



Children's Hospital

Additional Value of 3DRA in the Diagnostic Evaluation and Percutaneous Treatment of Children With Univentricular Hearts

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Mirella Molenschot, Femke vd Stelt, Hans Breur, Gregor Krings



University Medical Center Utrecht

Background

Aim of this study

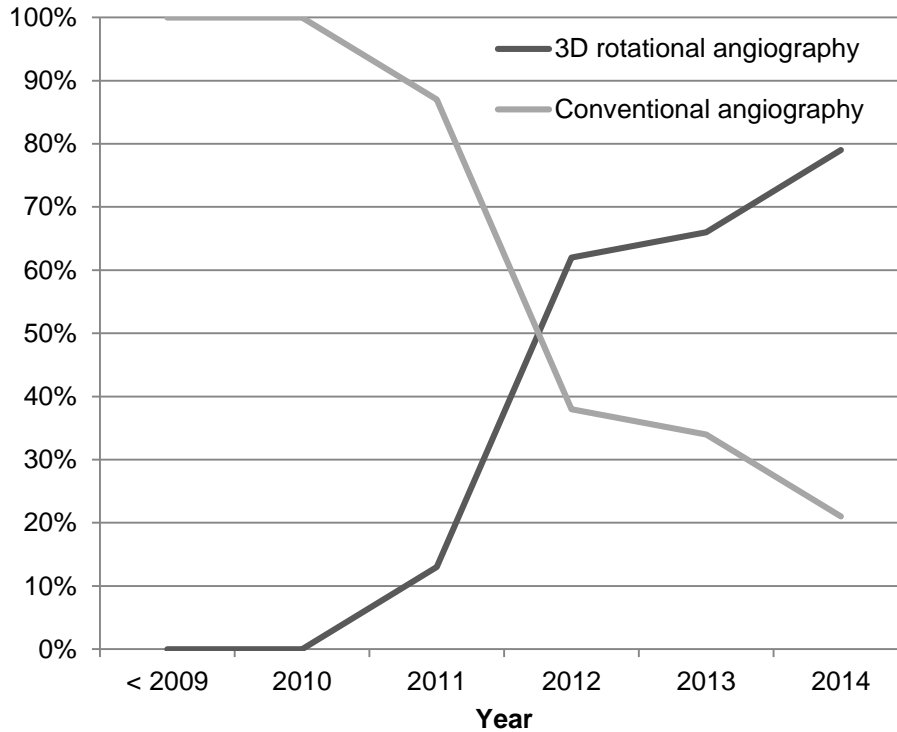
Methods

Results

Conclusion

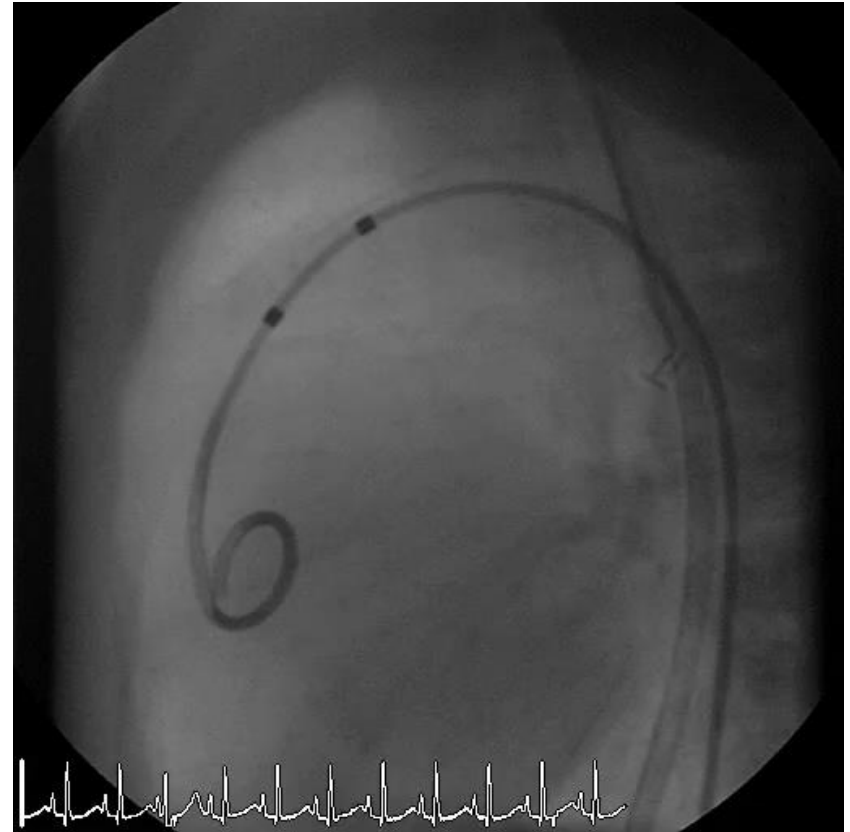
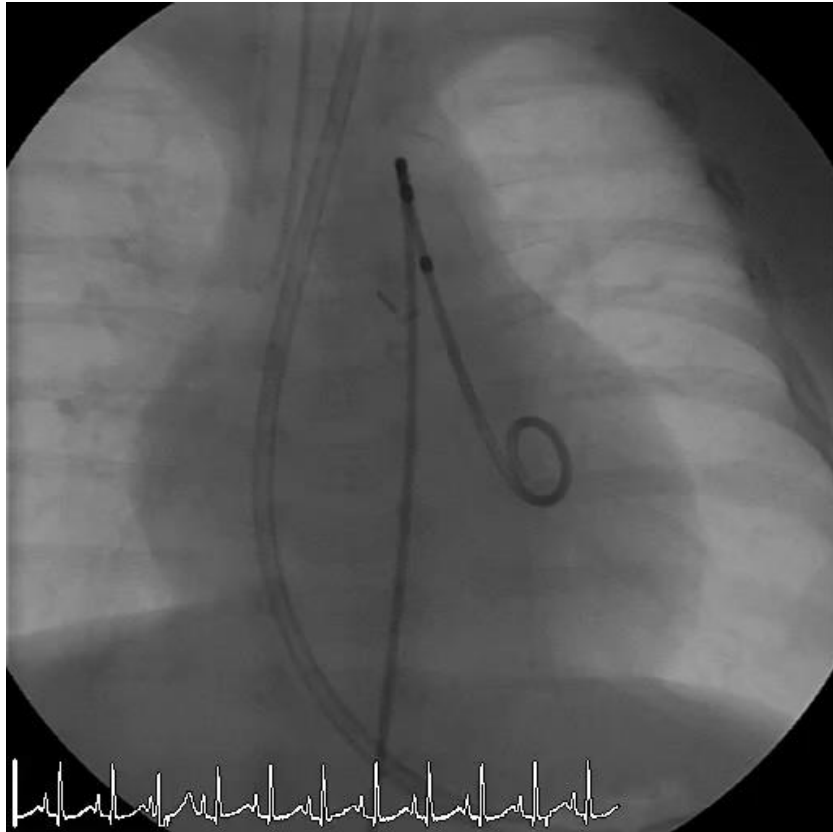


Background



Background – study aim– Methods – Results – Conclusion

Background : Conventional Angiography (CA)



