

Paediatric Interventional Cardiology Diagnostic Reference Levels in Ireland

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Aims and objectives

The aim of this work was to propose a set of national diagnostic reference levels (DRLs) for paediatric interventional cardiology (IC) procedures for the Irish population. As has been previously reported [1], little published information exists on radiation exposure in paediatric IC. In recent times, ICRP [2] have highlighted the need for DRLs in IC. Furthermore, RP 185 [3] states that "no NDRLs exist for paediatric IR procedures, and LDRLs have been published only for paediatric interventional cardiology (IC) procedures. The development of LDRLs for these procedures should be encouraged and the feasibility of NDRLs and EDRLs should be studied." This study uses data from the national specialist paediatric centre in Ireland. As noted in [4], in small countries most paediatric interventions are carried out in a single paediatric centre and DRLs calculated from the workload for that centre could reasonably be considered national DRLs.

Methods and materials

Interventional Cardiology (IC) procedures from the national specialist paediatric centre, Our Lady's Children's Hospital, Dublin, were collated over an 18 month period. All procedures were performed on a Siemens Artis Q-Zen. Patient dose was recorded as kerma-area product (KAP). Data for the most common examinations were collated and analysed for the presence of correlations between patient weight and KAP (using Spearman's Rank Order Correlation). Where strong to moderate correlations were found, a DRL for that examination was proposed as KAP per kg.

Results

Although all examinations contained numerous outliers, strong to moderate correlations were found between KAP and patient weight for the majority of procedures (see table 1). The median (Q50) and 75th percentile (Q75) are presented for each examination as KAP per kg (see table 2). An example of how these values translate to a variety of patient weights is illustrated in figure 1, for atrial septal defect closure.

Other studies have reported diagnostic reference levels for all IC procedures taken together [4, 5]. Table 3 compares our IC data, taken together, with those reported in the literature.

Images for this section:

Correlating Patient Weight (kg) with KAP (Gy.cm²) by Procedure				
	Spearman's Correlation	P Value	n	Correlation Strength
IC AORTA COARCTATION DILATION	0.831	0	18	STRONG
IC CARDIAC ANGIO CONGEN ANOMALY STUDY	0.594	0	259	MODERATE
IC CARDIAC ATRIAL SEPTAL CLOSURE	0.766	0	90	STRONG
IC CARDIAC SEPTOSTOMY	0.667	0.05	9	MODERATE
IC CARDIAC VALVULOPLASTY	0.523	0.002	33	MODERATE
IC CLOSURE PATENT DUCTUS ARTERIOSUS	0.516	0	138	MODERATE
IC FENESTRATION CLOSURE	0.393	0.096	19	WEAK
IC PULMONARY ARTERY DILATION	0.411	0.012	37	MODERATE
IC PULMONARY VALVE DILATION	0.471	0.076	15	MODERATE
IC STENT DILATION	0.803	0	34	STRONG
IC STENT PATENT DUCTUS ARTERIOSUS	0.215	0.262	29	WEAK
IC VSD CLOSURE	0.333	0.059	33	WEAK
ALL DATA	0.679	0	806	STRONG

Table 1: Correlation between patient weight (kg) and KAP (Gy.cm²) for a variety of paediatric IC examinations

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Q50 & Q75 for Specific IC Examinations, KAP per kg		
	Q75	Q50
	Gy.cm²/kg	
IC AORTA COARCTATION DILATION	0.269	0.214
IC CARDIAC ANGIO CONGEN ANOMALY STUDY	0.442	0.209
IC CARDIAC ATRIAL SEPTAL CLOSURE	0.077	0.039
IC CARDIAC SEPTOSTOMY	0.191	0.071
IC CARDIAC VALVULOPLASTY	0.250	0.151
IC CLOSURE PATENT DUCTUS ARTERIOSUS	0.140	0.075
IC PULMONARY ARTERY DILATION	0.615	0.481
IC PULMONARY VALVE DILATION	0.186	0.158
IC STENT DILATION	0.508	0.234

Table 2: Median (Q50) and 75th Percentile (Q75) values presented as KAP per kg for a variety of paediatric IC procedures

