Doppler-ultrasound of vascular complications after pediatric liver transplantation: incidence, time of detection and positive predictive value

Verhagen MV, de Kleine R, van der Doef H, Kwee T, de Haas R.

ESPR 2022, Marseille

Medical Imaging Centre, UMCG
Groningen
The Netherlands

MIC
MEDICAL IMAGING CENTRE
GRONINGEN

ESPR
European Society of Paediatric Radiology

umcg

m.verhagen@umcg.nl

Disclosures

No conflicts of interest to declare

MIC
MEDICAL IMAGING CENTRE
GRONINGEN

ESPR
European Society of
Paediatric Radiology

umcg

Doppler ultrasound (DUS) for peri- and postoperative detection of vascular complications in pediatric liver transplantation (LT):

- Timing of DUS varies among LT centers
  - Daily postoperative DUS is advised, but more evidence is needed
  - Perioperative DUS is advised, but effectiveness is unclear
- Distinction is made between early (<2 weeks) and late complications, more exact incidences may be helpful

Primary aim:

- To assess the moment of first detection of vascular complications with DUS

Secondary aim:

- To determine the positive predictive value (PPV) of DUS

MIC
MEDICAL IMAGING CENTRE
GRONINGEN

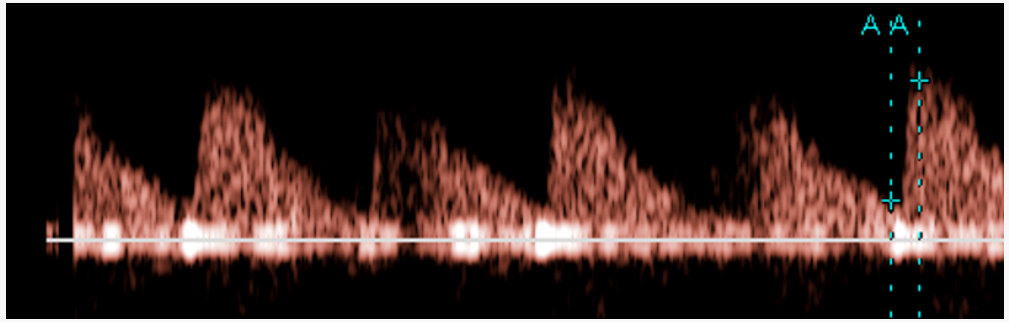
ESPR
European Society of Paediatric Radiology

umcg

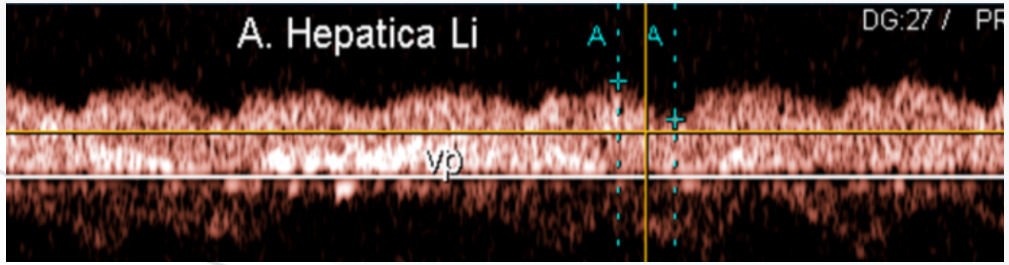
Vascular complications:

