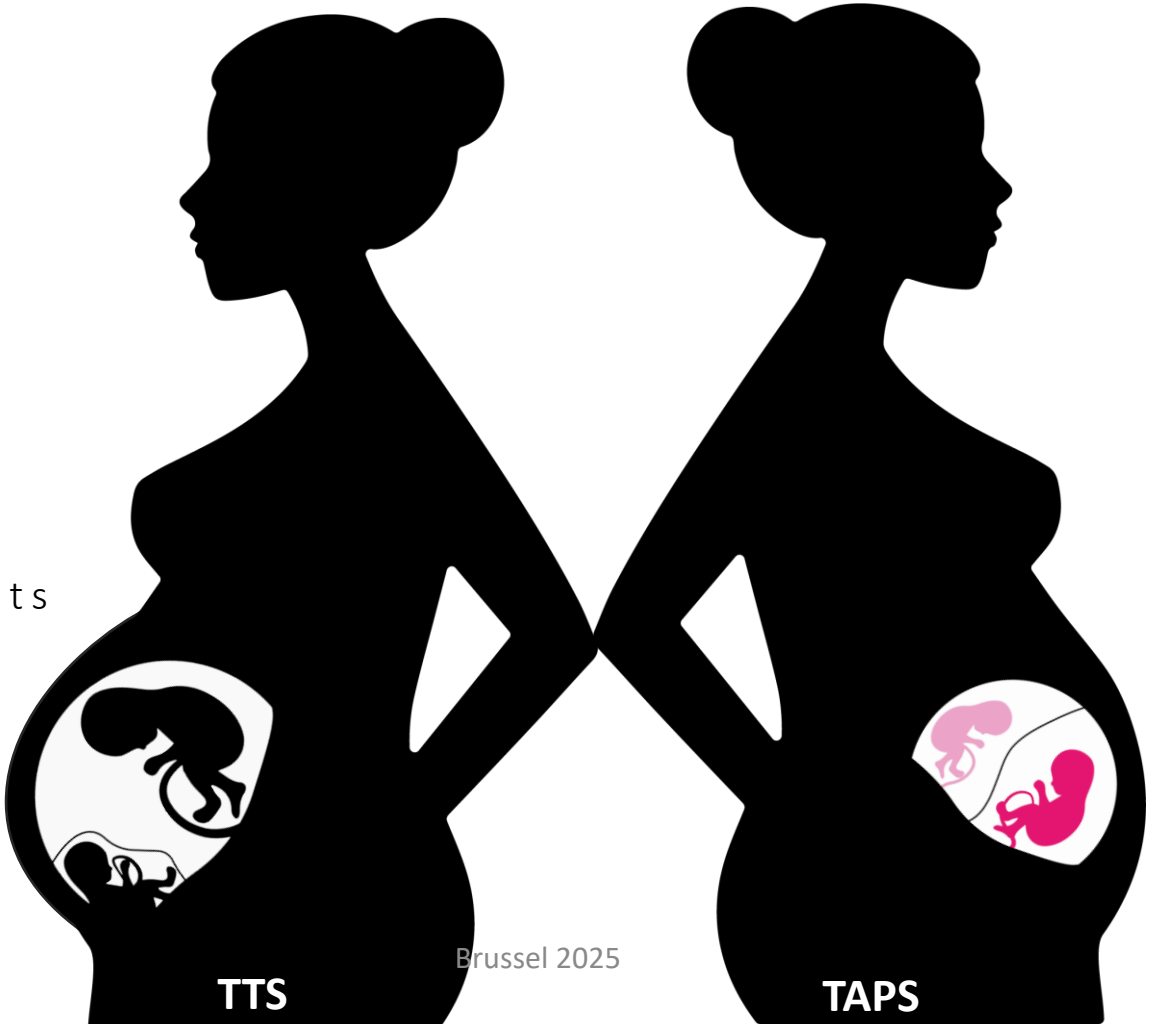
Ceci n’est pas une TTS!



ALARM Symptoms

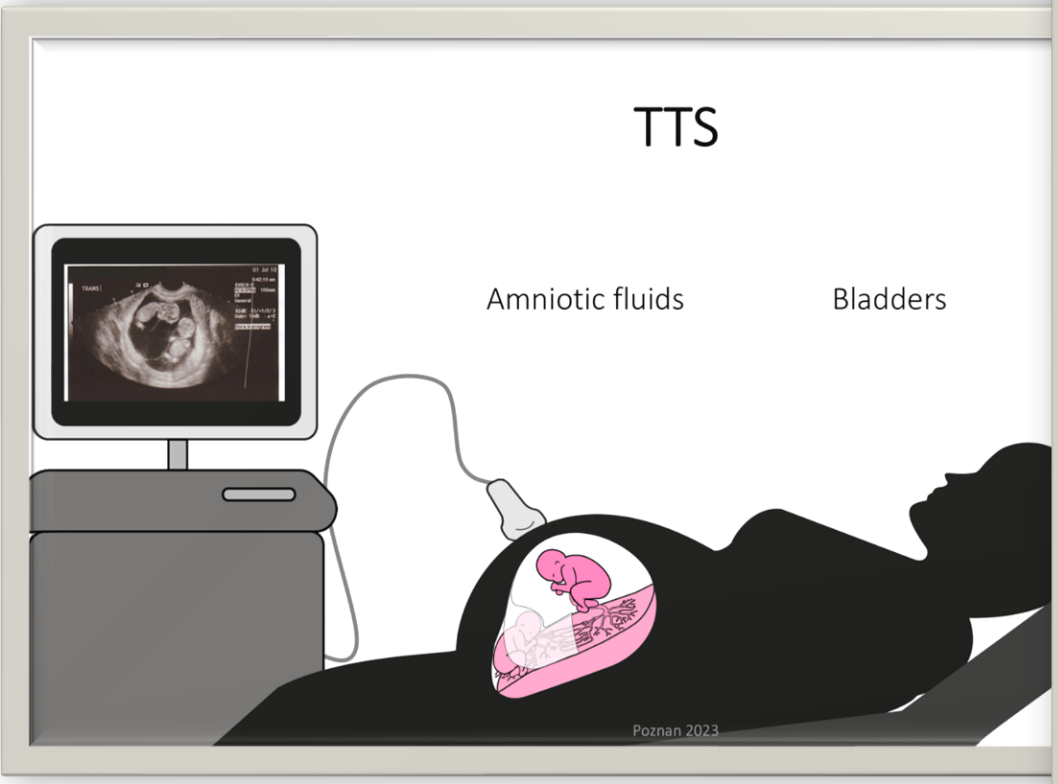
TTS vs. TAPS

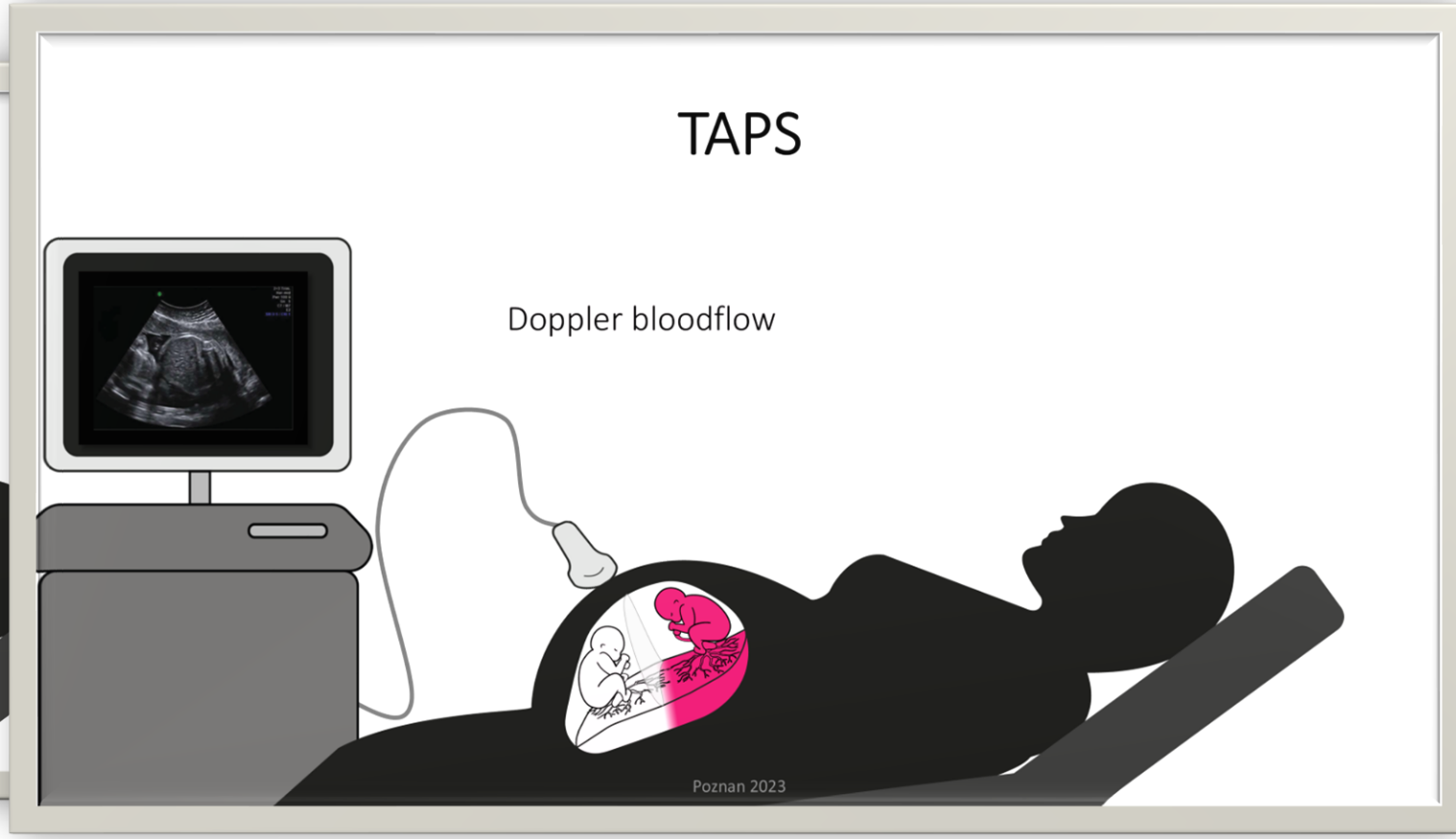
- Rapid growth of belly
- Contractions, PPROM
- Reduced fetal movements
- Shortness of breath



No symptoms!

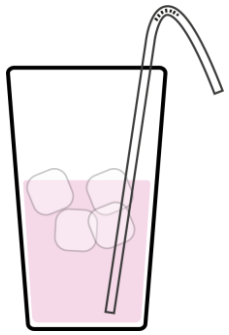
Antenatal diagnosis: **Doppler ultrasound**





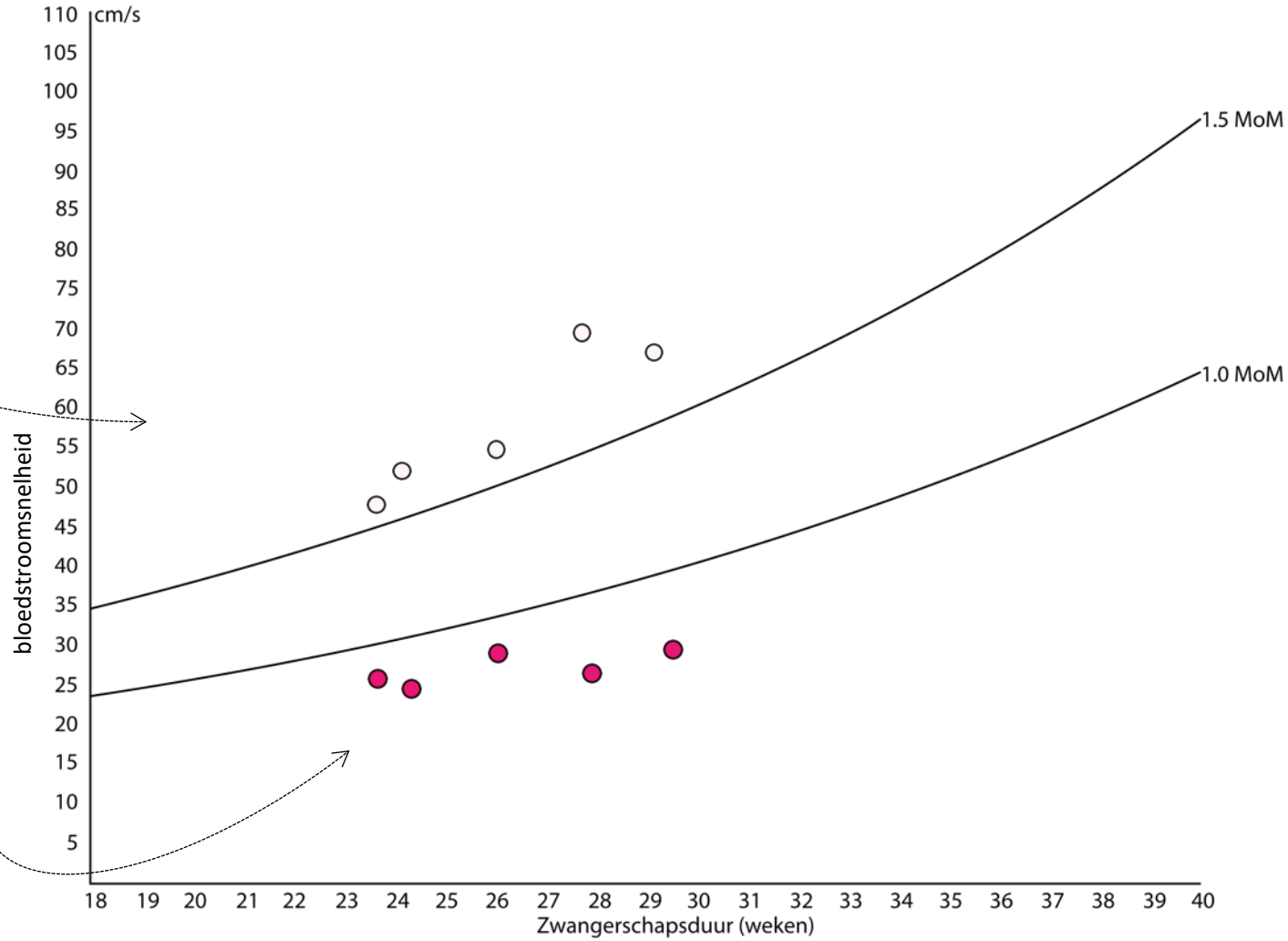
ANTENATAL DIAGNOSIS

BLOOD FLOW VELOCITIES



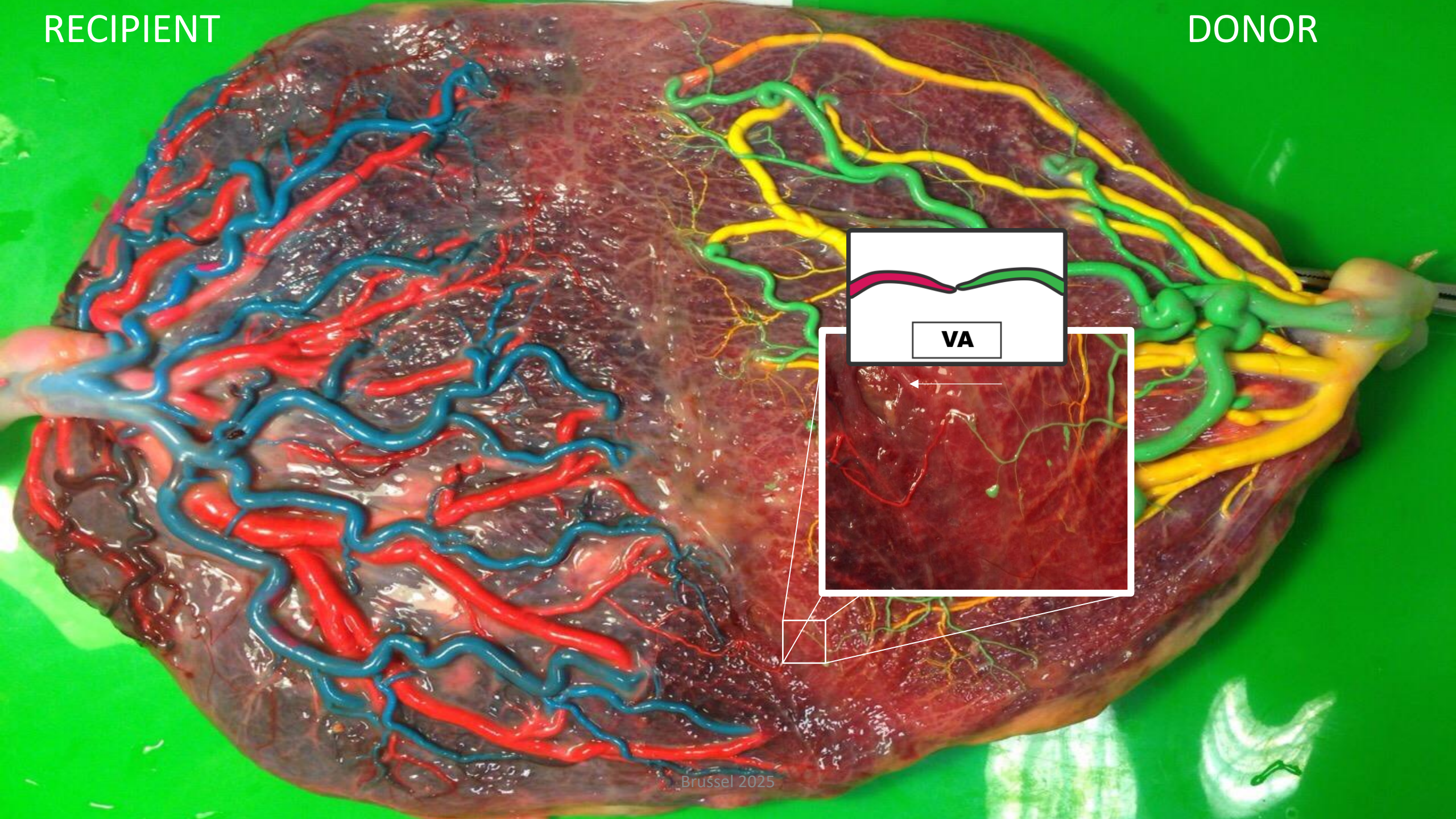
Donor has **thin blood**,
Flows quickly
(blood is like lemonade)