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Comparison of OLCHC Data with Published Studies						
	OLCHC		Onnasch [5]		Ubeda [4]	
	Q50	Q75	Q50	Q75	Q50	Q75
kg	Gy.cm ²		Gy.cm ²		Gy.cm ²	
10	1.37	3.64	2.92	5.39	0.96	1.66
20	2.74	7.28	5.84	10.78	1.92	3.32
30	4.10	10.92	8.76	16.17	2.88	4.98
40	5.47	14.56	11.68	21.56	3.84	6.64
50	6.84	18.20	14.60	26.95	4.80	8.30
60	8.21	21.83	17.52	32.34	5.76	9.96
70	9.58	25.47	20.44	37.73	6.72	11.62
80	10.94	29.11	23.36	43.12	7.68	13.28

Table 3: Comparison of Q50 and Q75 values for ALL paediatric IC procedures undertaken in Ireland, with published studies

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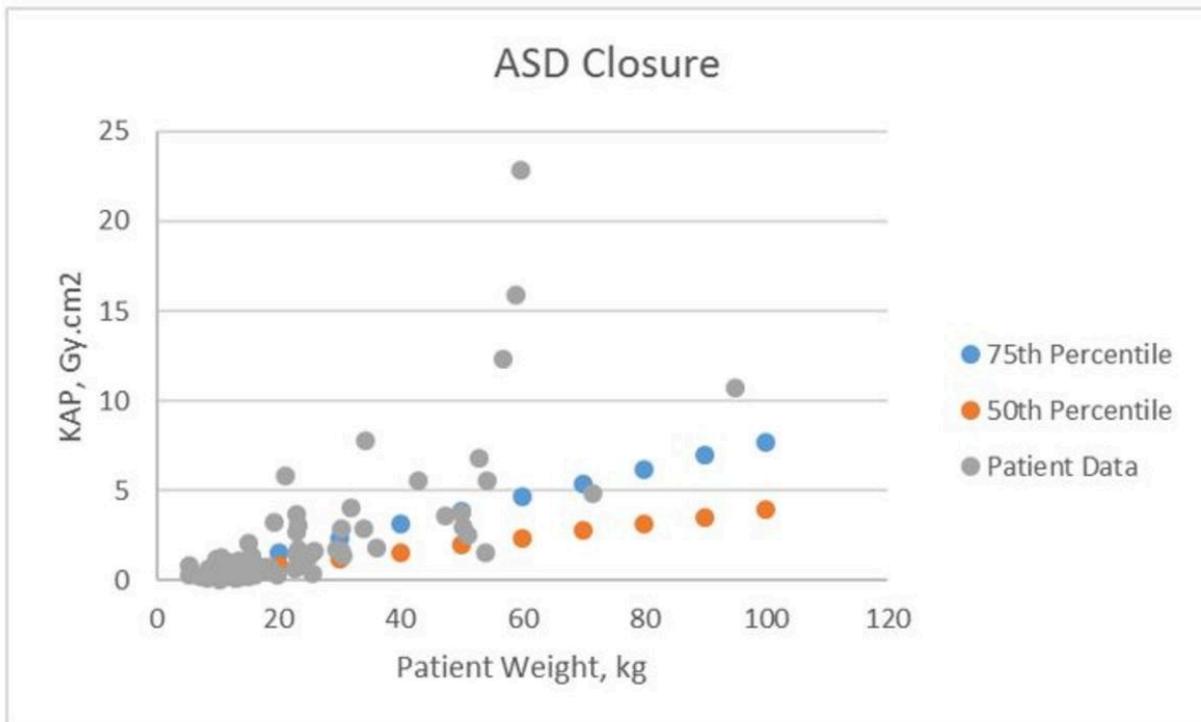


Fig. 1: Illustration of Q50 and Q75 values as applied to Atrial Septal Defect Closure examinations undertaken in Ireland

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Conclusion

Paediatric IC procedures present particular challenges when attempting to calculate DRLs. The variety of the examinations, the complexity of the procedures and experience of the operators all influence the patient's radiation exposure.

Both Q75 and Q50 percentiles are presented as KAP per kg for a variety of paediatric IC procedures. As all paediatric IC procedures, on the island of Ireland, are performed in a single hospital, these values are proposed as national DRLs.

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