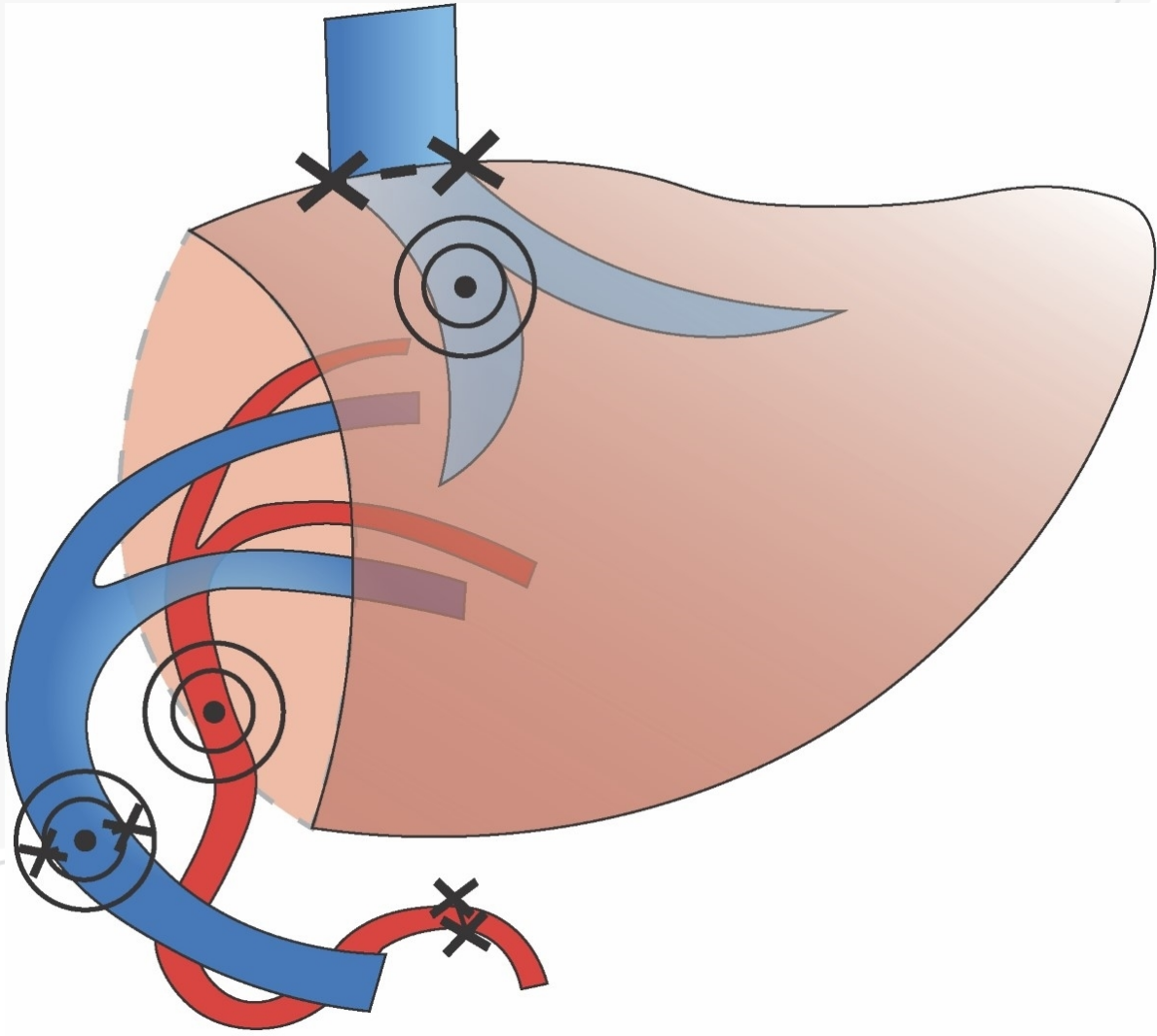
- Thrombosis
- Stenosis/kinking
- Extrinsic compression (e.g. fluid collection)

normal



stenosis





MIC
MEDICAL IMAGING CENTRE
GRONINGEN

Design:
- Retrospective cohort study

Inclusion:
- Patients <18 years, between 2015 and 2019
- Primary and repeat LT
- 1 year clinical follow-up after LT

Exclusion:
- No DUS

DUS protocol:
- Day 0: intraoperative and immediately postoperative
- Day 1-7
- Month 1, 3, 12