Background – study aim– Methods – Results – Conclusion



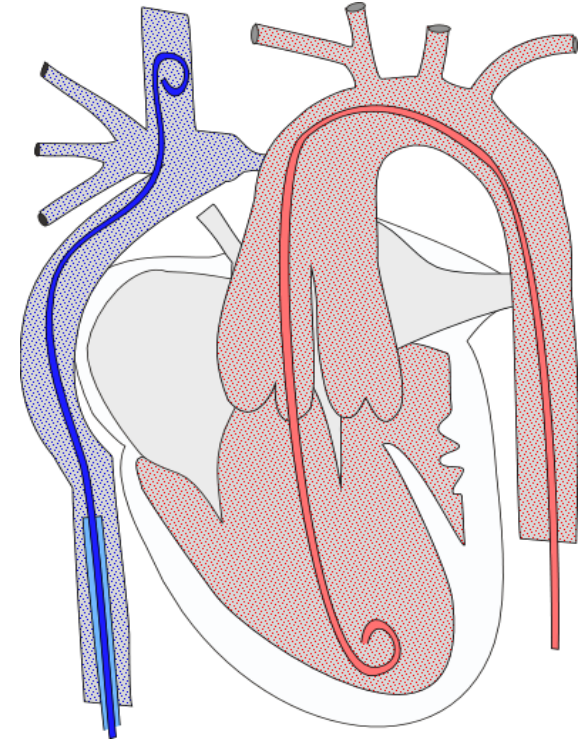
Background : 3DRA workflow

multi location injection

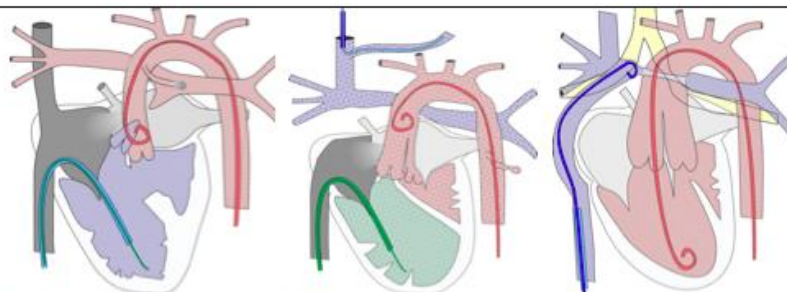
SV : double Flow (high C.O. Stage I+II)

rapid pacing (Stage I + II +/- III)