Recipient has **thick blood**,
Flows slowly
(blood thick like ketchup)

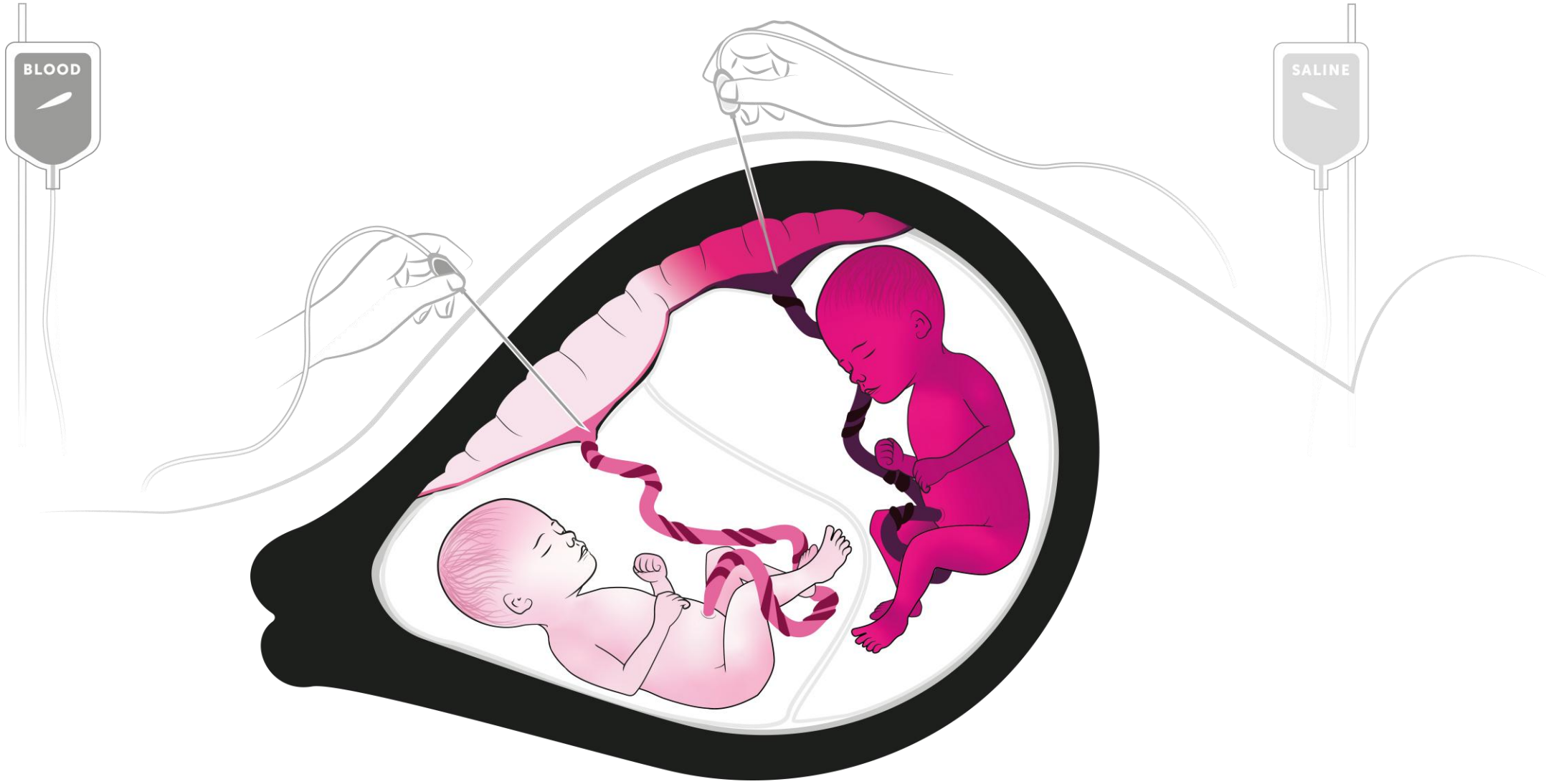


RECIPIENT

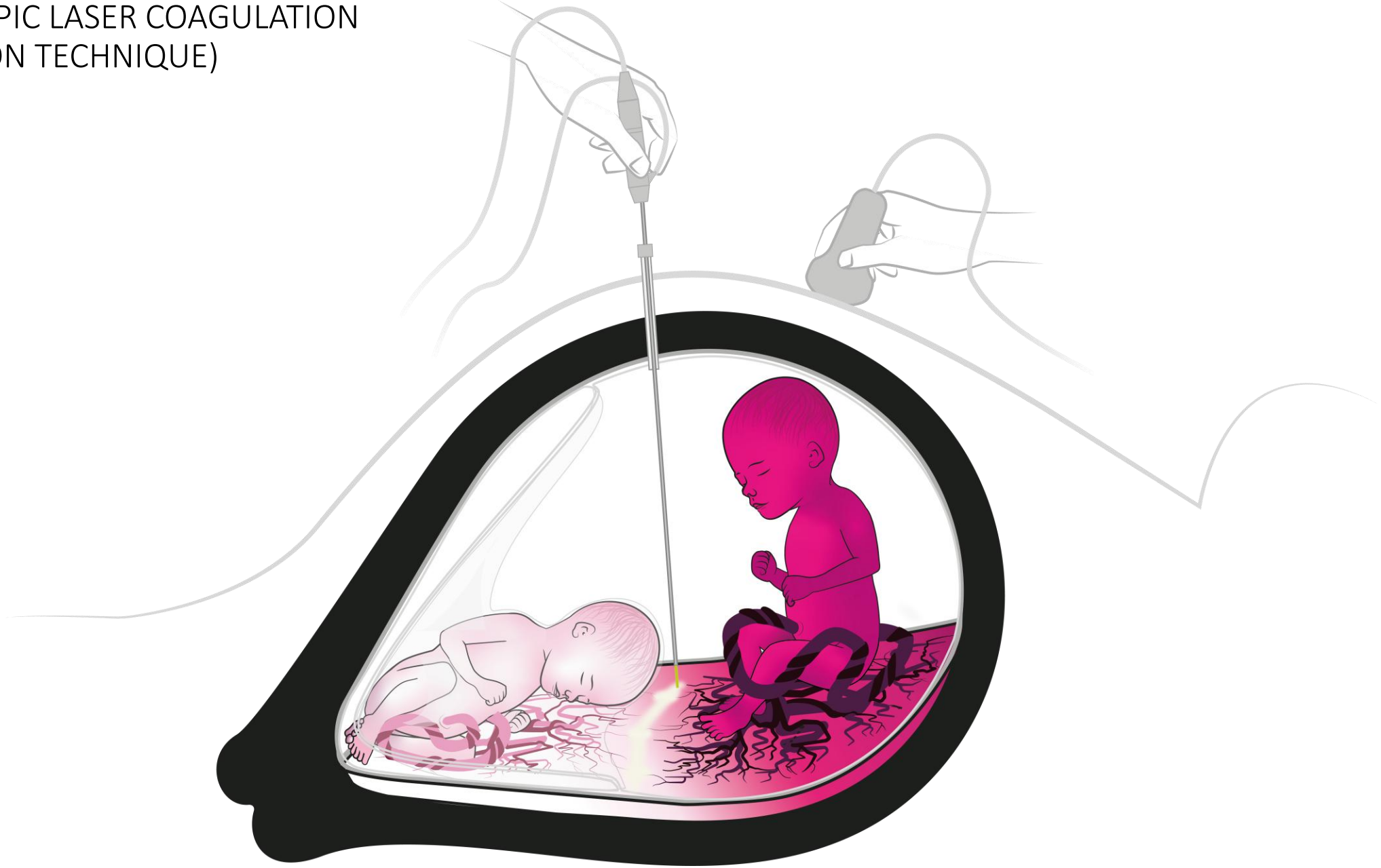
DONOR



IUT (intrauteriene transfusion)
PET (partial exchange transfusion)



FETOSCOPIC LASER COAGULATION (SOLOMON TECHNIQUE)



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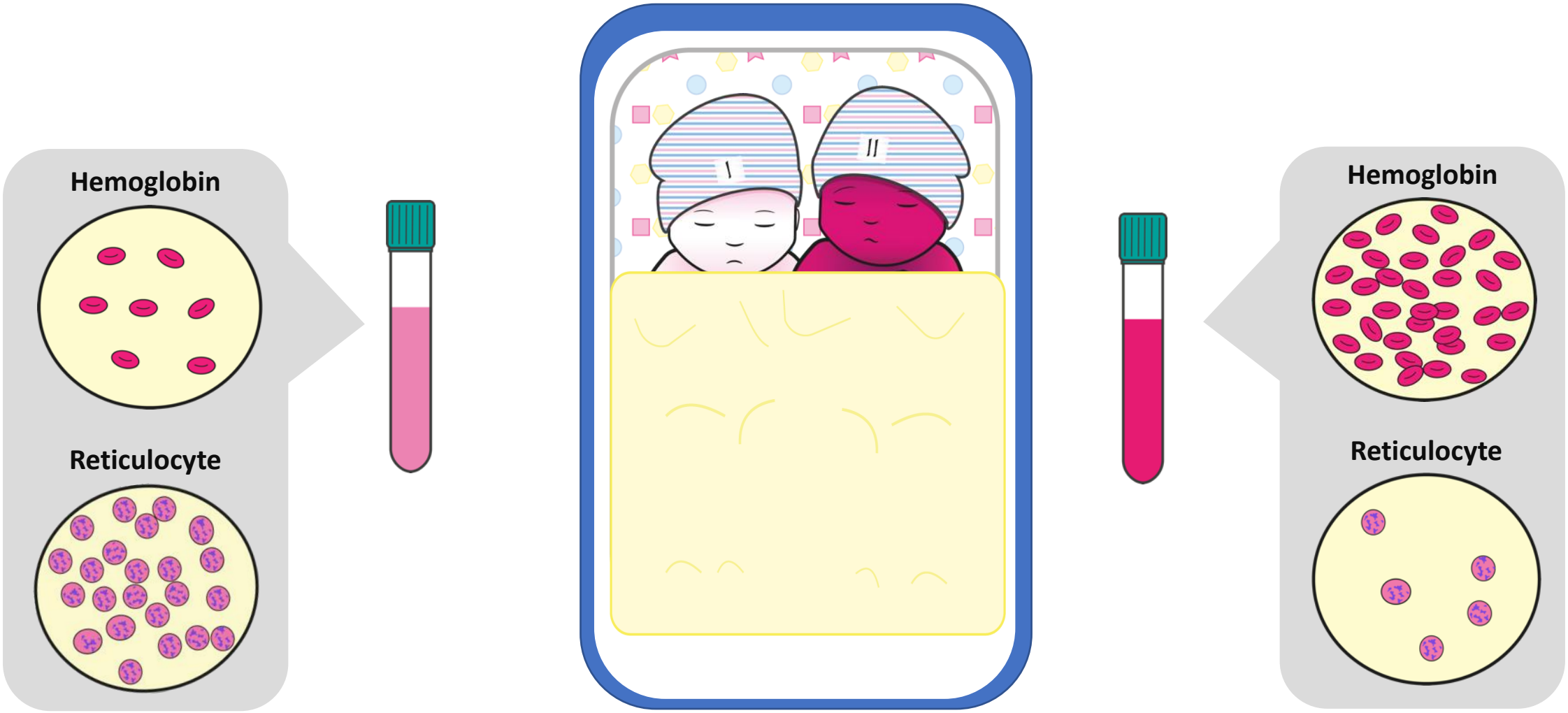
TAPS DIAGNOSIS AT BIRTH



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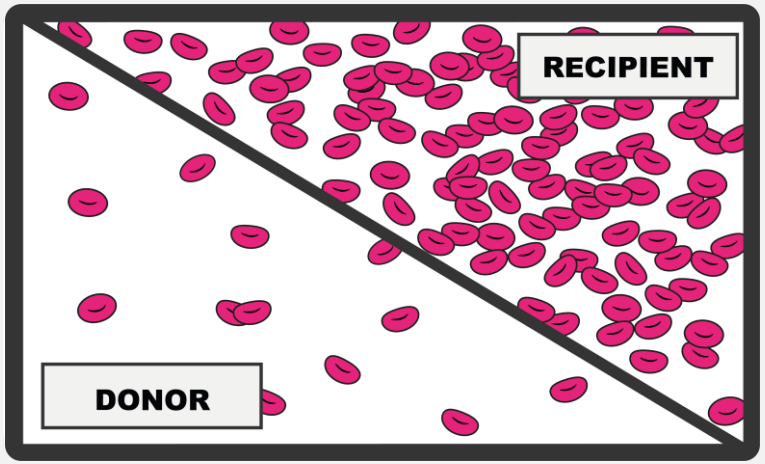
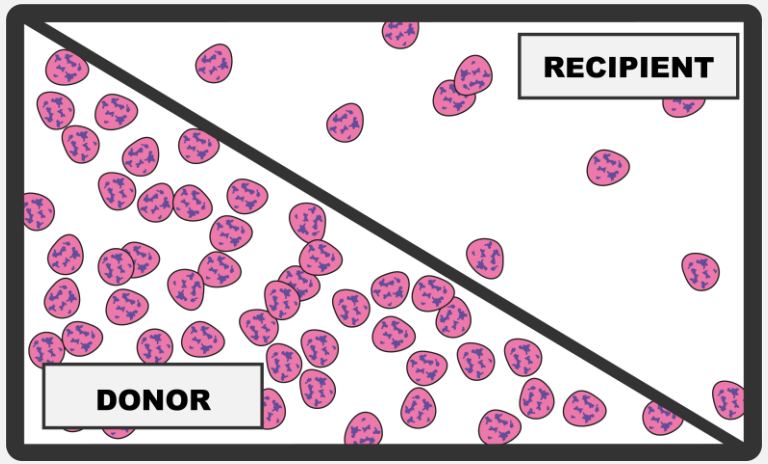
POSTNATAL DIAGNOSIS TAPS



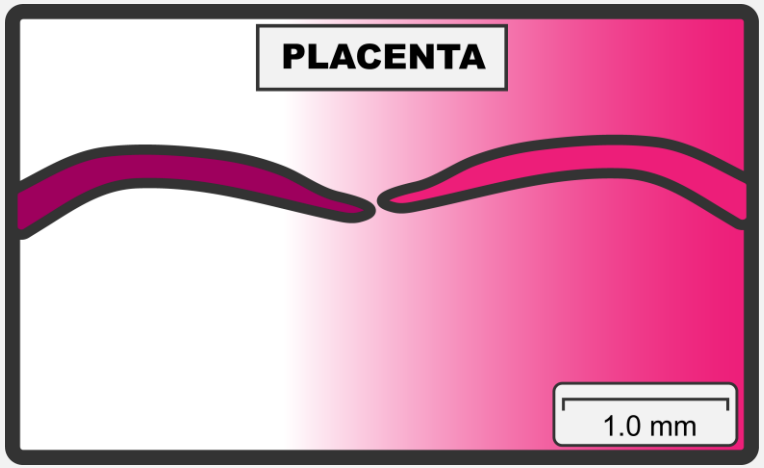
HEMOGLOBIN DIFFERENCE

> 8 g/dL



RETICULOCYTE RATIO (‰)