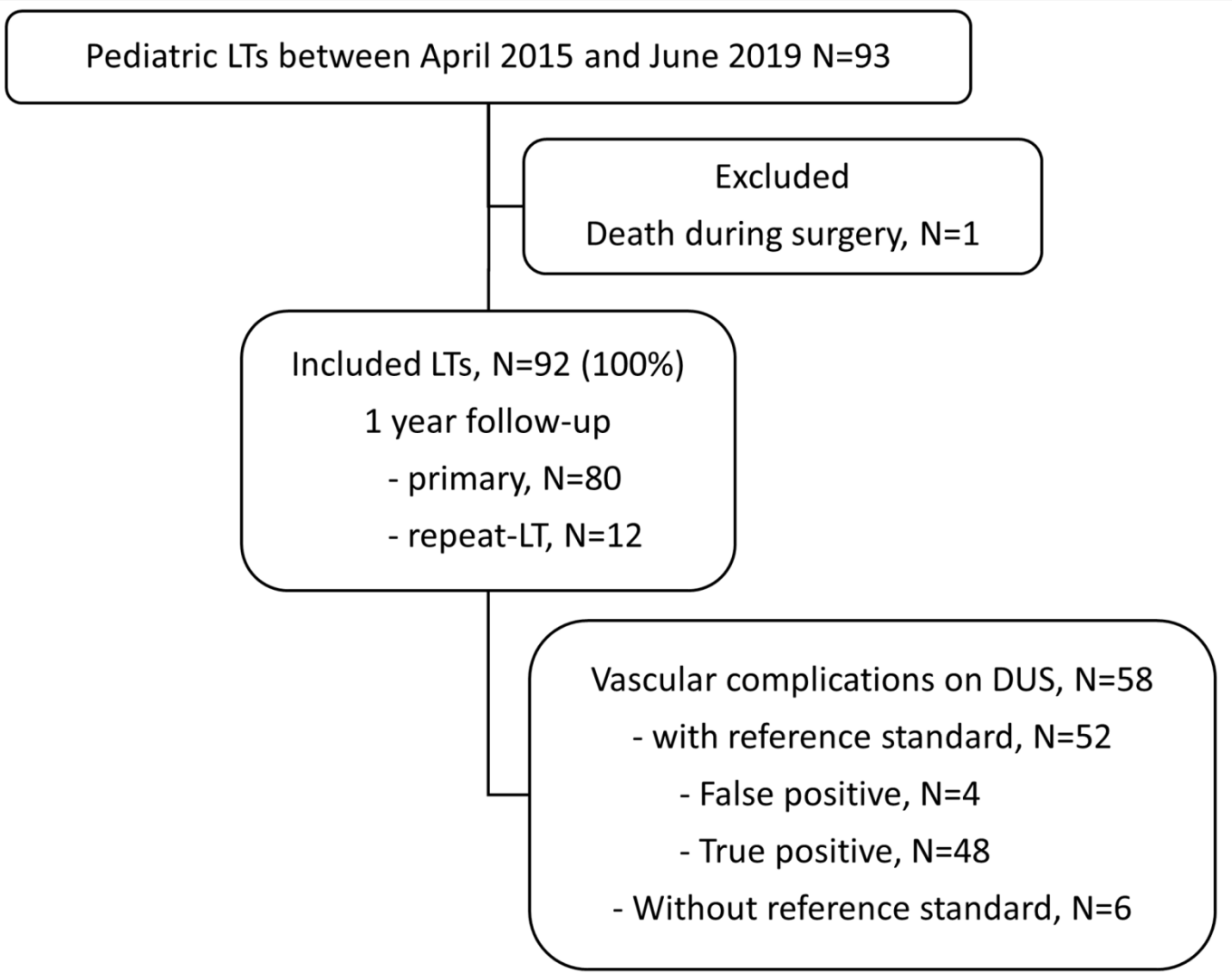
DUS technique:
- Hepatic artery:
  - Peak systolic velocity (PSV)
    - >200cm/s as abnormal
  - Resistive index (RI) and spectral waveform
    - Tardus parvus
- Portal vein:
  - PSV >125cm/s
  - Pre- to anastomotic ratio ≥4
- Hepatic vein(s):
  - Monophasic

Multiple vascular complications per patient allowed

Reference standard:
- Surgery, angiography, CT

MIC MEDICAL IMAGING CENTRE GRONINGEN

umcg



MIC
MEDICAL IMAGING CENTRE
GRONINGEN

ESPR
European Society of
Paediatric Radiology

umcg

Number of LTs	92 LTs in 83 patients
Age at LT (years), median (inter quartiel range)	3.9 (0.7-10.5)
Gender, male, N (%)	53 (57.6%)
Cirrhotic disease, N (%)	76 (82.6%)
Full size **Deceased donor**	24 (26.1%) 24 (100%)
Split liver **Living donor** **Deceased donor**	68 (73.9%) 33 (48.5%) 35 (51.5%)