Reconstruction after dataset **duplication**

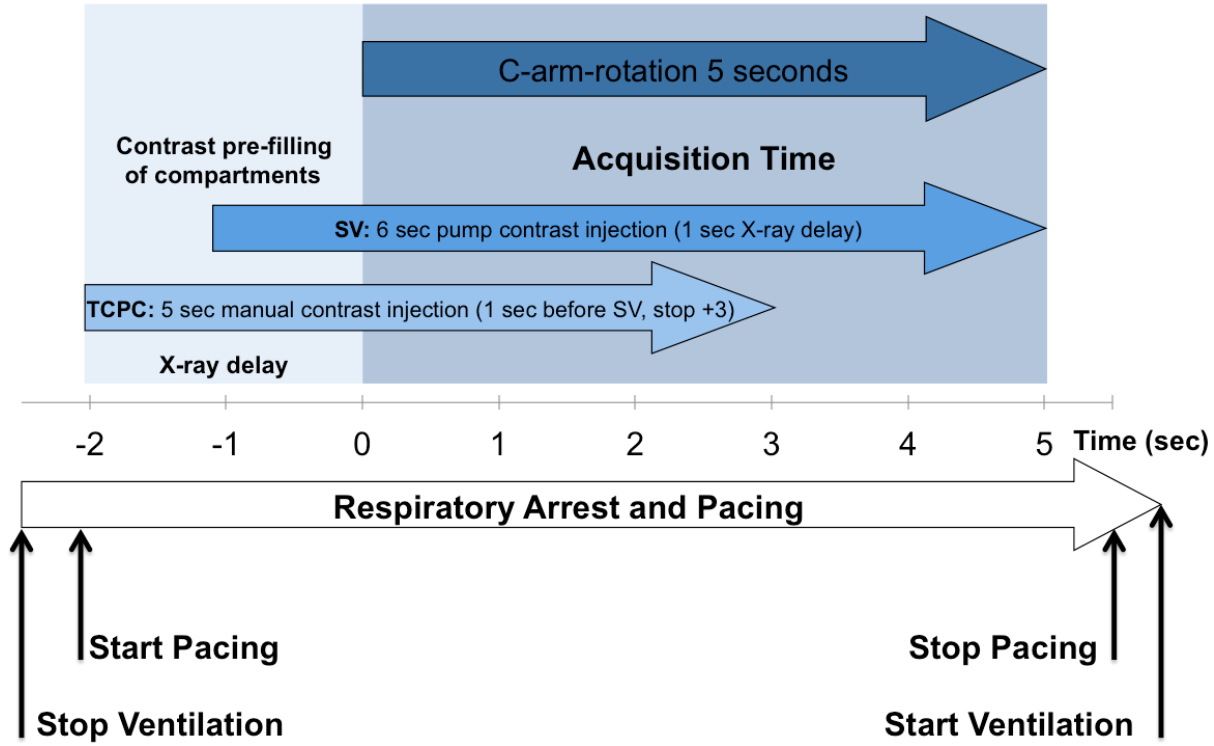


Background : 3DRA



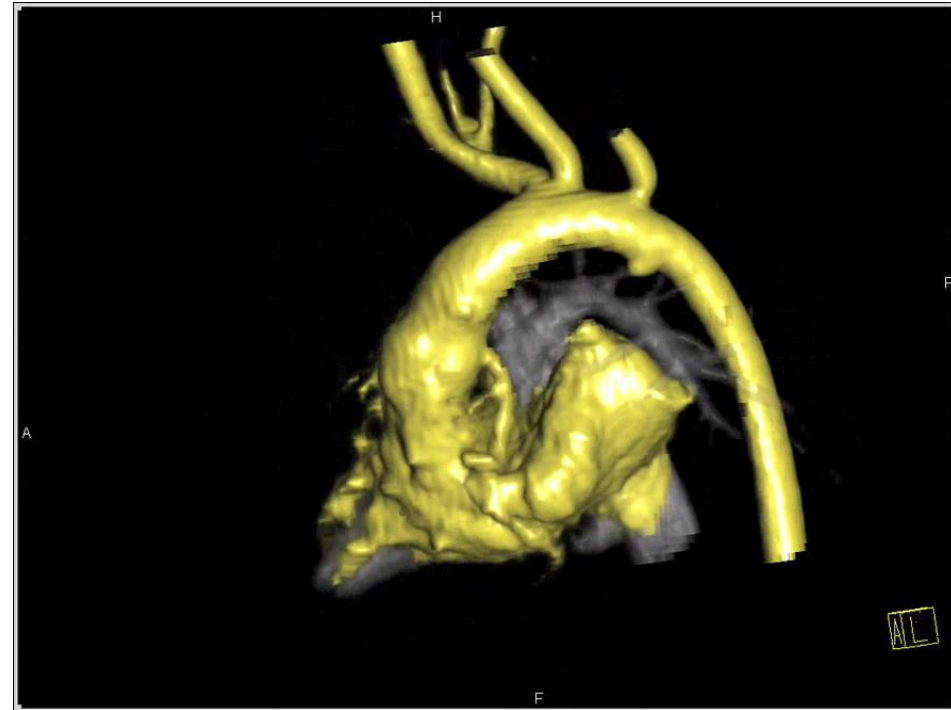
Stage	Pre-PCPC		PCPC		TCPC	
Pacing frequency	200-260 bpm		200-260 bpm		180-220 bpm	
X-ray delay	1 sec		1-2 sec		1-2 sec	
Power injector	Ventricle/aorta		Ventricle/aorta		Ventricle	
Manual injection(s)	None/ventricle/aorta		SVC + RJV/IV		SVC + IVC + RJV/IV	
	<i>ml/kg</i>		<i>ml/kg</i>		<i>ml/kg</i>	
Contrast injection	Volume	Pure	Volume	Pure	Volume	Pure
- Systemic Injector	4.85	3.25	3.60	2.40	2.50	1.70
- Systemic Manual	3.90	2.60	2.00	1.35	-----	-----
- PCPC Manual	-----	-----	3.45	2.30	-----	-----
- TCPC Manual	-----	-----	-----	-----	2.40	1.60
- Dilution	60-67%		60-67%		60-67%	
- Injection speed	± 3.5-4 ml/sec		± 7 ml/sec		± 12 ml/sec	

Background : 3DRA



Background – study aim– Methods – Results – Discussion – Conclusion

Background : 3DRA



Background – study aim– Methods – Results – Conclusion

Study aim

1. Evaluate the **diagnostic accuracy** and **additional value** of 3DRA compared to conventional angiography (CA) in children with univentricular hearts.