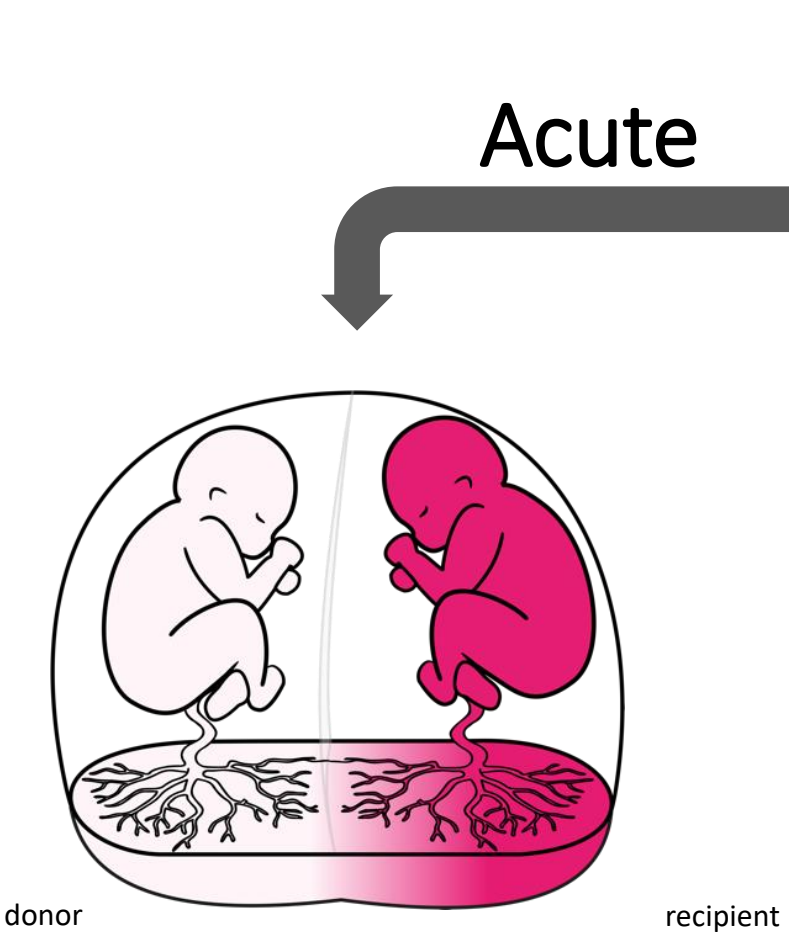
> 1.7

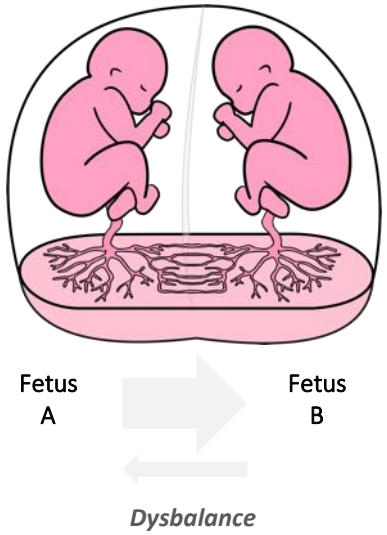


MINUSCULE ANASTOMOSES

diameter < 1 mm

FETO-FETAL TRANSFUSION





1. ACUTE PERIPARTUM TTS

2. PLACENTO-FETAL TRANSFUSION

Diagnostic evaluation **at birth**

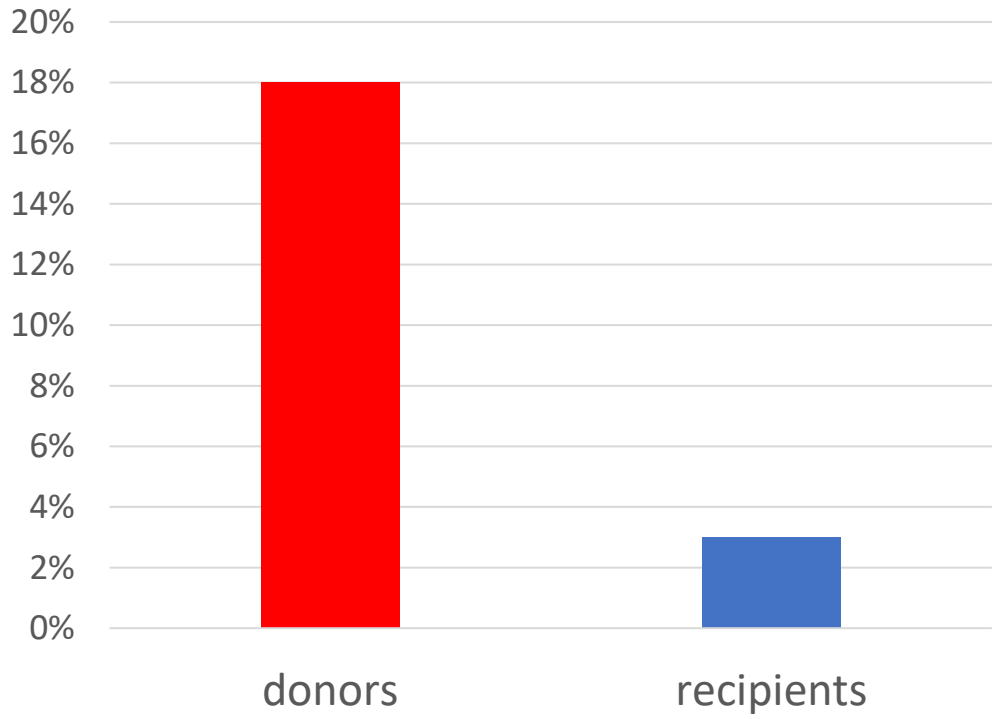
	Acute peripartum TTS	TAPS
Hb discordance	> 8g/dL	> 8g/dL

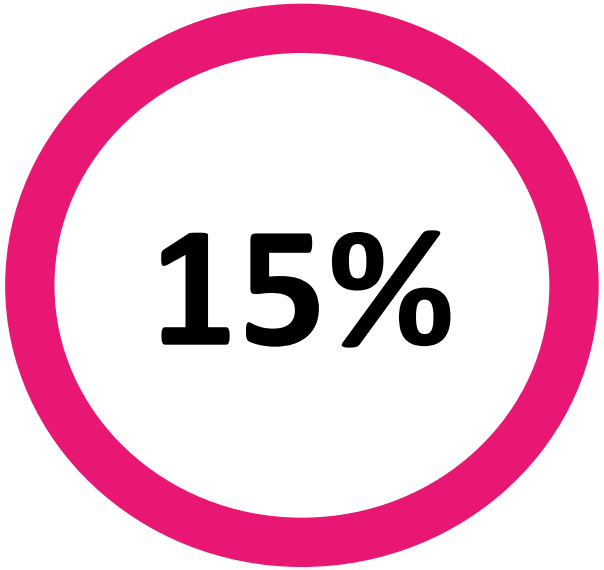
Management at birth

	Acute peripartum TTS	TAPS
donor	• Hypovolemic shock • Quick saline volume bolus	• Normovolemic • Slow RBC transfusion • Hypoglycemia, low albumin, low ferritin
recipient	• Polycythemia + • Often no treatment needed	• Polycythemia ++++ • Partial exchange transfusion

Long-term outcome in **spontaneous** TAPS

Tollenaar *UOG* 2019





Severe NDI

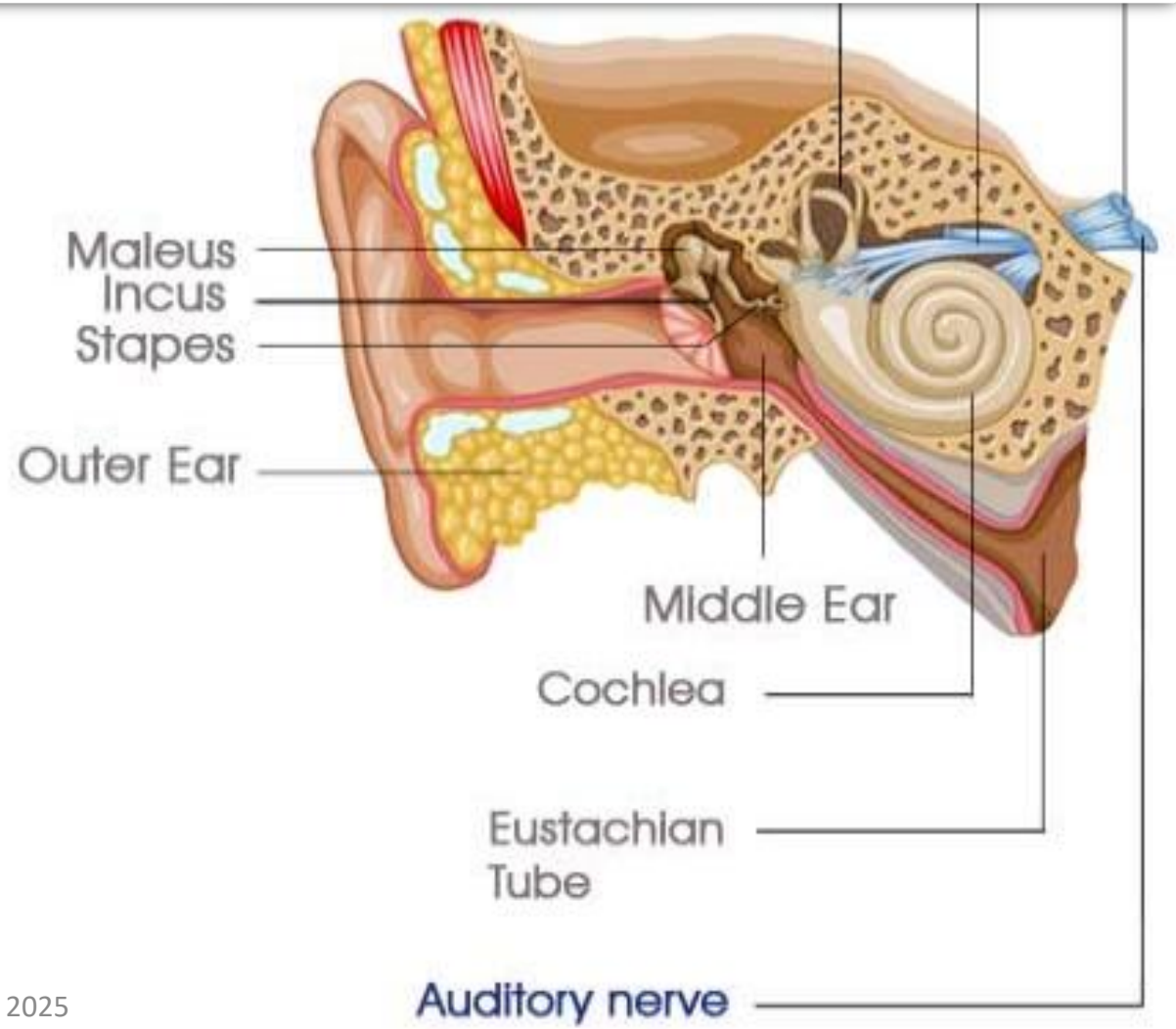
Bilateral deafness

Deafness in spontaneous TAPS donors:

Auditory neuropathy

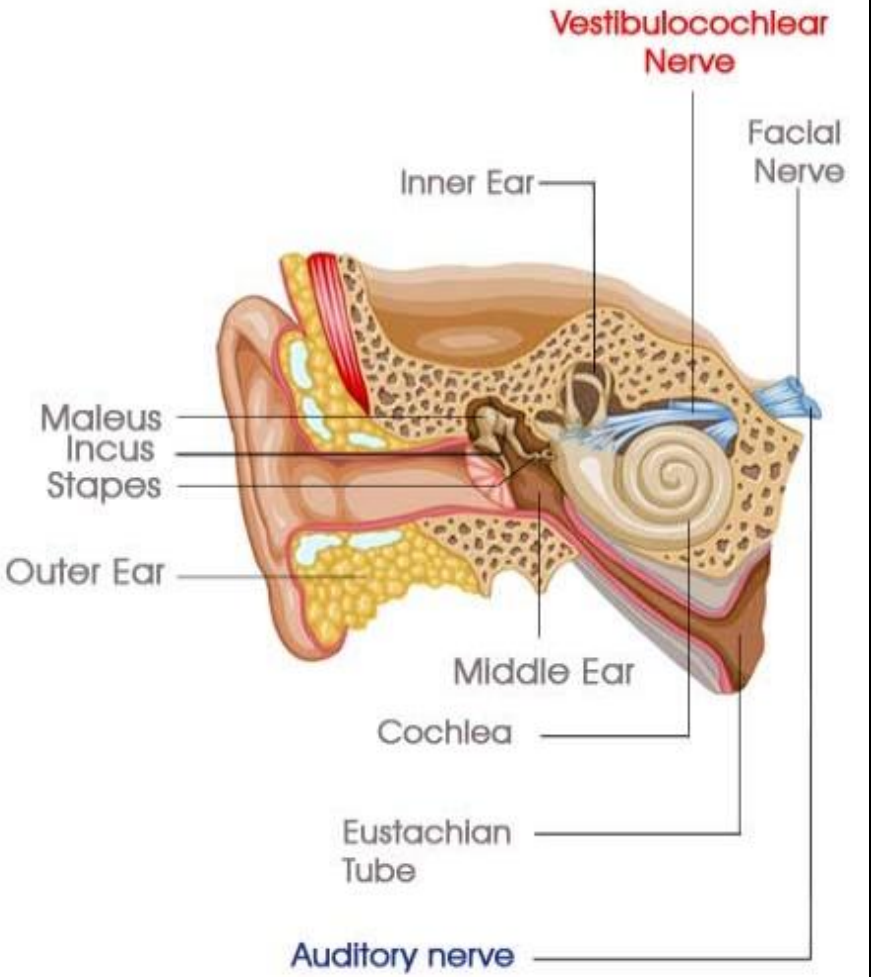
OAE

otoacoustic emissions



Deafness in spontaneous TAPS donors:

Auditory neuropathy



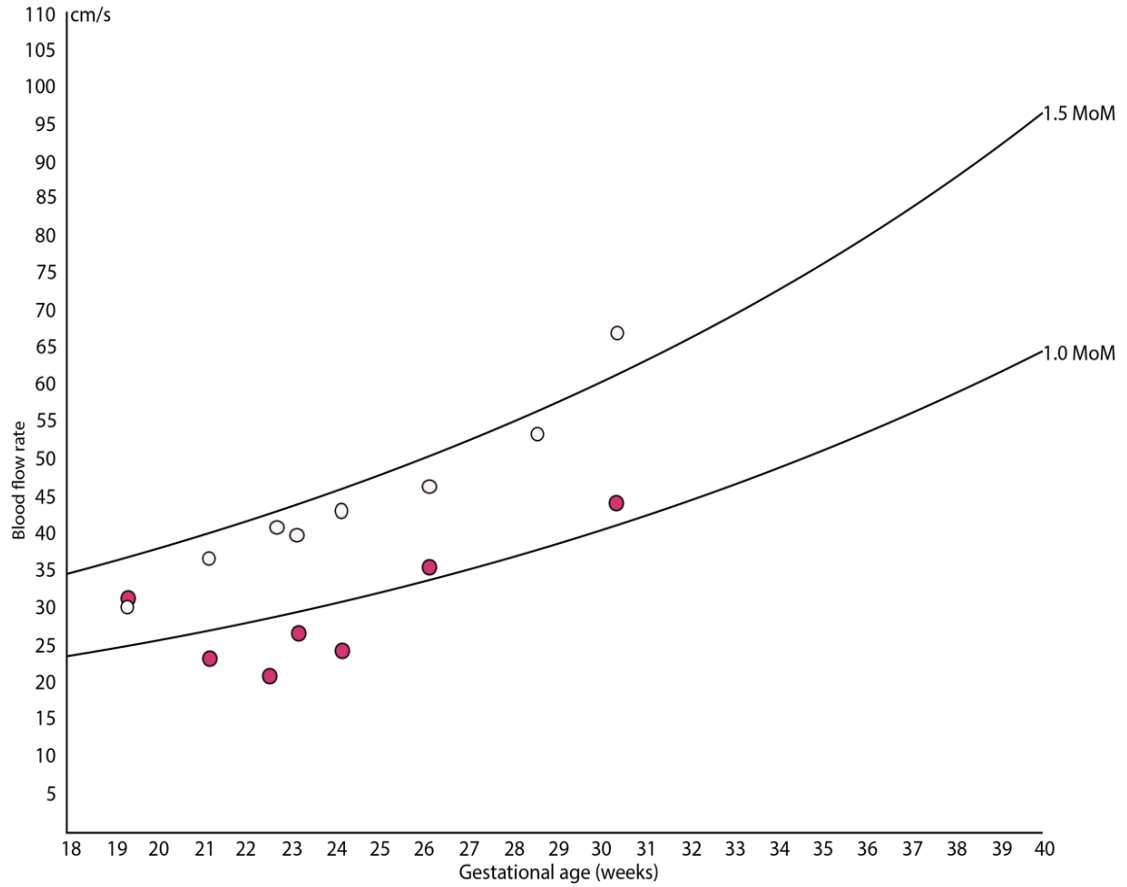
WHY???

1. Chronic fetal anemia/hypoxia
2. Low albumin *(higher bilirubin/albumin ratio->bilirubin-induced injury)*
3. Iron deficiency *(TAPS and the risk of iron deficiency in donors and iron overload in recipients. Rondagh et al. J Perinatol 2025)*
4. Or?

TAPS case

Leiden, 2012

- G3P2
- sFGR, gratacos type 1
- 30^{+1} SC due to fetal distress of IUGR baby



TAPS case

Neonatal course

- Donor
- 843 gr (<p1)
- Hb 3.1
- Retic 363 ‰ (ratio 5)

- Recipient
- 1423 gr (p50)
- Hb 19.2
- Retic 73‰

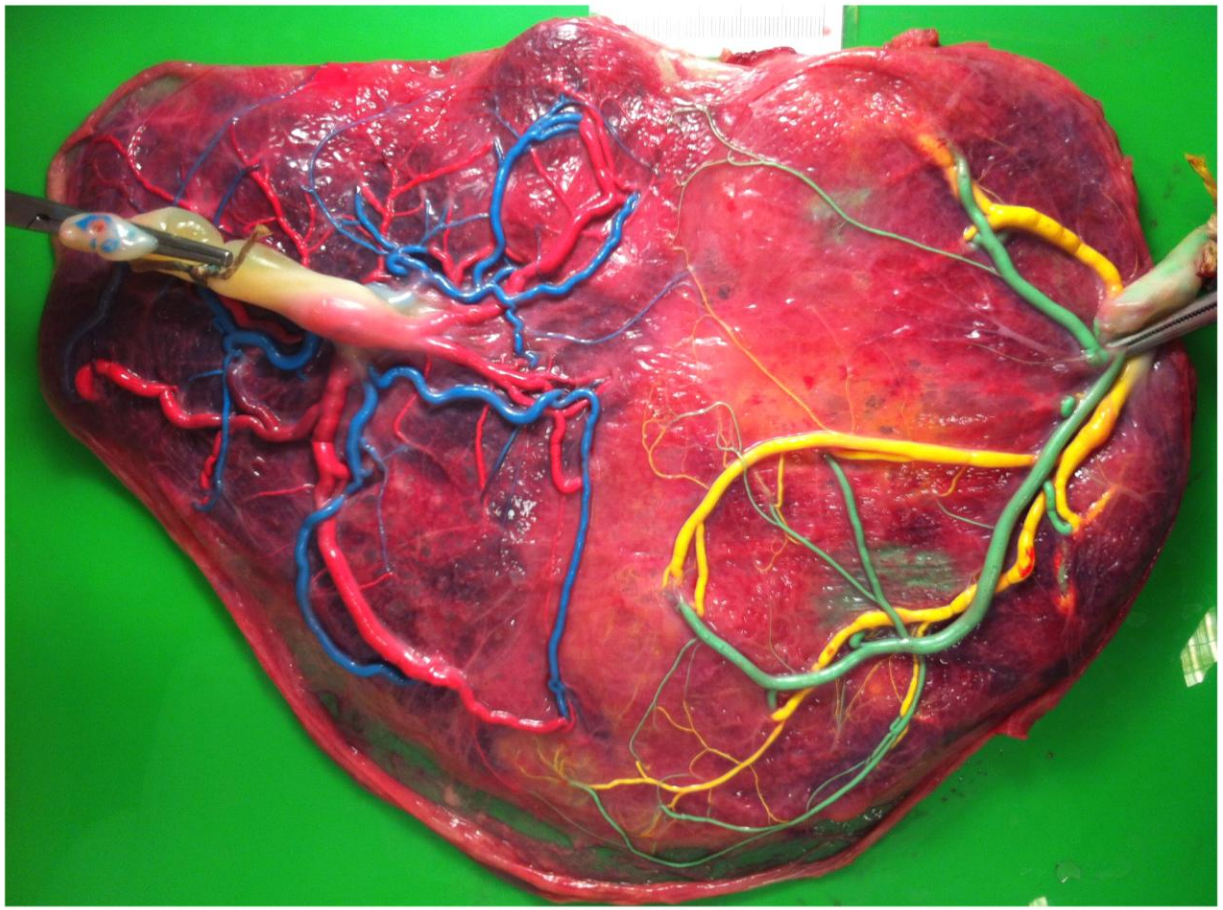
TAPS stage 3

- Severe anemia
- PPHN (HFO, NO, inotropics)