MIC
MEDICAL IMAGING CENTRE
GRONINGEN

ESPR
European Society of
Paediatric Radiology

umcg

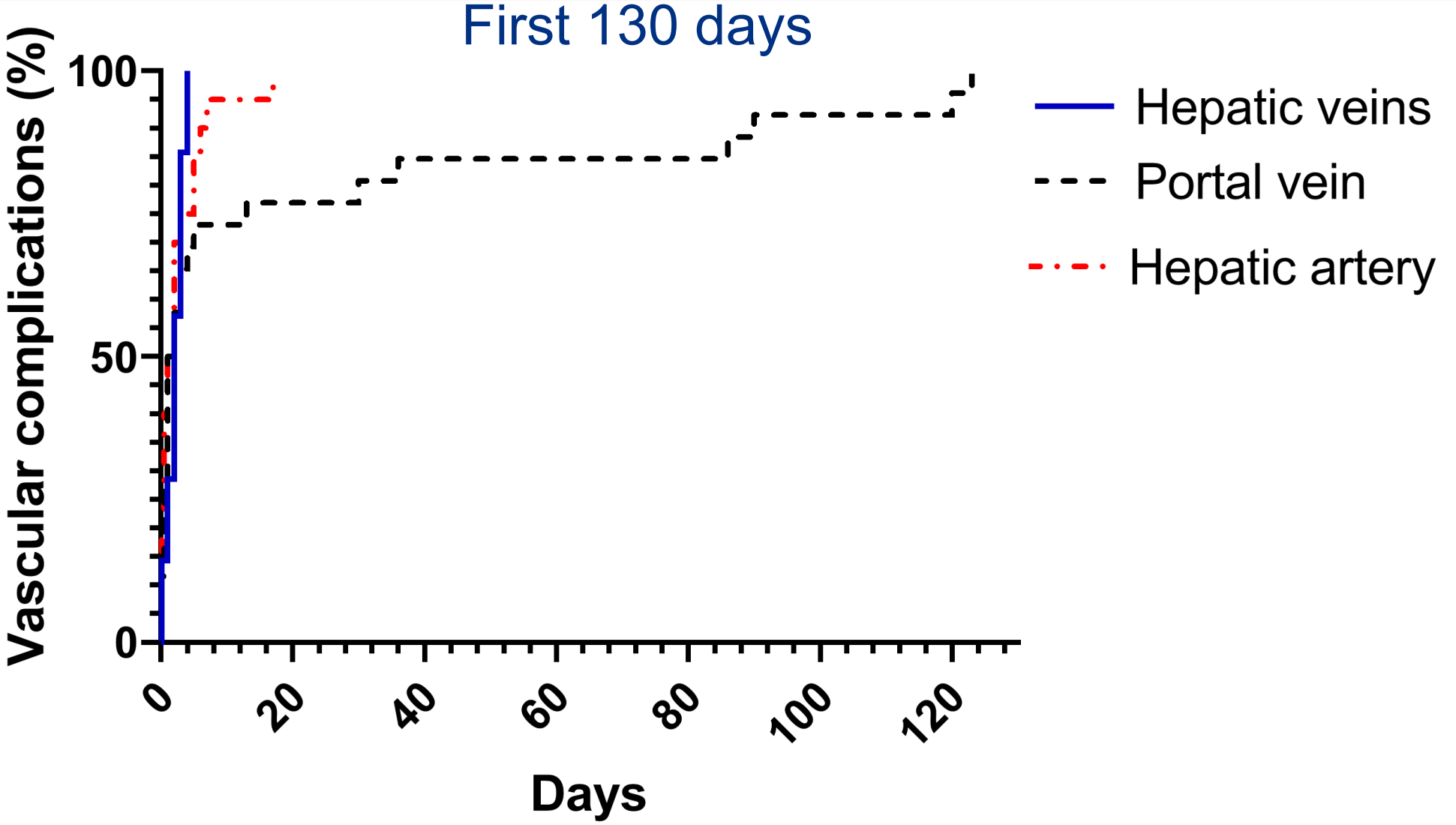
True positive (TP) and false positive (FP) cases					
		Perioperative	Day 1-7	Day 8-365	Total
Hepatic artery					
Thrombotic	TP FP	2	2 1	1	5 1
Kinked	TP	4	4		8
Extrinsic compression	TP		2		2
Significant stenosis	TP	1	2		3
Total		7	11	1	19
Portal vein					
Thrombotic	TP	5	5	1	11
Kinked	TP		2		2
Significant stenosis	TP FP	2	4 1	6	10 3
Total		7	12	7	26
Hepatic vein					
Thrombotic	TP	1			1
Extrinsic compression	TP		2		2
Significant stenosis	TP		4		4
Total		1	6		7
Total		15 (28.8%)	29 (55.8%)	8 (15.4%)	52 (100%)

True positive (TP) and false positive (FP) cases					
		Perioperative	Day 1-7	Day 8-365	Total
Hepatic artery					
Thrombotic	TP	2	2	1	5
	FP		1		1
Pseudoaneurysm	TP	4	4		8
Extrinsic compression	TP		2		2
Significant stenosis	TP	1	2		3
Total		7	11	1	19
Portal vein					
Thrombotic	TP	5	5	1	11
Pseudoaneurysm	TP		2		2
Significant stenosis	TP		4	6	10
	FP	2	1		3
Total		7	12	7	26
Hepatic vein					
Thrombotic	TP	1			1
Pseudoaneurysm	TP		2		2
Significant stenosis	TP		4		4
Total		1	6		7
Total		15 (28.8%)	29 (55.8%)	8 (15.4%)	52 (100%)