1. Setup of imaging protocol

Methods

Design

- Retrospective

Inclusion

- Pts < 18y, UVH
- Cath pre-PCPC/TCPC or aortic/PA intervention

Time frame

- conventional Angio(CA) < 2014
- 3DRA (Artis Zee, Siemens) > 2011

Data collection

- demographic / clinical / cath
- Image quality & additional value score
- Interventions & interventional success
- complications

Results

- **Inclusion**
 - 128 patients (78 male)
 - 242 catheterizations
 - 186 CA
 - 56 3DRA's

Reason	Type	Conventional angiography	3DRA
Pre-PCPC	D	61	7
Pre-PCPC with intervention	D/I	16	9
Pre-TCPC	D	41	5
Pre-TCPC with intervention	D/I	36	19
Intervention PA or Ao	I	32	16
Total		186	56

Results

Characteristic	CA (N = 186)	3DRA (N = 56)	Total N = 242
Reason catheterization	N	N	N
Pre-PCPC (+/- intervention)	77	16	93
Pre-TCPC (+/- intervention)	77	24	101
Intervention PA or Ao	32	16	48
Age (years)	Mean ± SD	Mean ± SD	<i>p</i> -value
Pre-PCPC (+/- intervention)	0.446 ± 0.387	0.379 ± 0.169	0.504
Pre-TCPC (+/- intervention)	3.210 ± 2.568	2.641 ± 1.499	0.305
Intervention PA or Ao	3.795 ± 4.473	4.623 ± 4.680	0.555
Weight (kg)	Mean ± SD	Mean ± SD	<i>p</i> -value
Pre-PCPC (+/- intervention)	5.96 ± 1.67	5.99 ± 1.01	0.937
Pre-TCPC (+/- intervention)	13.95 ± 6.89	13.14 ± 3.48	0.579
Intervention PA or Ao	15.73 ± 12.33	16.67 ± 11.60	0.801
Length (cm)	Mean ± SD	Mean ± SD	<i>p</i> -value
Pre-PCPC (+/- intervention)	61.55 ± 7.33	61.75 ± 5.52	0.916
Pre-TCPC (+/- intervention)	93.20 ± 16.26	90.31 ± 11.21	0.419
Intervention PA or Ao	91.42 ± 32.02	95.00 ± 32.64	0.719

Results : Image quality

Structure	Conventional angiography % of good quality	3DRA % of good quality	<i>p</i> -value
Single ventricle	100	100	-
Aorta	97.9	100	<u>1.00</u>