- Bilateral pneumothorax (drains, HFO)
- US; IVH gr3 (L), IVH gr2 (R)

TAPS case

Placenta



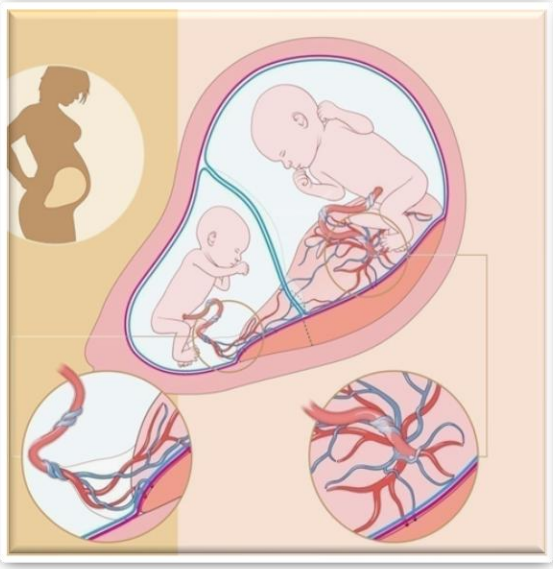
- MRI (term age): both mild WM lesions
- Hearing test OAE: both ormal
- Follow-up at 1yr: moderate motor delay (fysiotherapy)

Donor: Bilateral deafness (ANSD)
Severe developmental (speech) delay

3 Take-back-to-work TAPS messages

1. Measure Hb level *AND* **reticulocyte count**
2. Inject the placenta, or just **flip** it around
3. Beware of **deafness** in donors
   - Do a **BERA** hearing test

Long-term outcome in
selective Fetal Growth Restriction (sFGR)

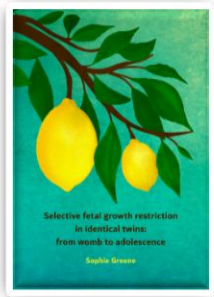


Brussel 2025

Respiratory problems in sFGR

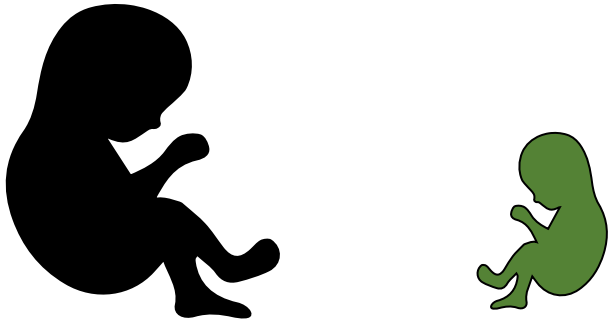
Groene *et al* JCM 2019, E Clinical Med 2021

Respiratory distress syndrome - RDS	+++	-
Chronic Lung Disease - CLD	-	+++

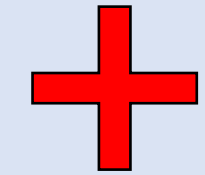


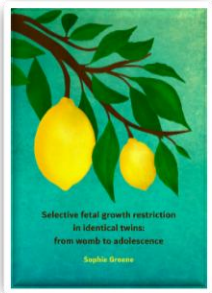
Cerebral injury in sFGR

Groene *et al* JCM 2019, E Clinical Med 2021



Intraventricular hemorrhage - IVH	+	+
Periventricular leucomalacia - PVL		+





Cerebral injury in sFGR

Gratacos *et al* UOG 2004

Table 1 Perinatal outcome in the study groups

	Dichorionic	*Monochorionic no IUGR*	*Monochorionic selective IUGR*	P
n (%)	29	32	42	
Gestational age at delivery (weeks, median (range))	29.9 (26.1–33.6)	30.6 (26.6–33.4)	30.7 (27.2–33.5)	0.08
Birth weight (g, median (range))				
Larger twin	1467 (590–2400)	1547 (610–2370)	1507 (920–2200)	0.35
Smaller twin	1298 (550–2260)	1395 (570–2210)	972 (390–1650)	< 0.0001
Weight discordance (%, median (range))	11 (1–24)	10 (2–23)	37 (25–64)	< 0.0001
Intrauterine death (%)				
Overall	0/58 (0)	0/64 (0)	9/84 (10.7)	< 0.001
Larger twin	0/29 (0)	0/32 (0)	3/42 (7.1)	0.1
Smaller twin	0/29 (0)	0/32 (0)	6/42 (14.2)	< 0.01
At least one	0/29 (0)	0/32 (0)	6/42 (14.2)	< 0.01
Intraventricular hemorrhage (%)				
Overall	6/58 (10.3)	10/64 (15.6)	4/75 (5.3)	0.13
Larger twin	4/29 (13.8)	5/32 (15.6)	2/39 (5.1)	0.31
Smaller twin	2/29 (6.9)	5/32 (15.6)	2/36 (5.5)	0.31
Parenchymal brain damage (%)				
Overall	1/58 (1.7)	0/64 (0)	9/75 (12.0)	< 0.002
Larger twin	1/29 (3.4)	0/32 (0)	8/39 (20.5)	< 0.005
Smaller twin	0/29 (0)	0/32 (0)	1/36 (2.8)	0.42

Cerebral injury in sFGR

Gratacos *et al* UOG 2004

Antenatal cerebral injury due to intertwin blood shift through AA anastomosis

Case	Weight discordance (%)	Intermittent A/REDV	GA at delivery (weeks)	Reason for delivery	Larger twin		Smaller twin	
					Birth weight (g)	Condition	Birth weight (g)	Condition
1	54	No	29	Fetal distress, IUGR	1200	PVL III	550	A&W
2	27	No	28	Fetal distress, IUGR	990	A&W	730	PVL II
3	38	Yes	30	Elective	1180	PVL IV	740	IVH, NND
4	32	Yes	29	Elective	1160	PVL III	790	A&W
5	48	Yes	31	Elective	1380	PVL III	720	A&W
6	44	Yes	30	PROM	1160	Occipital cavitated infarction	—	IUD 28 weeks
7	35	Yes	33	Elective	1300	PVL II	850	A&W
8	41	Yes	31	Elective	1360	PVL IV	800	A&W
9	47	Yes	31	Elective	1600	PVL III	850	A&W

A/REDV, absent or reversed end-diastolic flow velocity in the umbilical artery; A&W, alive and well; GA, gestational age; IUD, intrauterine fetal death; IVH, intraventricular hemorrhage; NND, neonatal death; PROM, premature rupture of membranes; PVL, periventricular leukomalacia (expressed as grade of severity).

Cerebral injury in sFGR

Lopriore *et al* Twin Res Hum Genet 2012

	Small twin (n=47)	Large twin (n=47)	p-value
Birth weight – g (SD)	1411 ± 421	2118 ± 572	.001
Respiratory distress syndrome – no. (%)	3 (6%)	15 (32%)	.001
Patent ductus arteriosus – no. (%)	1 (2%)	5 (11%)	.125
Necrotising enterocolitis – no. (%)	1 (2%)	2 (4%)	1.0
Sepsis– no. (%)	6 (13%)	6 (13%)	1.0
Severe neonatal morbidity – no. (%)	9 (19%)	18 (38%)	.001
Neonatal death – no. (%)	0 (0%)	1 (2%)	1.0
Severe cerebral lesions - no. (%)	0 (0%)	1 (2%)	1.0

Case: type 3 sFGR, emergency CS @ 28^{+6} weeks

Lopriore *et al* Twin Res Hum Genet 2012

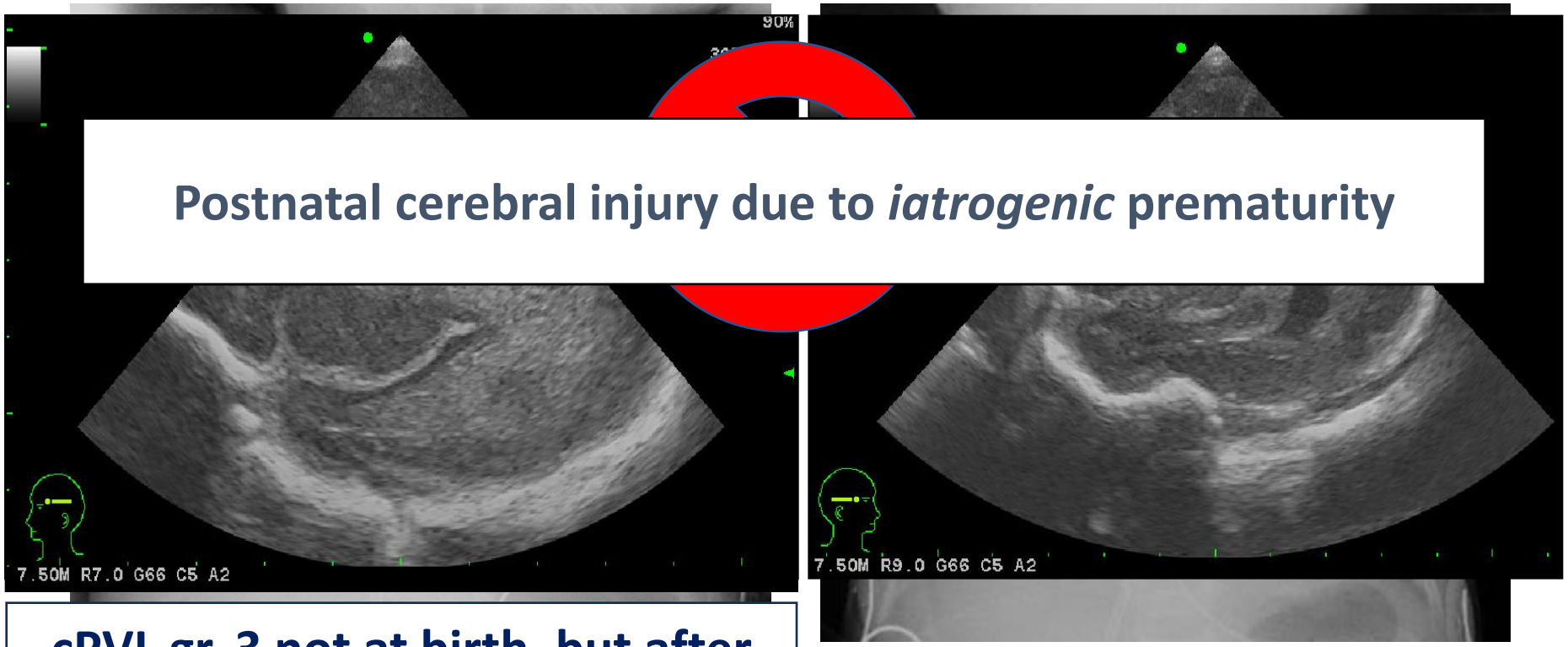
Twin 1 (larger)	Twin 2 (smaller)
BW 1262 gr	BW 880 gr
RDS grade 3	RDS grade 1
HFOV, surfactant	Mild mechanical ventilation
PIE (lung emphysema)	No CLD
cPVL grade 3 @ d14	No PVL
NND @ d16	A &W @ 1 yr of age

Case: type 3 sFGR, emergency CS @ 28^{+6} weeks

Lopriore *et al* Twin Res Hum Genet 2012

Twin 1 (larger)

Twin 2 (smaller)



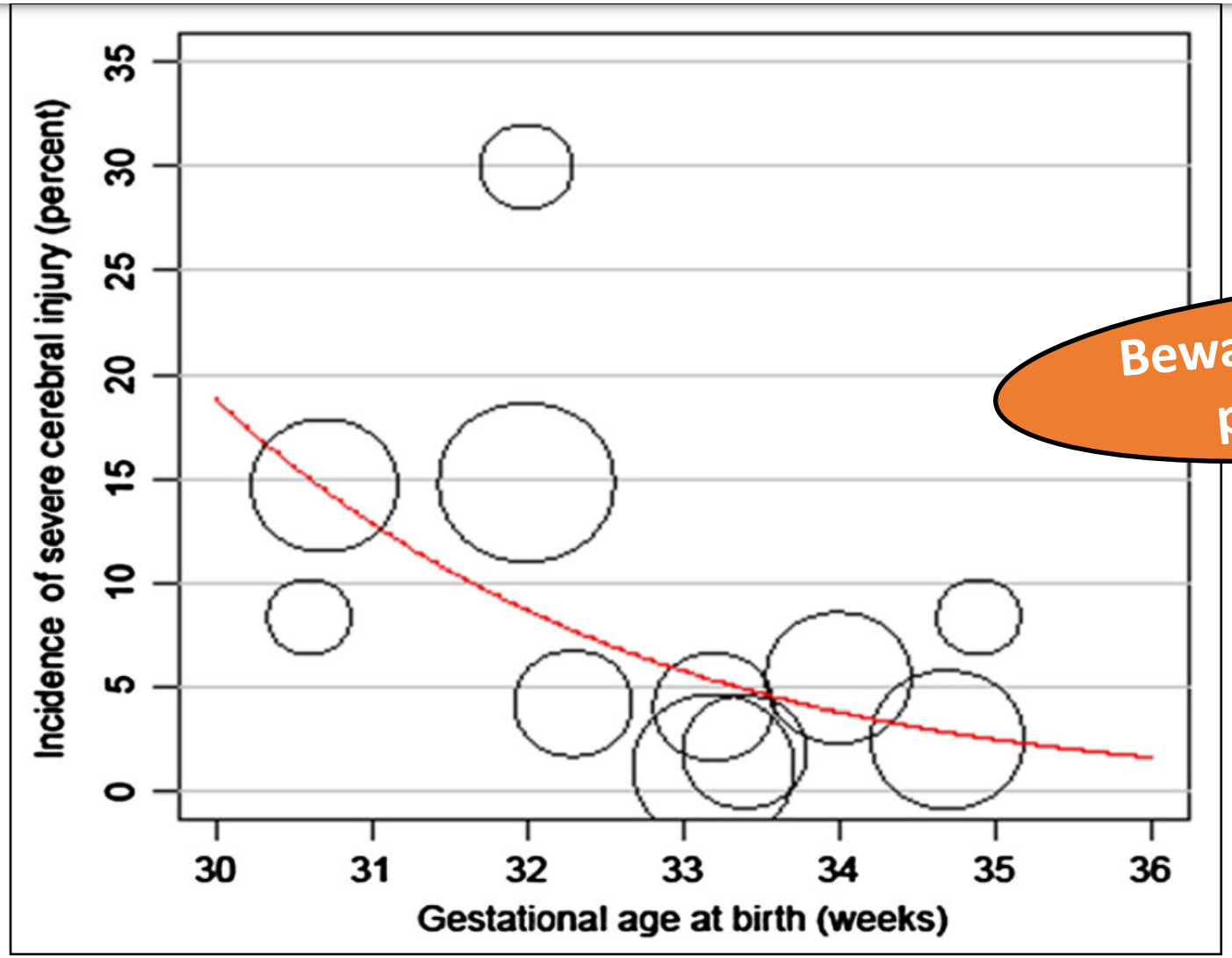
Postnatal cerebral injury due to *iatrogenic* prematurity

cPVL gr. 3 not at birth, but after 14 days

2025

sFGR: cerebral injury and GA at birth

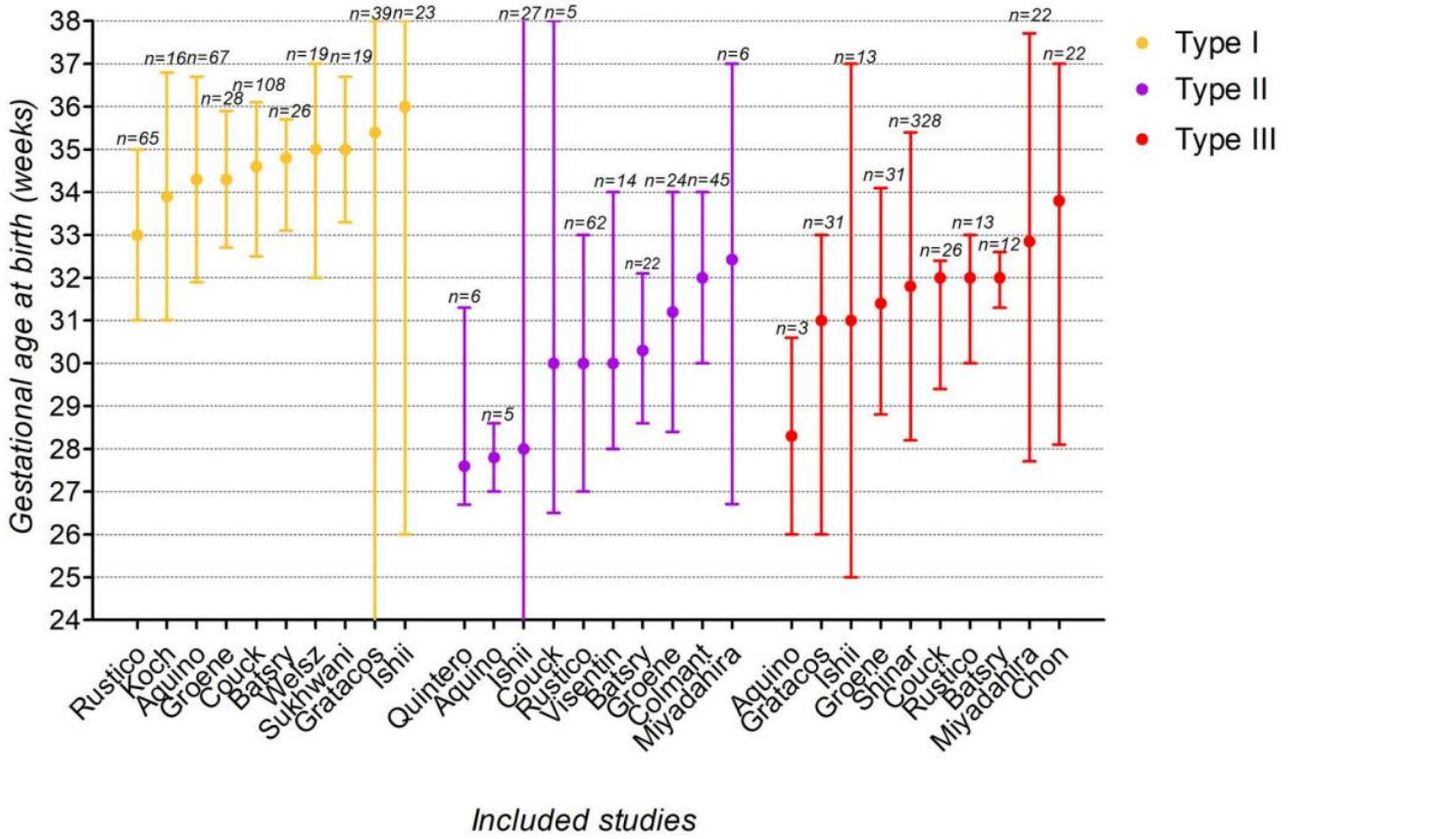
Inklaar *et al* Prenat Diagn 2014



Beware of iatrogenic prematurity!

