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Radiation dose reduction in pediatric coronary CT: Assessment of effective dose and image quality



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Aim To assess the impact of different scanning protocols on radiation dose and image quality for pediatric coronary computed tomography.

Materials and methods 100 children underwent coronary computed tomography after arterial switch operation from November 2012 to March 2014. Scans were done using two different scanner models without difference in scanning and image reconstruction parameters: Light speed VCT and Discovery HD750, 64-slice from GE Healthcare. Two consecutive changes in scanning protocols were performed: 1) the use of adaptive statistical iterative reconstruction (ASIR) instead of filtered back projection (FBP) for image reconstruction; 2) the optimization of scan acquisition parameters (current and tube voltage reduction). Premedication (beta-blocker) was used for all children to obtain heart rate < 80 BPM. Effective dose (ED) was calculated with the dose-length product method with a conversion factor adjusted for patient age. Image quality was evaluated by the referent physician. Scans were classified as "excellent", "good" or "with significant artifacts".

Results Patients were divided in three age groups: 0–4, 5–7 and 8–18 years. After adjustment for scan settings, median ED decreased by 28% (3.9 mSv, IQR 2.8–4.2), 40% (0.9 mSv, IQR 0.6–2.6) and 65% (0.7 mSv, IQR 0.5–0.9) for 0–4, 5–7 and 8–18 years age groups ($P < 0.05$), respectively. The prospective protocol (PULSE) was used in 40% of children. The reduction in radiation dose was not associated with reduction in diagnostic image quality.

Conclusions Coronary CT can be obtained at very low radiation doses in pediatric patients using ASIR and prospective ECG-triggered acquisition with optimized scan parameters.

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Perioperative assessment of left ventricular function by 2D strain (speckle tracking) in pediatric cardiac surgery



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Introduction Conventional echographic parameters are neither accurate nor reproducible to assess left ventricular function after cardiac surgery with cardiopulmonary bypass. The main objective of this study was to evaluate the feasibility and reproducibility of 2D strain during the peri-operative period. The second objective was to assess the post-operative evolution of 2D strain, particularly after an atrial septal defect closure.

Methods 33 pediatric patients (< 18 years) with congenital heart disease undergoing cardiac surgery with cardiopulmonary bypass were included in this prospective single center study. Daily echocar-

diography was performed from the day before surgery to the sixth post-operative day. Left ventricular ejection fraction (Teichholz and Simpson) and 2D strain (longitudinal, circumferential and radial) were measured.

Results Mean age and weight were 4 years [2–6] and 15 kg [10–20]. Mean durations of cardiopulmonary bypass and aortic cross-clamp were 117 min [86–148] and 58 min [44–72]. The global post-operative feasibility of longitudinal, circumferential and radial strain was respectively 91%, 95% and 95%, similar to the feasibility of conventional parameters (97%). The intra- and inter-observer correlation coefficients were good for longitudinal strain (0.916, $P < 0.001$ and 0.885, $P < 0.001$), circumferential strain (0.880, $P < 0.001$ and 0.829, $P < 0.001$) and radial strain (0.701, $P = 0.002$ and 0.559, $P = 0.020$). Early post-operative circumferential strain was correlated to the durations of aortic cross-clamp ($r = 0.603$, $P = 0.001$), inotropic support ($r = 0.558$, $P = 0.004$) and mechanical ventilation ($r = 0.580$, $P = 0.002$). Circumferential strain significantly improved after an atrial septal defect closure (–19.86 [–22.73; –17.00] versus –14.95 [–17.79; –12.11], $P = 0.028$).

Conclusion 2D strain is feasible and reproducible in the post-operative period. Further studies are needed to assess its interest in early diagnosis of post-operative myocardial dysfunction.

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Stents in pediatric and adult congenital cardiac catheterization in France in 2013



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Stents have contributed to the development of the interventional catheterization for congenital heart diseases (CHD). The aim of this study was to describe indications, results and adverse events in current practice.