difficult to compare

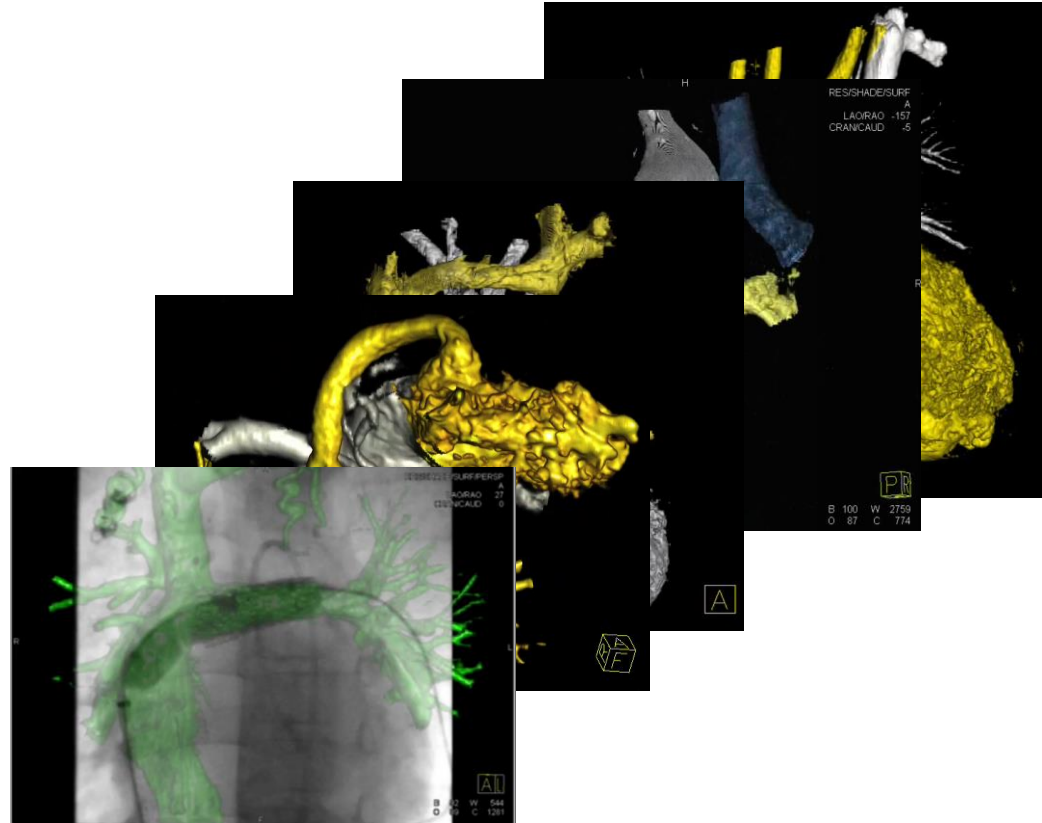
Conventional Angio scored “good” being conventionally good

3DRA scored “good” offering maximal 3D info

Inferior vena cava	94.1	100	0.51
Innominate vein	89.4	100	0.20
Left jugular vein	82.2	100	0.10

Results : additional value

- Collaterals
- Airway-vessel interaction
- Vessel-vessel interaction
- Virtual angulations
- Roadmap
- The unexpected....