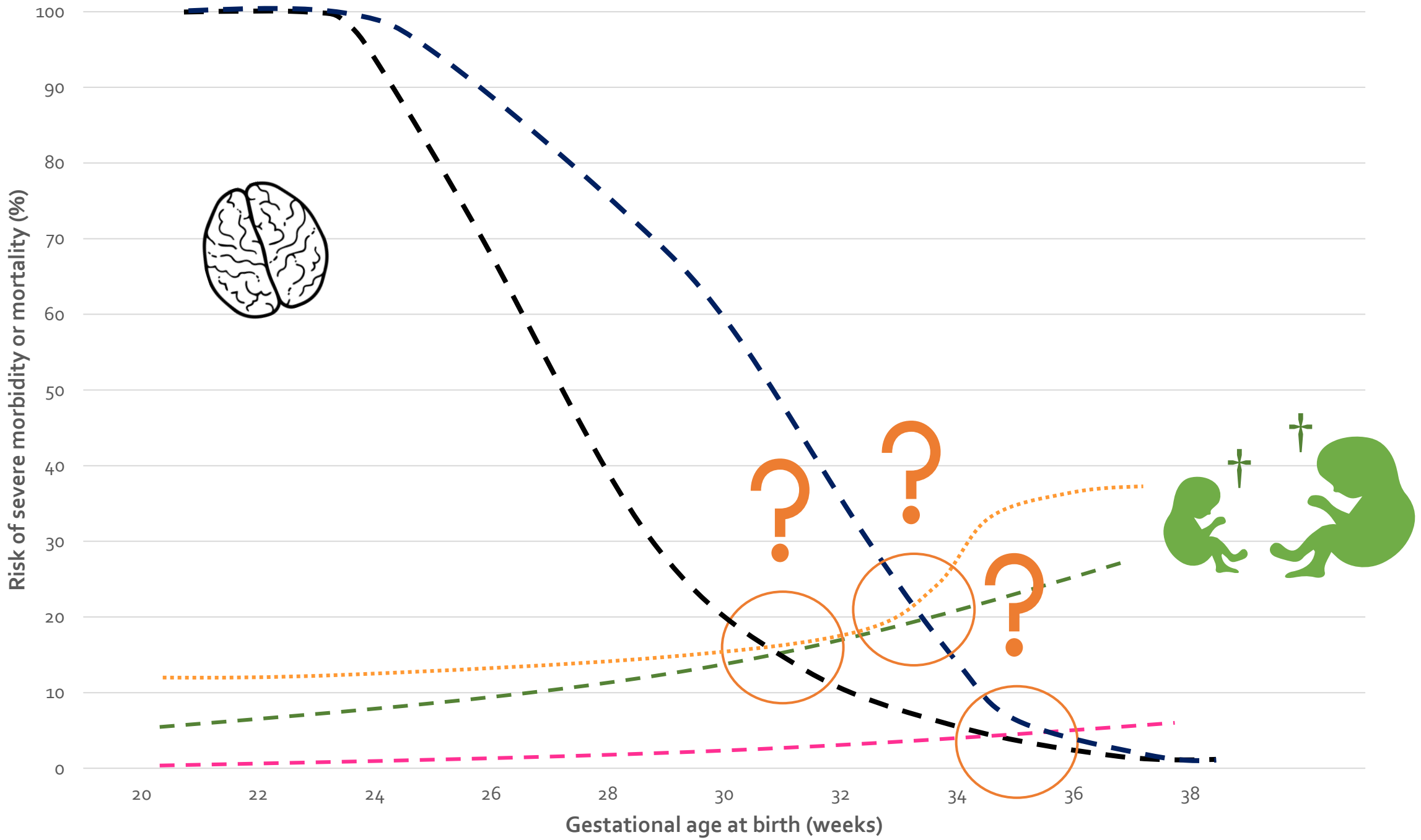
GA at birth and outcome in MC twins with sFGR

El Emrani & Groene *et al Prenat Diagn* 2022



Biggest sFGR-challenge for next decade(s):

Optimal gestational age at birth?


Risk of severe morbidity or mortality (%)
100
90
80
70
60
50
40
30
20
10
0
20
22
24
26
28
30
32
34
36
38
Gestational age at birth (weeks)

Leids Universitair Medisch Centrum

Funded by Hartstichting
Grant: 2017T075

Lemon study

The lifelong effect of fetal growth restriction: neurodevelopmental outcome in growth discordant twins

The Lancet Child and Adolescent Health. 2022 May.

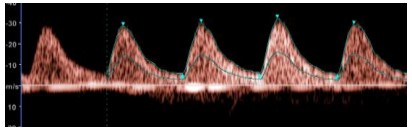
Brussel 2025

Sophie Groene
Postdoctoral researcher
Neonatology
Leiden University Medical Center

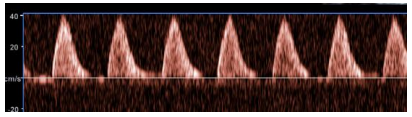
Baseline characteristics

Groene et al *Lancet Child & Adolescent Health* 2022

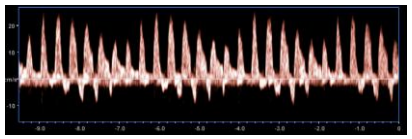
I:



II:



III:



	MC twins (n = 94; 47 pregnancies)	Smaller twin (n = 47 children)	Larger twin (n = 47 children)
Gratacós type			
Type I	24 (51)		
Type II	10 (21)		
Type III	13 (28)		
Gestational age at birth – *weeks*	33.9 (31.3-36.0)		
Birth weight discordance – *%*	30.1 (26.1-33.4)		
Birth weight – *grams*		1400 (1111-1875)	2003 (1600-2680)
Age at participation – *years*	11 (8-13)		

**Type I: positive end-diastolic flow, Type II: persistent absent/reversed end-diastolic flow, Type III: intermittent absent/reversed end-diastolic flow in the umbilical artery of the smaller twin. Data are median (IQR) or n/N (%).*

Neurodevelopment outcome

Groene et al *Lancet Child & Adolescent Health* 2022

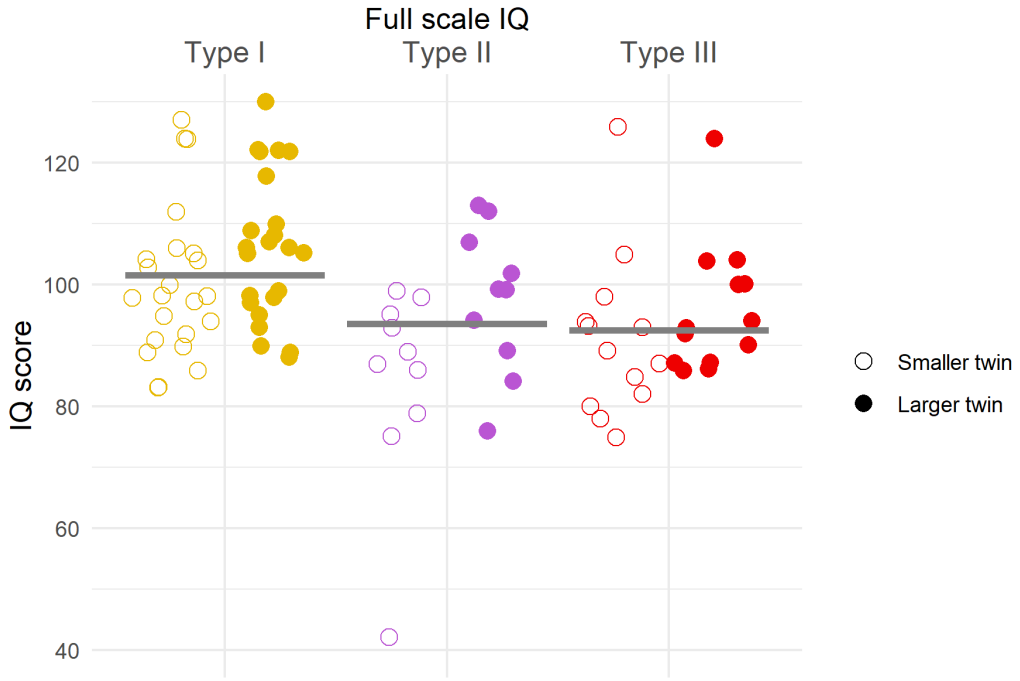
	Smaller twin (n= 47 children)	Larger twin (n= 47 children)	*p*-value
Cognitive test score			
Full scale IQ	94 (86-101)	100 (92-108)	**<0.0001**
Verbal Comprehension	96 (86-103)	103 (92-113)	**<0.0001**
Visual Spatial	92 (85-104)	97 (89-110)	**0.001**
Fluid reasoning	97 (90-105)	100 (93-109)	**0.016**
Working memory	91 (85-100)	99 (88-110)	**<0.0001**
Processing speed	95 (86-106)	100 (94-108)	**<0.0001**
Neurodevelopmental impairment			
Mild	17/47 (36)	5/47 (11)	**0.005**
Severe	2/47 (4)	2/47 (4)	0.591

IQ: intelligence-quotient, SD: standard deviation, MND: minor neurological dysfunction. Data are median (IQR), n (%) or n/N (%).

OR mild NDI: 4.8 (95% CI 1.6-14.1)

Gratacos type & gestational age at birth

Groene et al *Lancet Child & Adolescent Health* 2022



$p = 0.006$

$p < 0.0001$

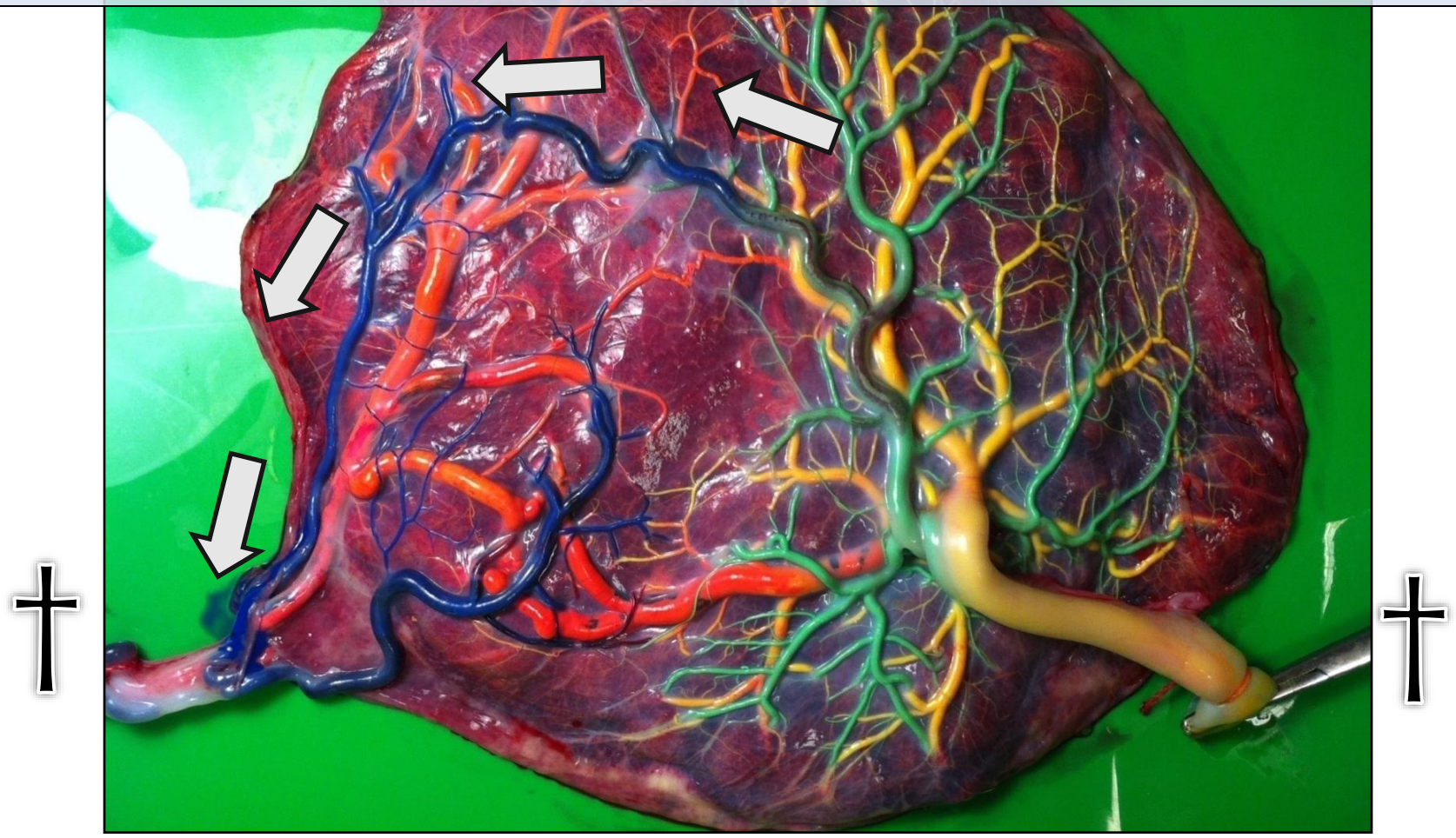
3 Take-back-to-work sFGR messages

1. More **RDS in larger twin**, but more BPD in smaller twin
2. Don’t deliver sFGR **too early**
3. Risk of severe NDI is low, but **5 times higher risk of mild NDI**

Single fetal demise in MC twins

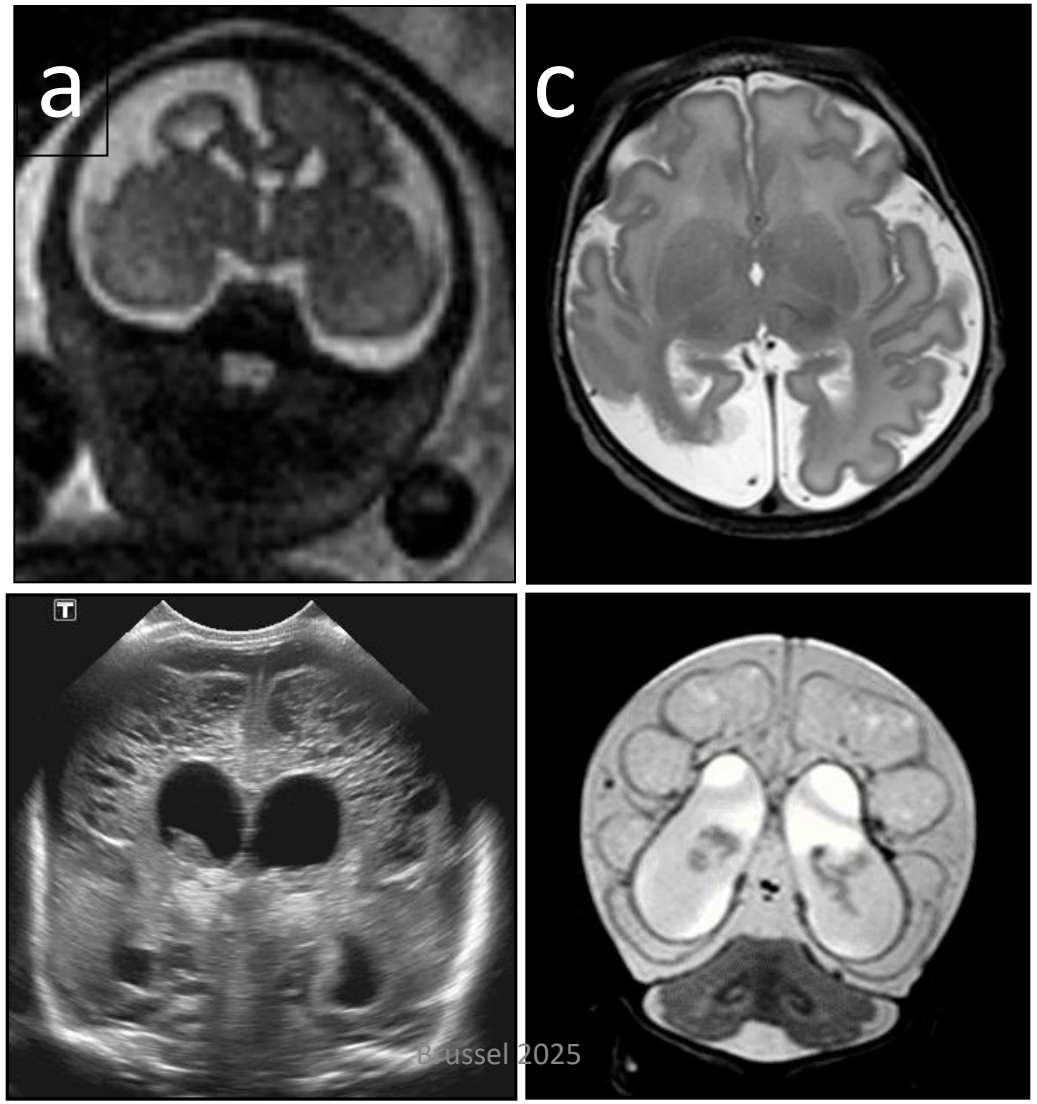
Acute exsanguination, brain injury and perimortem TTS