PPV 97.7% (18/19)

PPV 88.5% (23/26)

PPV 100% (7/7)



ESPR
European Society of Paediatric Radiology

umcg

- The vast majority of vascular complications after LT are diagnosed by DUS peri-operatively or during the first postoperative week
- DUS has a high PPV for vascular complications after LT (88.5-100%)
- These findings:
  - Provide improved insight in incidence and detection of vascular complication by DUS
  - Support an intense DUS imaging protocol

MIC
MEDICAL IMAGING CENTRE
GRONINGEN

ESPR
European Society of
Paediatric Radiology

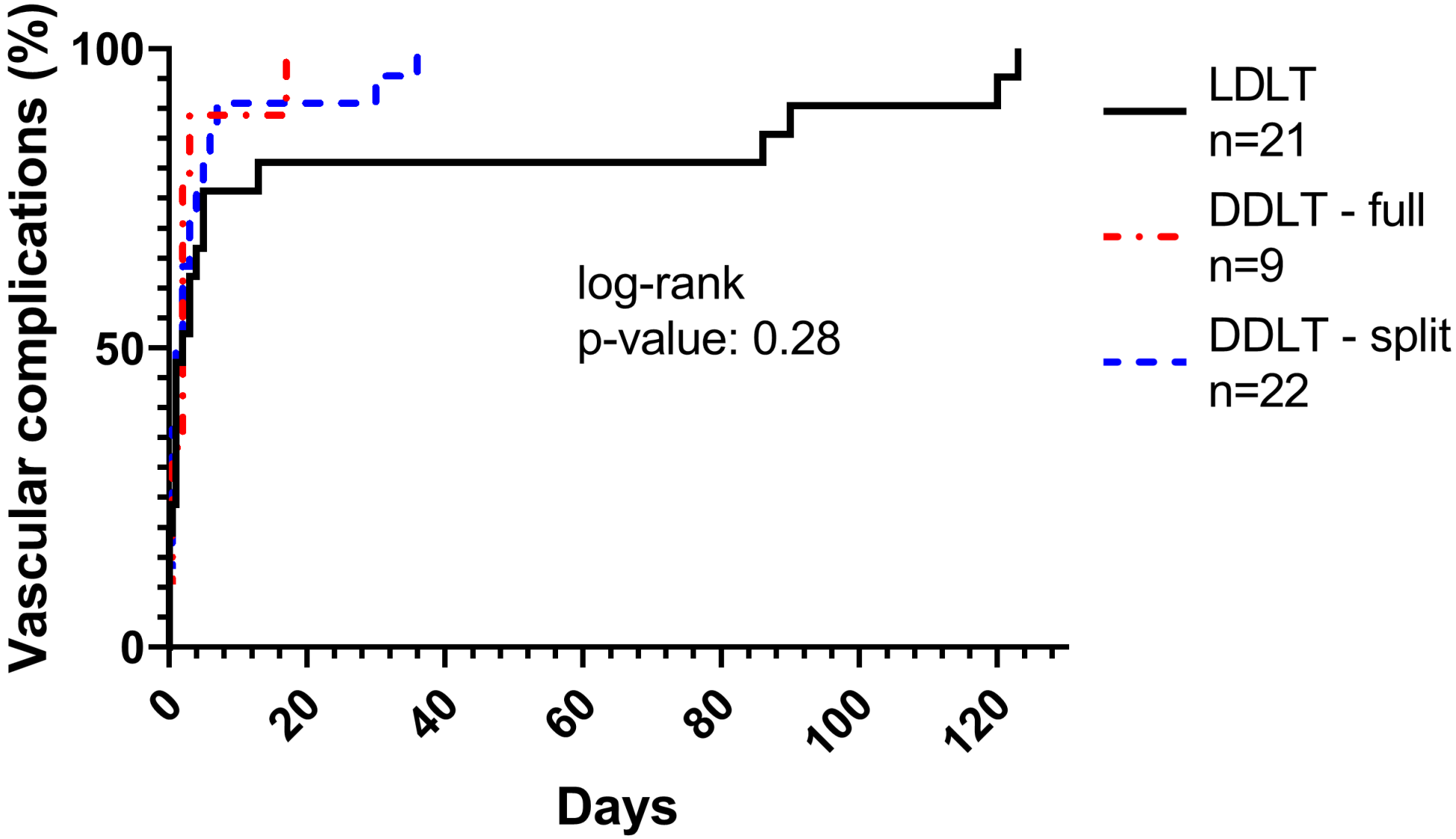
umcg

Thank you for your attention

Any questions?