Results : interventions

128 interventional cath

- 222 interventions
 - **CA: 45%** (n=145) **3D: 79%** (n=77) → $p = 0.000$

Bias

Conventional Angio “old” strategy

3DRA more contemporary interv. strategy

- Success rate
 - CA: 87.6%; 3DRA: 94.8% → $p = 0.087$

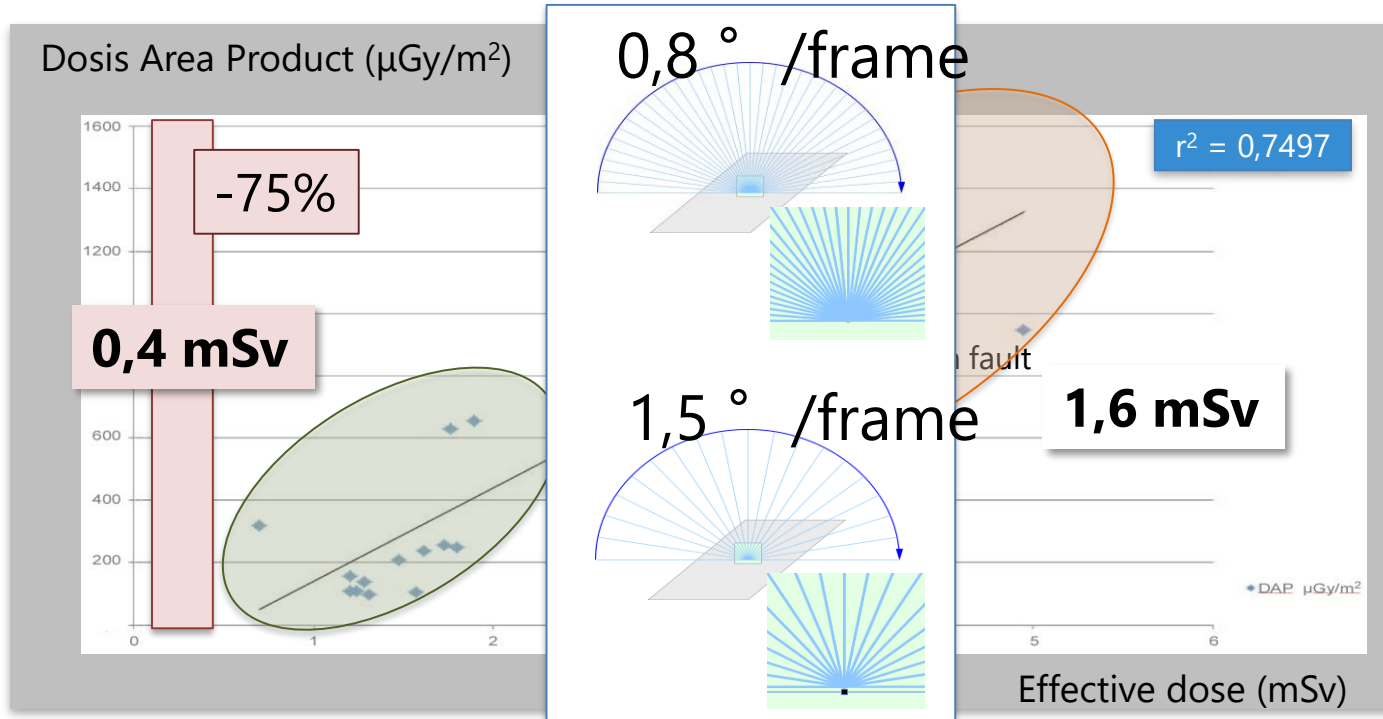
Results : complications

- Procedural complications
 - 12 in CA (6.5%)
 - 4 in 3DRA (7.1%)
→ $p = 0.77$
- Interventional complications
 - 13 in CA (8.9%)
 - 7 in 3DRA (9.1%)
→ $P = 0.98$

Results : number of angio's

Subgroup	CA	3DRA	<i>p-value</i>
Diagnostic	N = 154	N = 40	
A-plane	6.51 ± 3.32	4.60 ± 2.63	0.001*
B-plane	5.08 ± 2.55	2.60 ± 2.04	0.000*
Interventional	N = 84	N = 44	
A-plane	7.96 ± 7.53	8.32 ± 5.24	0.749
B-plane	4.39 ± 5.29	4.66 ± 4.47	0.780

Results : radiation



Results : radiation

Subgroups	CA	3DRA	<i>p-value</i>
Pre-PCPC and pre-TCPC	N = 102	N = 12	
Total DAP ($\mu\text{Gy}/\text{m}^2$)	479.65 \pm 456.73	341.17 \pm 460.65	0.305
Pre-PCPC/TCPC + intervention	N = 52	N = 28	
Total DAP ($\mu\text{Gy}/\text{m}^2$)	772.09 \pm 929.89	629.36 \pm 741.75	0.442
Separate intervention	N = 32	N = 16	
Total DAP ($\mu\text{Gy}/\text{m}^2$)	1293.85 \pm 1245.89	1241.32 \pm 1465.87	0.904

Conclusions

- 3DRA provides excellent imaging of univentricular hearts in all stages of palliation
- 3DRA is superior to CA in displaying shunts, collaterals and coronary anatomy
- Not at the expense of more radiation / more contrast / more complications
- Essential additional information “all in one run”

Thank you



*Pediatric Cardiology Department
Wilhelmina Children's Hospital Utrecht:*
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Hans Breur
Femke vd Stelt

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