Acute exsanguination through superficial anastomoses



Single fetal demise in MC pregnancies:

incidence and patterns of cerebral injury – van Klink et al. *UOG* 2014



Reviews

Co-Twin Prognosis After Single Fetal Death

A Systematic Review and Meta-Analysis

Sarah C. Hillman, MRCOG, Rachel K. Morris, MRCOG, Mark D. Kilby, FRCOG

	Monochorionic twins	Dichorionic twins	OR
Co-twin death	15%	3%	5.2
Preterm delivery <34wk	68%	54%	1.1
Cerebral injury (US/MRI)	34%	16%	3.2
Neurodevelopmental impairment	26%	2%	4.8

Obstet Gynecol 2011; 118:928-40

BJOG: An International Journal of Obstetrics & Gynaecology

WILEY

BJOG An International Journal of Obstetrics and Gynaecology

SYSTEMATIC REVIEW OPEN ACCESS

Brain Injury and Neurodevelopmental Outcome in Survivors After Spontaneous Single Fetal Demise in Monochorionic Twins: A Systematic Review and Meta-Analysis

Mathies Rondagh[1] | Lotte C. M. Zwinkels[1] | Jeanine M. M. van Klink[1] | Linda S. de Vries[1] | Sylke J. Steggerda[1] | Femke Slaghekke[2] | E. J. T. (Joanne) Verweij[2] | Monique C. Haak[2] | Sophie G. Groene[1] | Enrico Lopriore[1]

[1]Division of Neonatology, Department of Pediatrics, Willem-Alexander Children's Hospital, Leiden University Medical Center, Leiden, the Netherlands | [2]Division of Fetal Medicine, Department of Obstetrics, Leiden University Medical Center, Leiden, the Netherlands

Correspondence: Mathies Rondagh (m.rondagh@lumc.nl)

Received: 5 May 2025 | **Revised:** 5 September 2025 **Accepted:** 31 October 2025

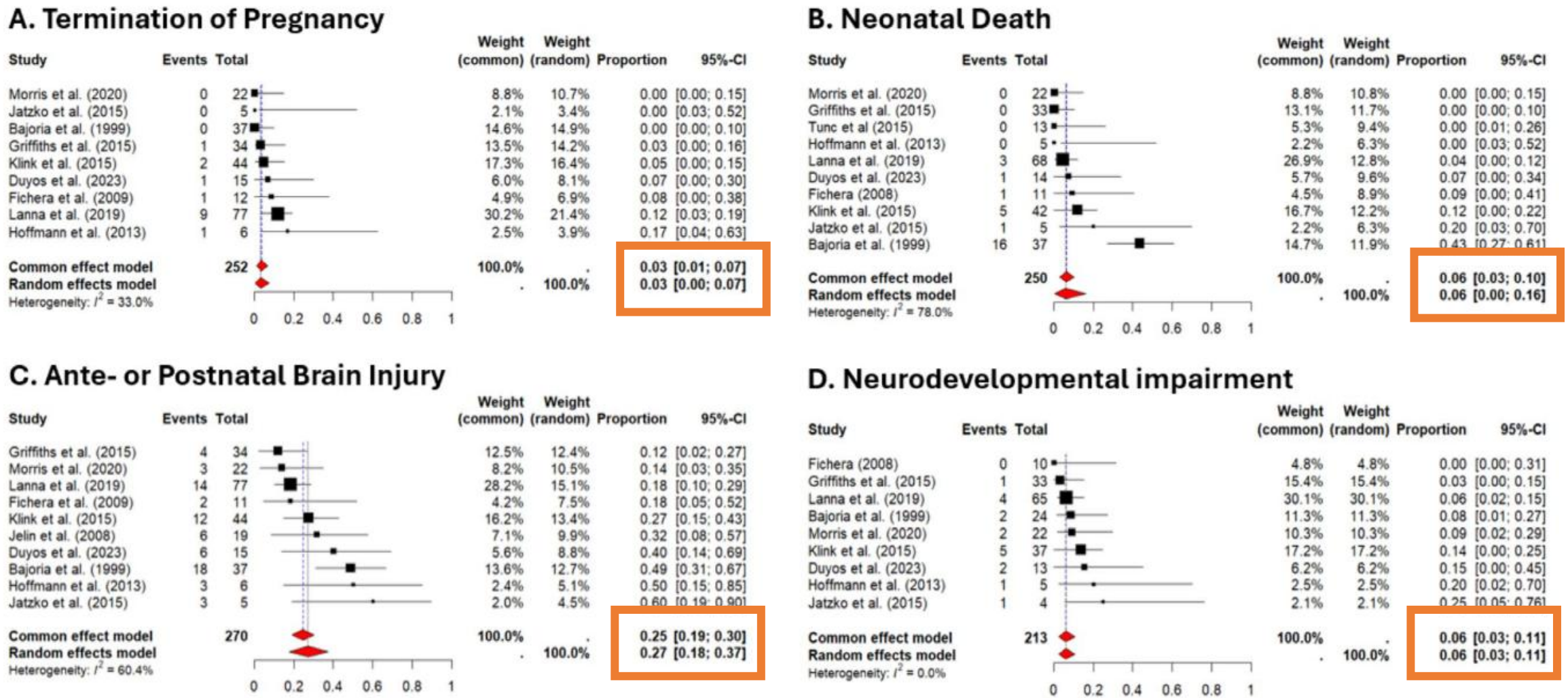


FIGURE 3 | Forest plots of pooled proportions of TOP, NND, brain injury and NDI. Forest plots displaying the pooled proportions of termination of pregnancy (A), neonatal death (B), brain injury (C) and NDI (D) across included studies. Each study is represented by a grey square, with the size of the square proportional to the study weight. The horizontal lines indicate 95% confidence intervals (CIs) for each study estimate. The vertical dashed line represents the pooled estimate. The diamond at the bottom of each plot represents the overall effect size with its corresponding 95% CI, calculated using both the fixed-effect model and random-effects model. Heterogeneity statistics includes I^2.

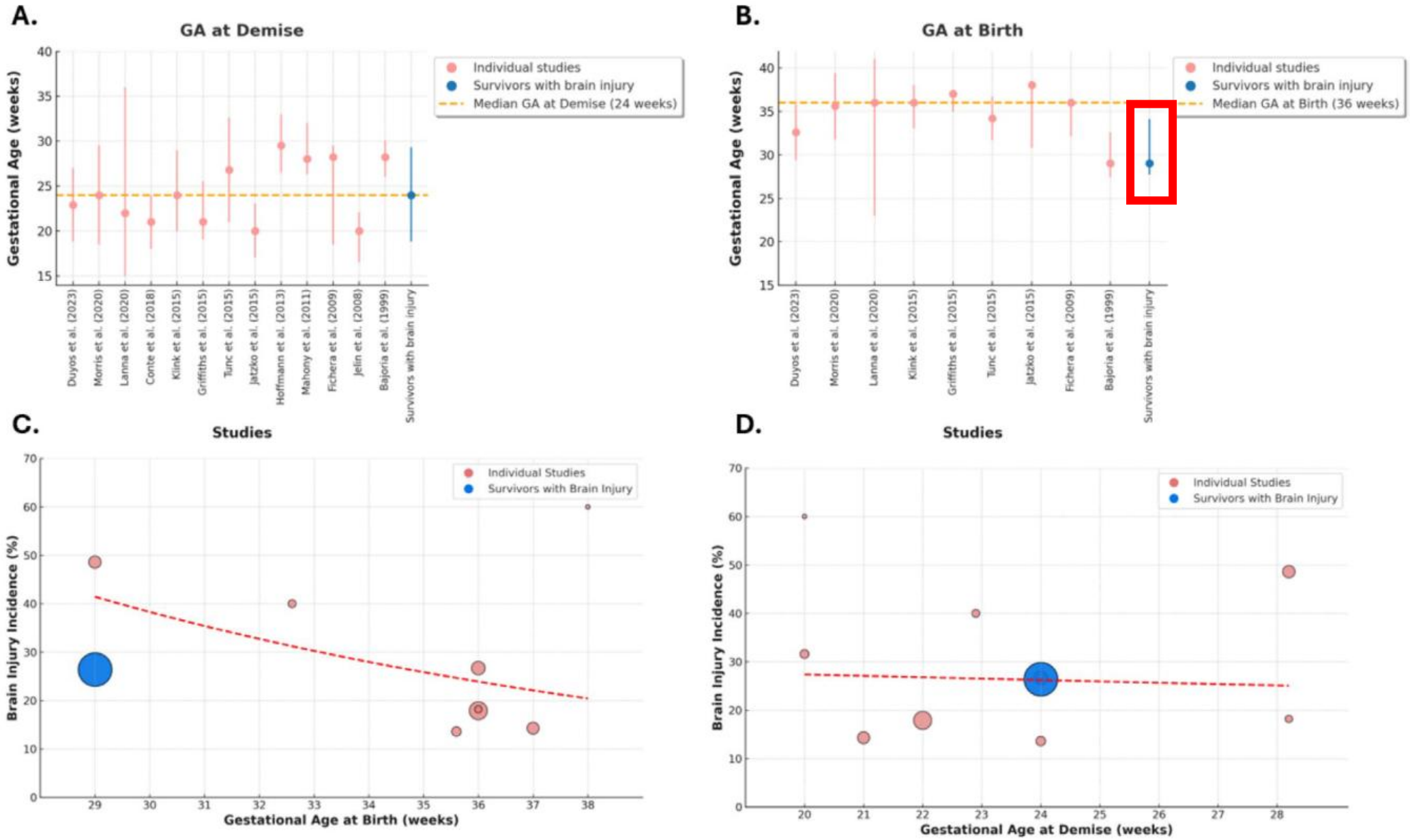
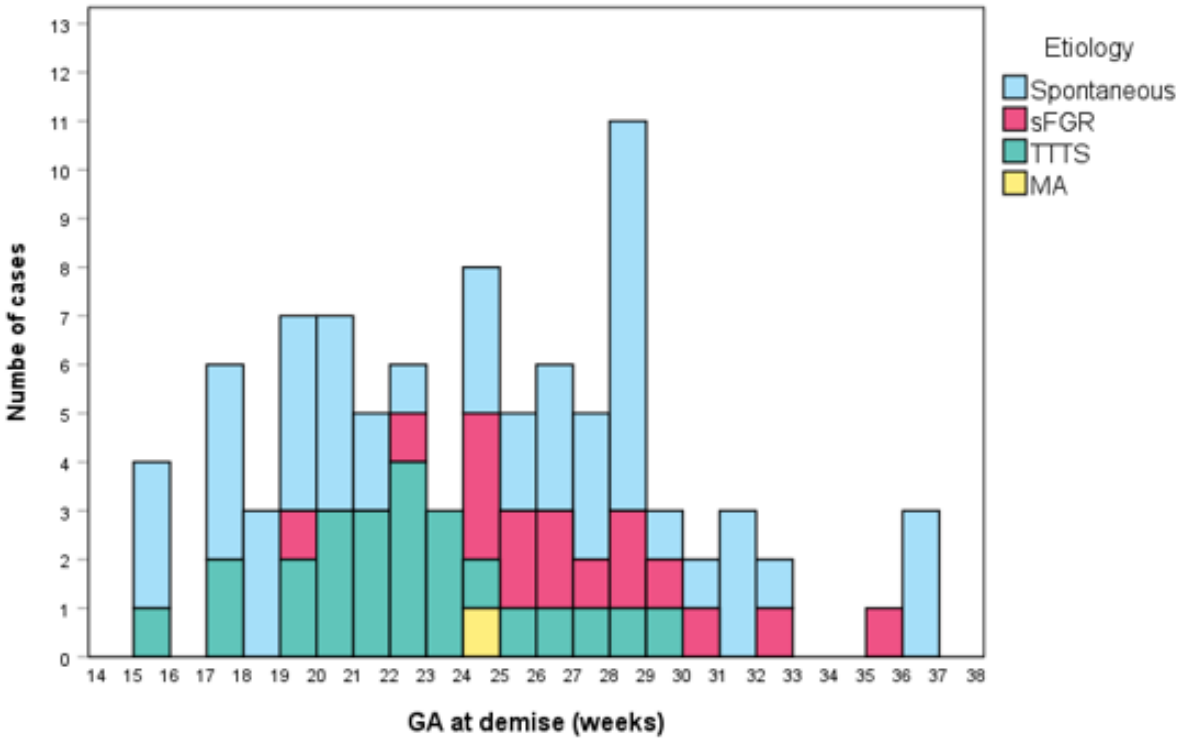
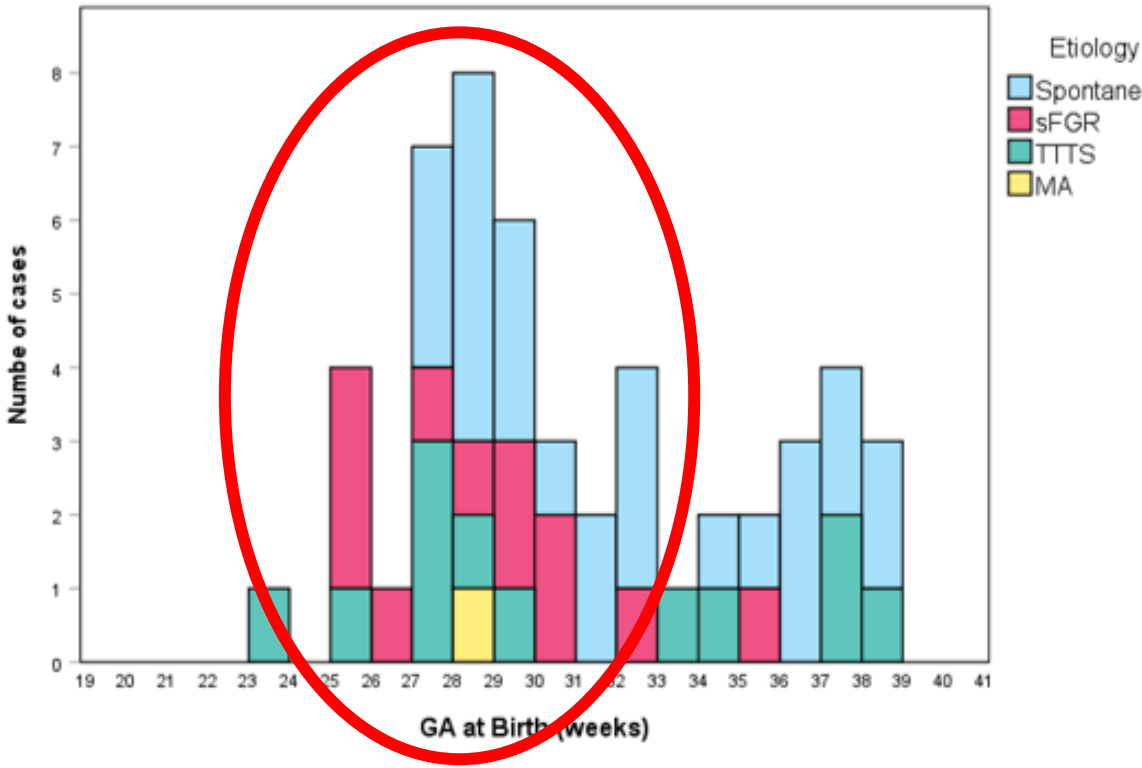


FIGURE 2 | GA at demise, birth and brain injury across studies. (A) Shows the gestational age (GA) at demise, and (B) shows the GA at birth across the included studies. The circles represent median or mean GA, with error bars indicating the interquartile range (IQR), standard deviation (SD) or range. The overall median GA for survivors with brain injury are represented in dark red. (C) Illustrates the prevalance of brain injury in relation to gestational age at birth. Each bubble represents an individual study, with the bubble size corresponding to the study population. (D) Illustrates



