Introduction:

We previously reported the first clinical study documenting the radiation dose reduction capabilities of a next-generation pediatric imaging platform (Q.zen - Siemens Healthcare, Forchheim, Germany) in patients < 20 kg undergoing elective patent ductus arteriosus (PDA) closure. Following this publication the AFCH catheterization laboratory instituted imaging protocols to further decrease procedural radiation exposure. The purpose of this study was to define the extent of radiation reduction on the Q.zen system in response to the interventions.

Methods:

In 1/2016 interventions instituted for all catheterization procedures included decreasing fluoroscopy rates from 15 frames/second to 7.5 frames/second and including fluoroscopy rates and planned angiogram acquisitions in the pre-procedural time out. Radiation dose data was retrospectively obtained for two study groups: Group 1 patients < 20 kg undergoing patent ductus arteriosus (PDA) closure and Group 2, all patients < 50 Kg having diagnostic or interventional catheterizations. Comparisons were made between the pre (6/2014-12/2015) and post (1/2016-7/2016) intervention dose data, Air Kerma (AK) and Dose Area Product (DAP). For both Group 1 & 2 comparisons patient demographics (age, weight and BSA) and procedural techniques (fluoroscopy time, number of angiograms) were similarly matched.

Results:

For Group 1 patients (pre-intervention n=26 vs. post-intervention n=6) radiation dose measured as AK decreased from 30 ± 15 mGy to 12.6 ± 7 mGy (p value .01) which represented a 58% dose savings. Similar (61%) reductions were measured for DAP 218 ± 190 $\mu Gy.m^2$ to 65 ± 30 $\mu Gy.m^2$ (p value .06). Both AK and DAP values are substantially less than the published benchmarks of Ghelani *et al.* for PDA closure in patients < 20 kg (AK 76 mGy, DAP 500 $\mu Gy.m^2$ - JACC Cardiovascular interventions 2014;7:1060-9). For Group 2 patients (pre-intervention n=140 vs. post-intervention n=36) AK decreased from 87 ± 108 mGy to 50 ± 80 mGy (p value .1) which represented a 39% dose savings. Similar, 34% dose savings were measured for DAP 858 ± 1400 $\mu Gy.m^2$ to 571 ± 1090 $\mu Gy.m^2$ (p value .3).

Conclusion:

Simple interventions universally instituted in a pediatric catheterization laboratory can substantially decrease radiation exposure without compromising image quality. Further interventions and advancing image technologies will redefine and dramatically reduce accepted patient and operator exposure benchmarks.