Methods The participation to this study was proposed to all catheterization laboratories specialized in CHD in France (M3C network). All cases with stents implantation in 2013 in pediatric and

adult CHD were retrospectively included. Adverse events were assessed using the Bergersen classification.

Results 174 stents were implanted during 132 procedures in 127 patients by 6 main operators in 9 centers. Patients were aged 15.7 ± 15.1 years old (min 5 day-old - max 70 years old). Sixteen types of procedures were identified. Main indications were transcatheter pulmonary valve replacement (29 patients, 23.0%), pulmonary artery branches angioplasty (34 patients, 27.0%), aortic (re)coarctation stenting (37 patients, 29.4%) and ductus arteriosus stenting (11 patients, 8.7%). 18 patients (14.3%) were under one y.o and 35 (27.8%) were over 18 y.o. Main pathologies were tetralogy of Fallot and variants (ACC-CHD 8.3, $n=45$, 35.7%), and aortic coarctation (ACC-CHD 9.2, $n=36$, 28.6%). More than 1 stent was implanted in 32 procedures (24.4%, max. 5 stents). Main stents implanted were the CP stent (33.0%), EV3 LD max (22.0%), Valeo (16.2%) and valved stents (15.0%). 98.5% procedures were considered as successful. Serious adverse events were observed in 12.9%. After multivariate adjustment, only procedure type was related to the risk of total adverse events (OR: 3.0, 95%CI 1.1–7.9) but not to stent related adverse events. Age, weight, center, operator, type of stents, stent diameter, genetic disorder and type of CHD were not significantly related to the risk of adverse events.

Conclusion Stents are used in various CHD catheterization procedures, from infancy to adult age. Adverse events rate is significant and seems related to the type of procedure.

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Conservative surgery for congenital mitral valve stenosis: Is it the best option?



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Objectives Congenital mitral valve stenosis (CMVS) is a heterogeneous group of lesions that can be isolated or part of left heart obstructive syndrome. Historically, mitral valve surgery has been associated with significant morbidity and mortality. Surgical techniques have recently improved. We review here a single-center experience in mitral valve (MV) surgery for CMVS.

Patients Between 1975 and 2013, 50 pts underwent MV surgery for CMVS. Six (12%) were adults (> 18 yrs) and 18 were < 2 yrs (36%). Median age was 3 yrs (19 d–30 yrs, mean 6.3 yrs), median weight 13 kg (2.7–80 kg, mean 19.2 kg). In 35 pts, CMVS was part of left heart obstructive syndrome, with 1 or more previous non-MV surgery in 25. Among the 15 pts with "isolated" CMVS, 2 had previous non-MV surgery. Two pts had previous mitral valvuloplasty in another center.

Results First choice MV surgery was valvuloplasty in 48 pts, prosthetic valve replacement (MVR) in 2. In the valvuloplasty group, 14 pts were reoperated with a median delay of 11 mo (mean 22 mo, 19 d–16.6 yrs). Second surgery was MVR in 3, valvuloplasty in 11. Five pts had a 3rd surgery (3 MVR, 3 valvuloplasty), 2 had a 4th surgery (redo MVR). There were 6 deaths (overall mortality 12%): 2 after first surgery (1 valvuloplasty, 1 MVR, respectively 8 and 14 days postop), 4 after the second surgery (24 days and 3.5 mo after valvuloplasty, 30 days and 31 yrs after MVR). Risk factors for postoperative death were: presence of supraventricular lesions (left superior vena cava in the coronary sinus and/or supramitral ring, $P < 0.04$), surgery for supraventricular lesions ($P < 0.04$), longer cardiac bypass time ($P < 0.03$) and longer ICU stay duration ($P < 0.01$). Risk factors for reoperation were younger age ($P = 0.008$) and low weight ($P < 0.04$) at first surgery.

Conclusion Valvuloplasty as first-choice surgery for CMVS carries an acceptable initial mortality but a relatively high rate of reoperations (29%). Iterative plasty is possible but mortality is higher (18%).

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