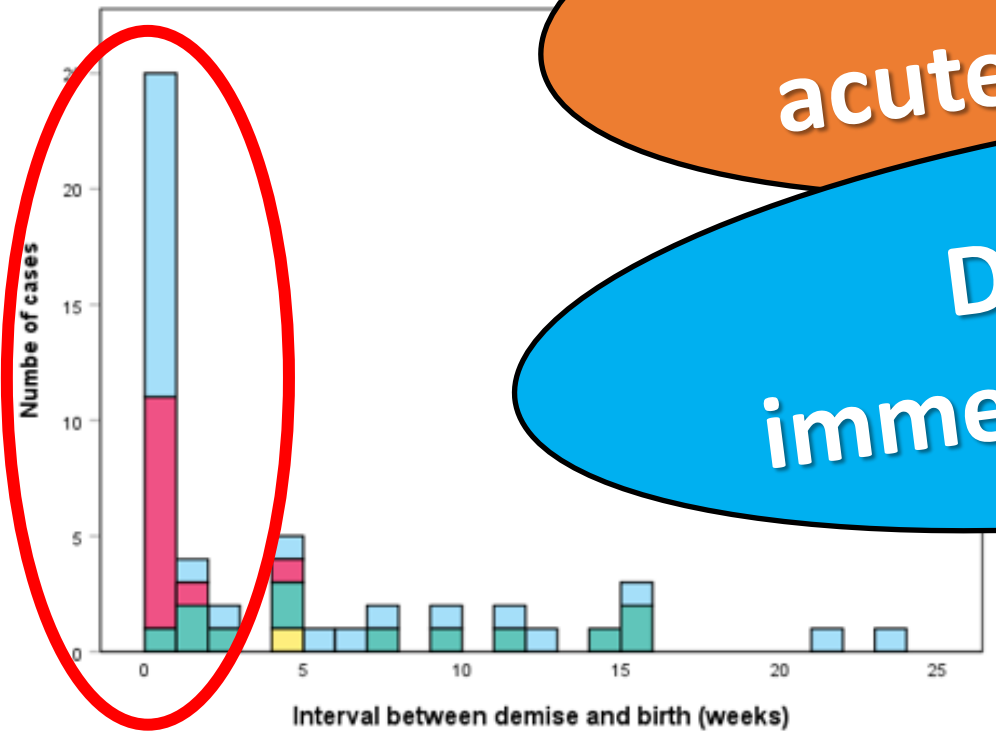


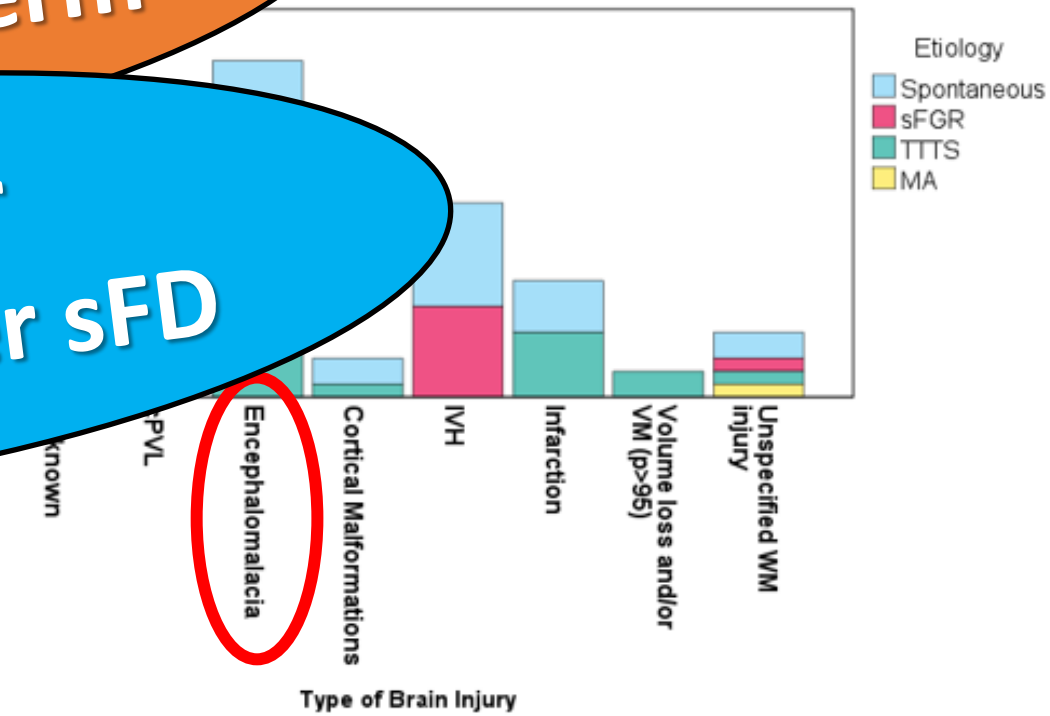
26% TTTS
17% sFGR

62% very preterm
85% preterm

Double hit: acute TTS + preterm

Don't deliver immediately after sFD





1/2 within 1 week after sFD
1/3 within 1 day after sFD

2/3 brain injury probably antenatal
1/3 brain injury probably postnatal

CITRUS study

Mathies Rondagh, PhD

Fondazione Buzzi
PER L'OSPEDALE DEI BAMBINI

St George's Healthcare NHS
NHS Trust

NHS
Liverpool University Hospitals
NHS Foundation Trust

LUMC

Boston Children's Hospital

SickKids | Centre for Global Child Health

Mount Sinai Hospital
Sinai Health System
Joseph & Wolf Lebovic Health Complex

Universidad Hospital Italiano

Clínic Barcelona | Universitat de Barcelona

SHEBA
Tel HaShomer

Indiana University Health

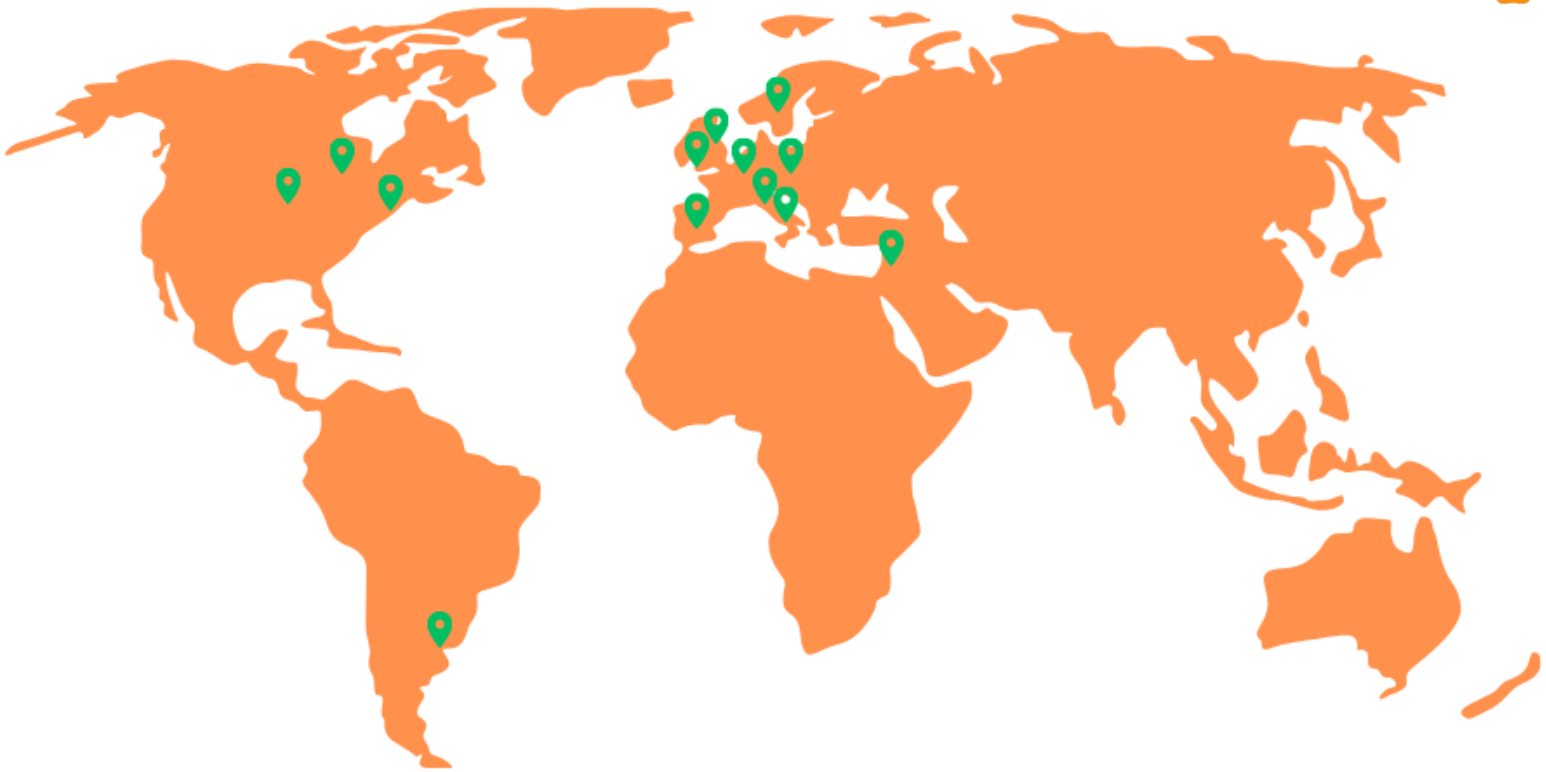
Technische Universität München

KU LEUVEN

KAROLINSKA UNIVERSITY HOSPITAL

CITRUS study

- Multicenter study with 15 institutions worldwide
- Data entry closing at 31/12/2025



CITRUS study

What do we not know?

- The exact incidence of cotwin demise, brain injury and neurodevelopmental impairment

- Potential risk factors;
  - Type of complication (TTTS, sFGR, MA, spontaneous)
  - Diameter of the AA or VV anastomoses
  - Gestational age at demise
  - Gestational age at birth

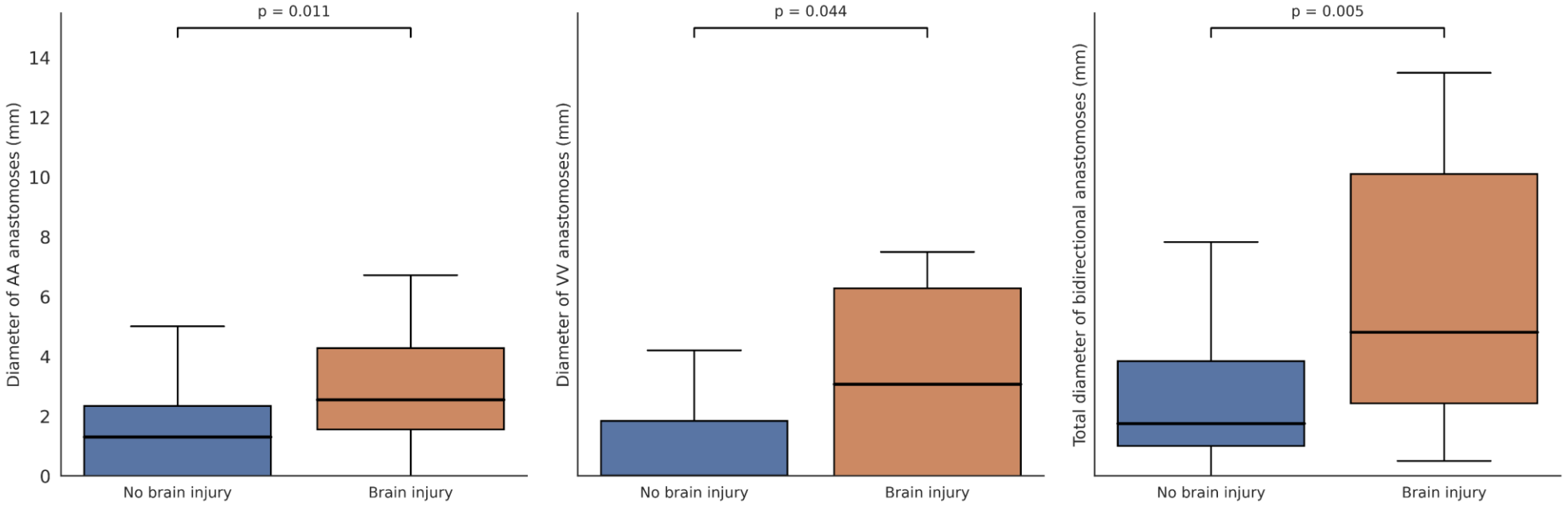
- Long-term neurodevelopmental outcome

CITRUS-Placenta Spin-off

- Centers with dye-injection of placentas after single (n=45) and double fetal demise (n=33).

- 17 out of 78 (22%) showed brain injury on perinatal imaging after sFD
  - Cystic periventricular leukomalacia (n=4)
  - Cystic encephalomalacia (n=3)
  - White matter injury and severe basal ganglia/thalamic injury (n=3)
  - Arterial ischemic stroke (n=2)
  - Intraventricular hemorrhage (n=2)
  - Migration or gyration disorder (n=2)
  - Parenchymal hemorrhage (n=1)

Bidirectional anastomoses



Diameter of AA anastomose

Diameter of VV anastomose

Total diameter bidirectional anastomoses

Fondazione Buzzi
PER L'OSPEDALE DEI BAMBINI

KU LEUVEN

KAROLINSKA
UNIVERSITY HOSPITAL

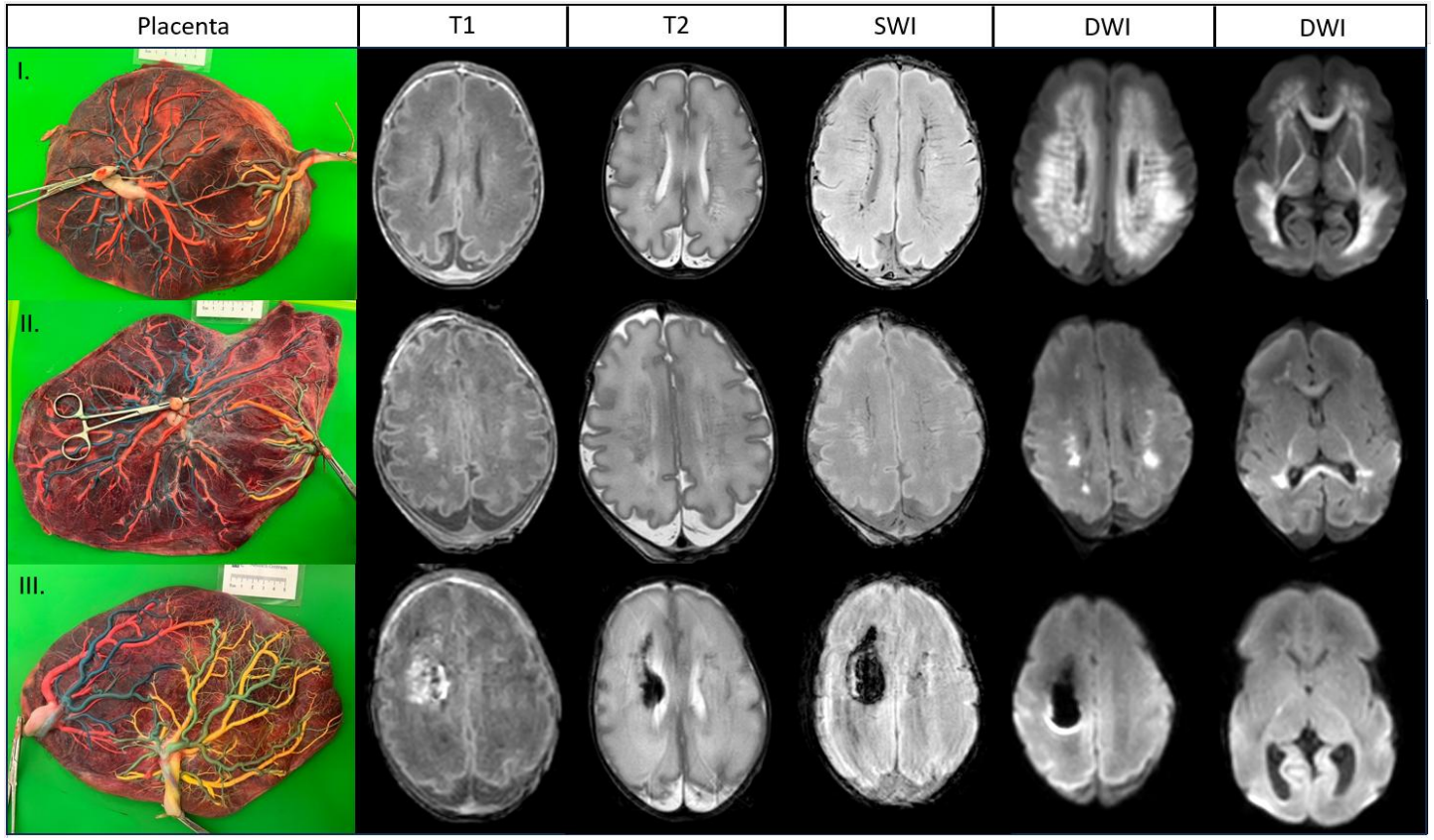
Brussel 2025

LUMC Leids Universitair Medisch Centrum

Delayed Cord Clamping in MC twins?

BEWARE of ACUTE PERIPARTUM TTS!

- Early (<60s) vs. delayed cord clamping (>60s) and prevalance of acute peripartum TTTS
- Single-center retrospective study (2020-2025), vaginal deliveries.
- 35 MC twin pregnancies (70 infants, n=17 ECC vs. n=18 DCC)
- **Acute peripartum TTTS in 0% of ECC vs. 17% in DCC group**
- 8% severe brain injury in the DCC group



Delayed cord clamping and acute twin-to-twin transfusion syndrome in vaginally born monochorionic twins: a single-centre retrospective cohort study

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ABSTRACT

Objective To evaluate the prevalence of acute peripartum twin-to-twin transfusion syndrome (TTTS) in vaginally born monochorionic (MC) twin pregnancies, comparing early cord clamping (ECC) to delayed cord clamping (DCC).

Design, setting and patients Single-centre retrospective cohort study including vaginally born MC twins at our institution between January 2020 and April 2025. Acute peripartum TTTS was defined as intertwin haemoglobin (Hb) difference >8 g/dL within 12 hours after birth, without signs of chronic TTTS or twin anaemia polycythaemia sequence. Twins were categorised to the ECC and DCC group if cord clamping occurred ≤60 s or >60 s after birth of the first twin, respectively.

Results Thirty-five twin pregnancies were included (n=17 in the ECC group; n=18 in the DCC group).

WHAT IS ALREADY KNOWN ON THIS TOPIC

⇒ Delayed cord clamping (DCC, >60 s) reduces morbidity and mortality in preterm infants, but its safety in monochorionic (MC) twins regarding the risk of acute peripartum twin-to-twin transfusion syndrome (TTTS) in vaginal births is uncertain.

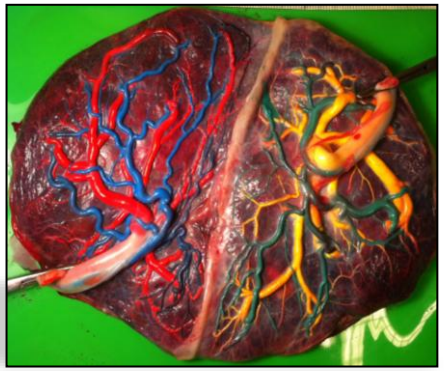
WHAT THIS STUDY ADDS

⇒ This study shows that DCC in vaginally born untreated MC twins may be associated with an increased risk of acute peripartum TTTS and severe brain injury compared to early cord clamping (≤60 s).

HOW THIS STUDY MIGHT AFFECT RESEARCH, PRACTICE OR POLICY

DC twins

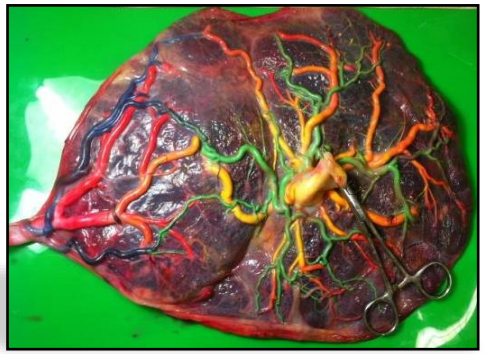
TTS treated with laser



Delayed Cord Clamping

All other MC twins

(uncomplicated, sFGR, MA, TTS without laser..)