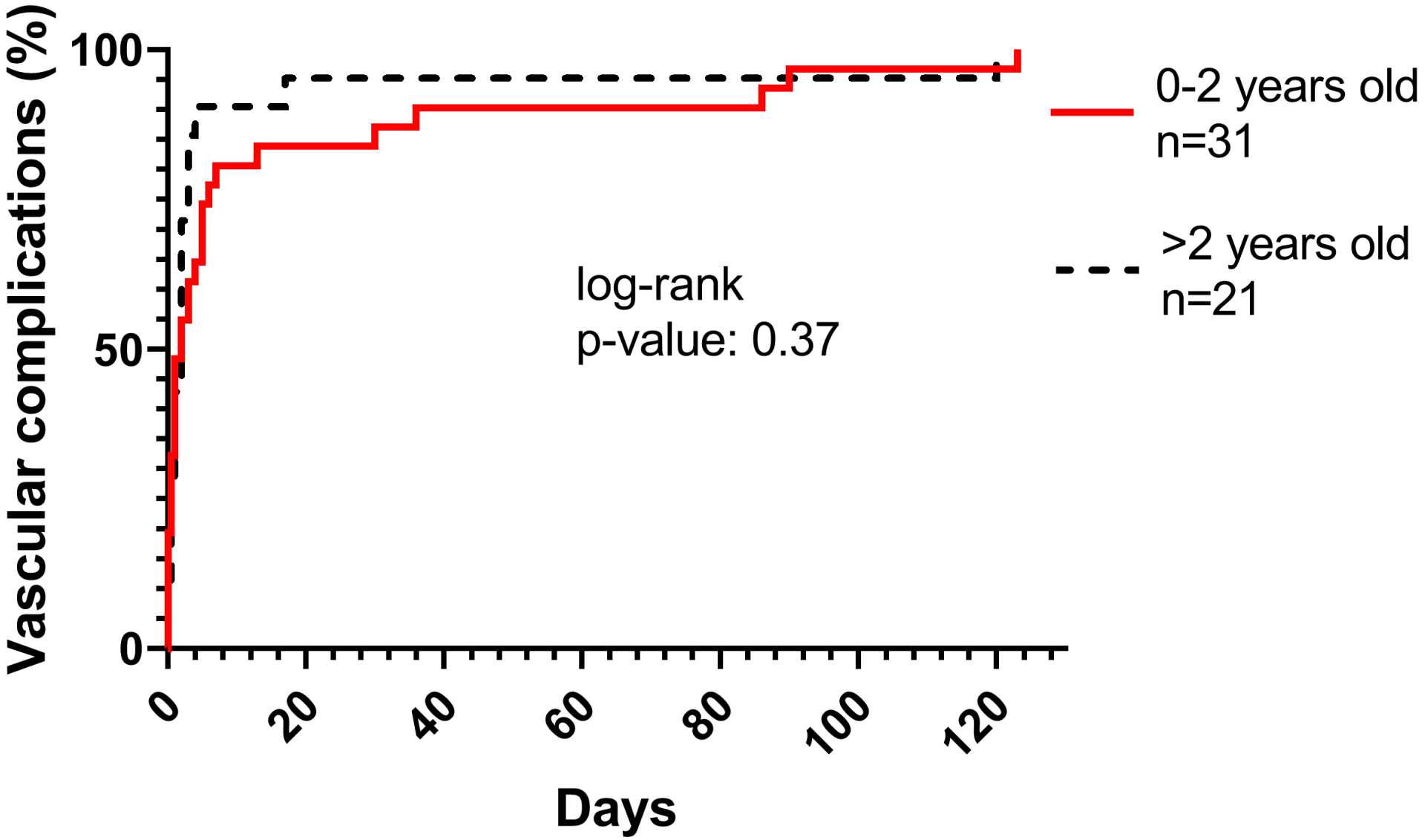
MIC
MEDICAL IMAGING CENTRE
GRONINGEN

umcg



ESPR
European Society of Paediatric Radiology

umcg



ESPR
European Society of Paediatric Radiology

umcg