

Definition of Institutional Diagnostic Reference Levels in Pediatric Interventional Cardiology Procedures

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Background

Children may be more sensitive to radiation induced cancer because of:

- Higher organ specific risk factor
- X-ray beam centered in a region with close proximity to more radiosensitive organs

Objectives

This study evaluates paediatric IC radiation doses in a dedicated cardiology center with the objective of characterising patterns in dose variation.

The ultimate purpose was to define Institutional Diagnostic Reference Levels (DRLs) for different types of paediatric IC procedures by age range.

Methods-Types of Procedures

- Diagnostic Cardiac Catheterization
- Aortic Angioplasty
- Pulmonary Artery Angioplasty
- Atrial Septal Defect (ASD) occlusion
- Pulmonary valve dilatation
- Patent Ductus Arteriosus (PDA) occlusion
- Electrophysiology study and Radiofrequency Ablation
- Pacemaker Implantation

Hospital	Total Procedures collected	X-ray Machine	Antiscatter grid YES or NO	Acquisition frames per second	Fluoroscopy pulses per second
Onassis Cardiac Surgery Center	477	SIEMENS Zee Biplane angiography machine with flat panel detector	Yes	30 f/s 5f/s (for patients >60kg)	7.5 p/s

RESULTS: The size of the patient is the major cause of increasing patient dose.

Age group	Examination type	# of cases	% males	P _{KA} median (range) Gy.cm ²
< 1	All	118	62.3	2.0 (0.2 - 65)
	1. Diagnostic Catheterization	54		2.0 (0.2 - 65)
	2. Aortic Angioplasty	10		1.7 (0.7 - 3.6)
	7. Pulmonary Valve Dilatation	9		1.9 (0.3 - 7.2)
	8. Patent Ductus Arteriosus (PDA) Occlusion	8		1.0 (0.5 - 5.0)
1 to < 5	All	123	48.7	3.0 (0.1 - 36)
	1. Diagnostic Catheterization	66		3.0 (0.1 - 36)
	3. Pulmonary Artery Angioplasty	5		2.9 (1.5 - 5.0)
	7. Pulmonary Valve Dilatation	4		3.8 (1.0 - 9.4)
	8. Patent Ductus Arteriosus (PDA) Occlusion	11		3.0 (0.4 - 8.8)
5 to < 10	All	135	48.1	7.0 (0.1 - 761)
	1. Diagnostic Catheterization	33		6.6 (1.0 - 56)
	2. Aortic Angioplasty	4		4.0 (1.2 - 28)
	5. Atrial Septal Defect (ASD) Occlusion	35		7.0 (2.0 - 196)
	8. Patent Ductus Arteriosus (PDA) Occlusion	7		3.0 (1.3 - 15)
	9. Electrophysiology study 10. Radiofrequency Ablation	5		17.0 (0.1 - 22)
10 to < 16	All	101	48.2	14 (1.0 - 128)
	1. Diagnostic Catheterization	28		12.4 (1 - 105)
	5. Atrial Septal Defect (ASD) Occlusion	17		11.0 (3.0 - 49)
	8. Patent Ductus Arteriosus (PDA) Occlusion	5		12.0 (3.0 - 32)
	9. Electrophysiology study 10. Radiofrequency Ablation	9		20.8 (5.4 - 128)
	11. Pacemaker Implantation	2*		(11 - 22)
Total		477		

Conclusions

- Our study suggests preliminary institutional DRLs for paediatric interventional procedures for 4 age groups.
- It shows that age influences radiation dose comparable to recently published data.
- Paediatric DRLs should be established to further optimise radiation dose and clinical practice.
- Detailed guidelines are needed on how to organise patient dose surveys and how to establish DRLs