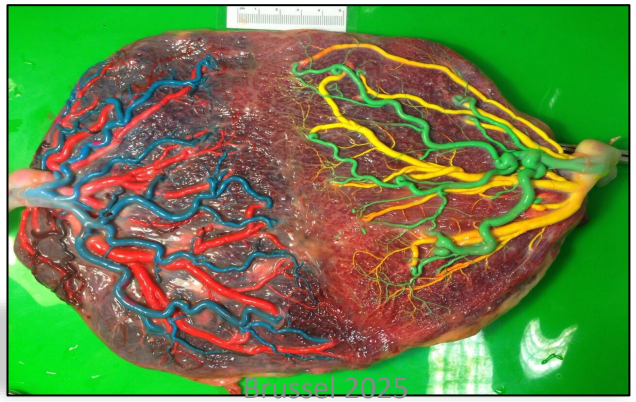


Early Cord Clamping

TAPS

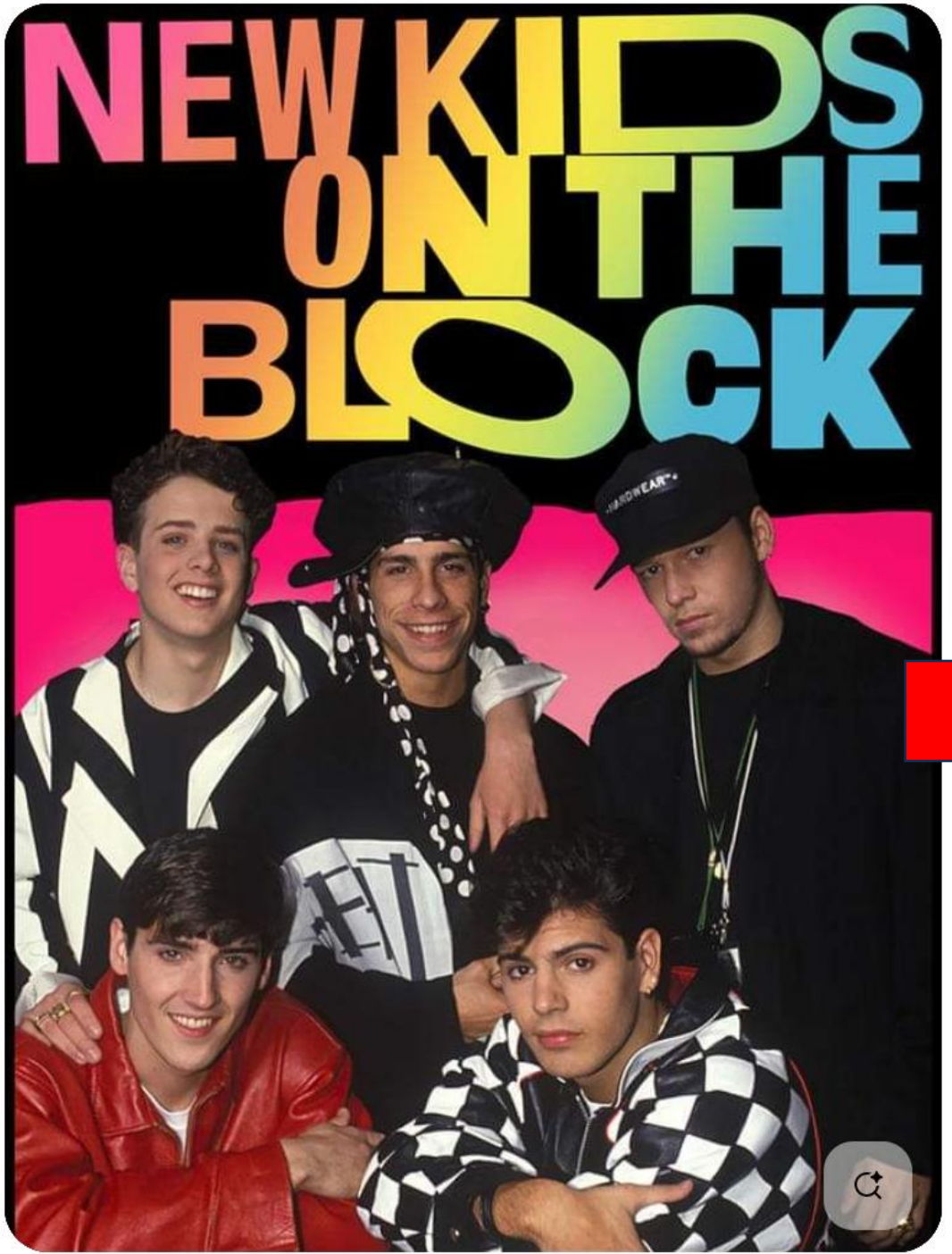
twin anemia

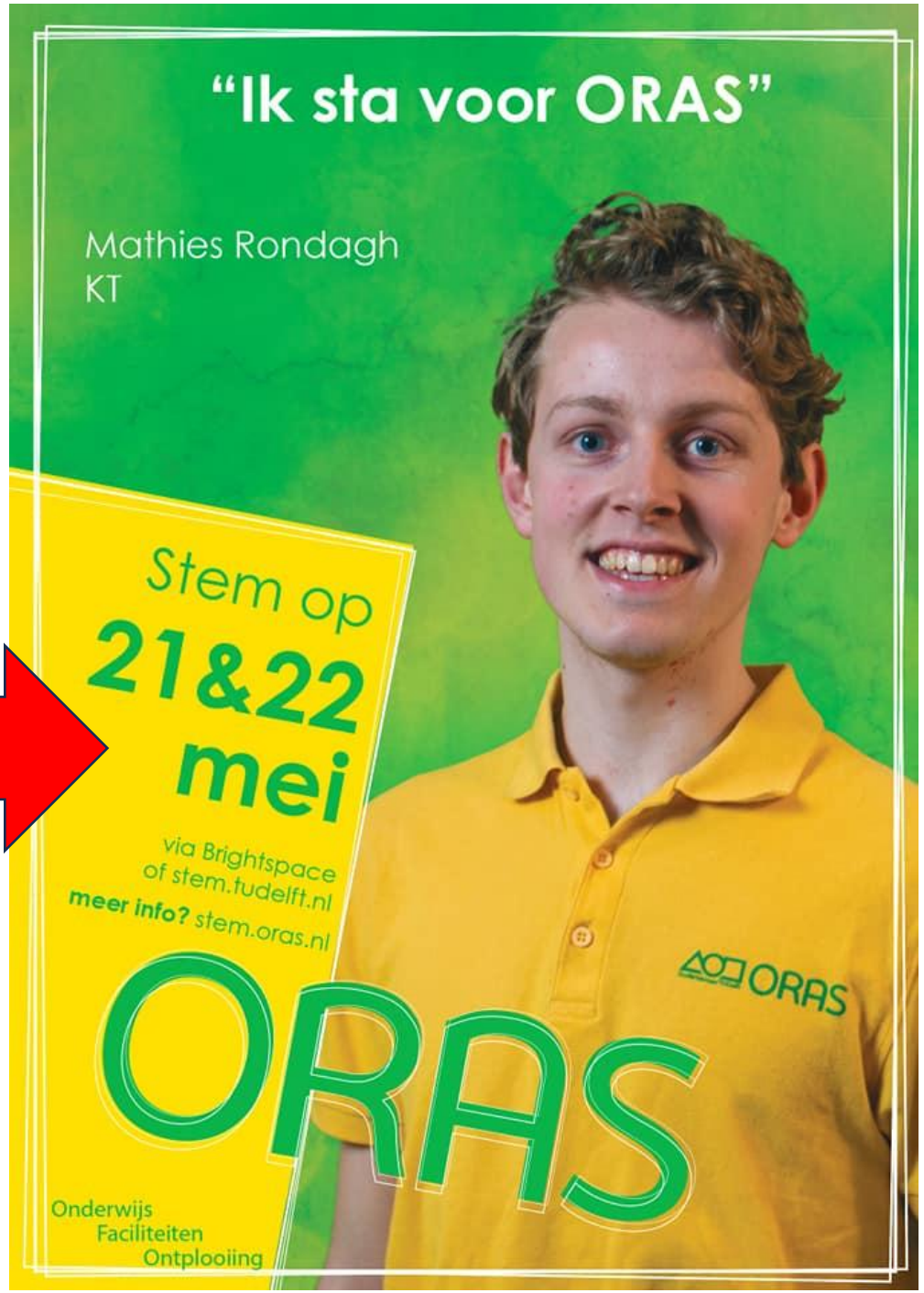
polycythemia sequence



Delayed Cord Clamping in donor

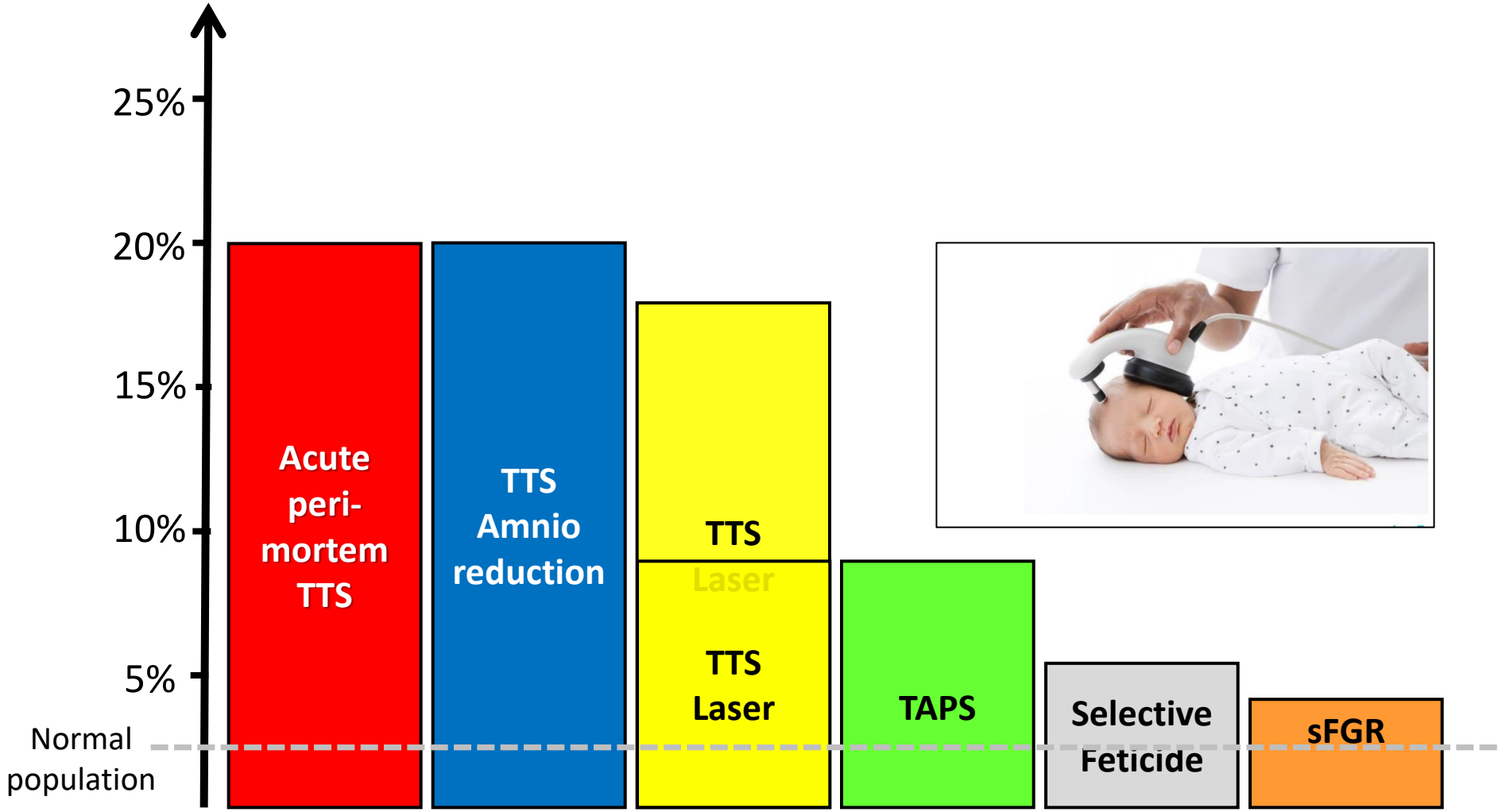
Early Cord Clamping in recipient


NEW KIDS ON THE BLOCK


"Ik sta voor ORAS"
Mathies Rondagh
KT
Stem op
21&22
mei
via Brightspace
of stem.tudelft.nl
meer info? stem.oras.nl
ORAS
Onderwijs
Faciliteiten
Ontplooiing
ORAS

Conclusions: Neurolodevelopmental impairment

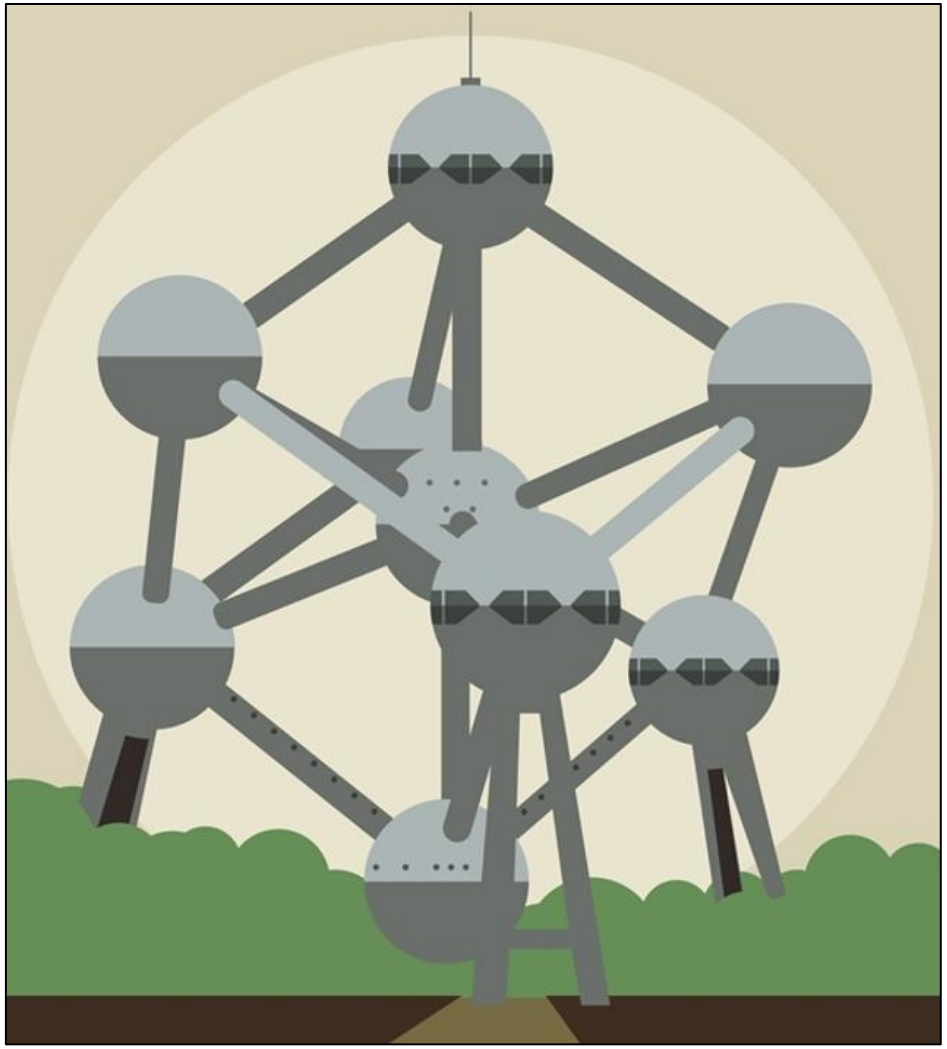
in complicated MC twins



Optimal management MC twins:

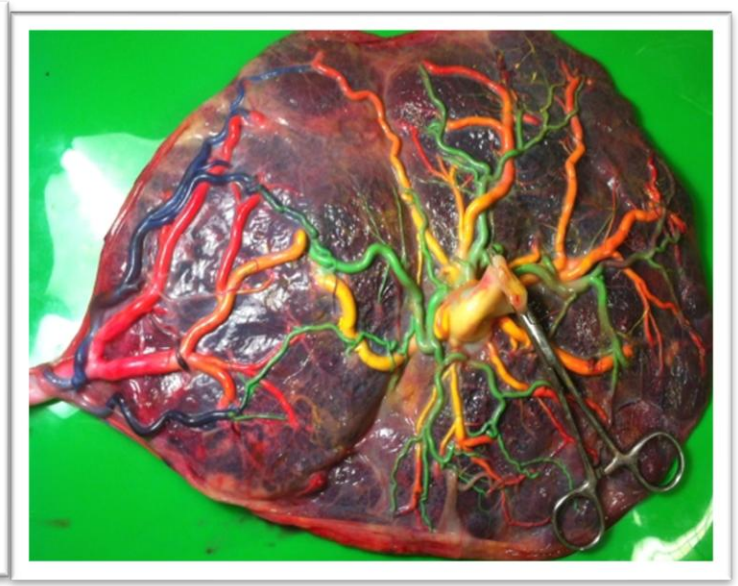
= teamwork!

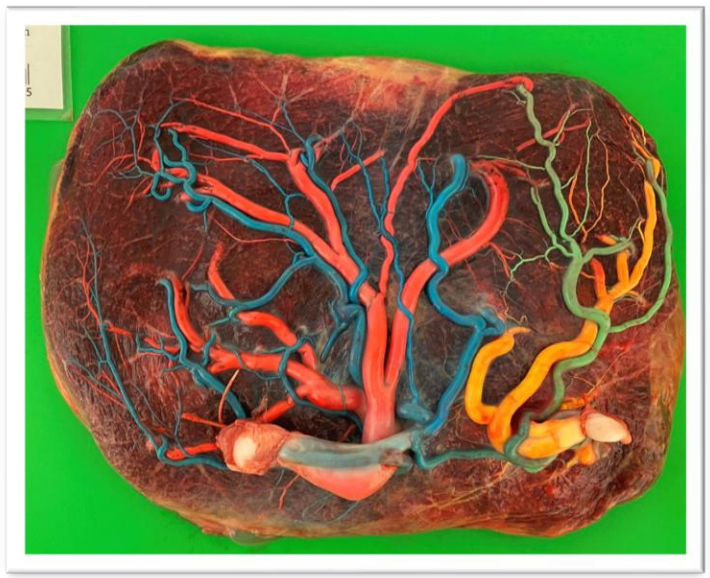
- Fetal surgeons
- Prenatal US
- Neonatologists
- Specialized nurses



- Pathologists
- Placenta-injection
- Psychologists
- Young researchers

Credits to the most beautiful and underappreciated organ: Monochorionic placenta





Brussel 2025