**O6-1**

# Pediatric Normal Values for Pulsed Doppler Velocities, Times, and Velocity Time Integrals for Semilunar Valves and Great Vessels

*Cantinotti M. (1), Marchese P. (1), Franchi E. (1), Corana G. (1),Viacava C. (1), Assanta N. (1), Santoro G. (1)*
*Pediatric Cardiology and GUCH Unit, Fondazione CNR-Regione Toscana G. Monasterio, Massa and Pisa , Italy*

**Background:** Doppler velocities are commonly employed for functional evaluation of semilunar valves and great vessels, however, pediatric nomograms are limited. Our aim was to prospectively establish pediatric nomograms for Doppler velocities in the great vessels at different sites in a large pediatric cohort.

**Methods:** We prospectively studied 912 healthy Caucasian Italian children (age 31 days-17 years, 48.6% female). Echocardiographic measurements included: pulsed Doppler velocities (cm/s), acceleration/deceleration times (ms), ejection times (ms), and velocity time integrals (VTI; cm) at multiple sites including the aortic valve, pulmonary valve, and aortic arch. Sub-aortic, pulmonary annulus and aortic isthmus diameters were measured, and stroke volume (ml) and cardiac output (L/min) derived at all sites. Age, weight, height, heart rate (HR), and body surface area (BSA) were used as independent variables in different analyses to predict mean values of each measurement.

**Results:** At all sample points the VTI, ejection time, diameter, SV and CO were positively correlated with BSA and age, but negatively correlated with HR ($r \geq 0.6$, $p<0.001$). Models with exponential ($\ln[y]=a+b*\ln[x]$), linear ($y=a+b*x$) or cubic ($y=a+b_1*x+b_2*x^2+b_3*x^3$), equations showed the best results. For all parameters, the association with BSA was stronger than for HR or age, so BSA was used for normalization. Predicted values and Z-score boundaries by BSA are provided.

**Conclusions:** We report pediatric echocardiographic normative data for Doppler velocities, acceleration/deceleration times, and VTI for semilunar valves and great vessels in a large pediatric population.Our data would serve as a baseline Doppler evaluation in children with congenital heart disease.

*Table 1a: Aorta Coefficients for regression equations relating echocardiographic measurements and BSA, the Standard Error of the Estimate, the determination coefficient. Normality test: Shapiro-Wilk and Lilliefors (Kolmogorov-Smirnov). Heteroscedasticity test (White test and Breusch-Pagan test). BSA HAYCOCK.*
*($\ln[y] = a + b*\ln[x]$); Z value = ($\ln[\text{Measurement}] - (\text{Intercept} + B*\ln[\text{BSA}]))/\sqrt{\text{MSE}}$*

| Measurement | Intercept | B | SEE (√MSE) | R2 | SW | KS | BP | W |
|---|---|---|---|---|---|---|---|---|
| Ao VTI (cm) | 3.160 | 0.353 | 0.188 | 0.459 | 0.067 | 0.193 | 0.468 | 0.085 |
| Ao ejection time (ms) | 5.687 | 0.209 | 0.112 | 0.459 | 0.062 | 0.087 | 0.074 | 0.264 |
| Ao Acc Time (AT) (ms) | 4.309 | 0.314 | 0.282 | 0.233 | <0.001 | <0.001 | <0.001 | <0.001 |
| Ao Dec Time (DT) (ms) | 5.383 | 0.180 | 0.162 | 0.230 | <0.001 | <0.001 | 0.184 | 0.724 |
| AO SV (ml) | 3.686 | 1.324 | 0.243 | 0.878 | 0.868 | 0.200 | 0.064 | 0.053 |
| AO CO (L/min) | 1.224 | 0.902 | 0.247 | 0.759 | 0.601 | 0.200 | 0.971 | 0.234 |

*Table 1b: Pulmonary artery:BSA HAYCOCK.*
*($\ln[y] = a + b*\ln[x]$); Z value = ($\ln[\text{Measurement}] - (\text{Intercept} + B*\ln[\text{BSA}]))/\sqrt{\text{MSE}}$*

| Measurement | Intercept | B | SEE (√MSE) | R2 | SW | KS | BP | W |
|---|---|---|---|---|---|---|---|---|
| Ao VTI (cm) | 3.160 | 0.353 | 0.188 | 0.459 | 0.067 | 0.193 | 0.468 | 0.085 |
| Ao ejection time (ms) | 5.687 | 0.209 | 0.112 | 0.459 | 0.062 | 0.087 | 0.074 | 0.264 |
| Ao Acc Time (AT) (ms) | 4.309 | 0.314 | 0.282 | 0.233 | <0.001 | <0.001 | <0.001 | <0.001 |
| Ao Dec Time (DT) (ms) | 5.383 | 0.180 | 0.162 | 0.230 | <0.001 | <0.001 | 0.184 | 0.724 |
| AO SV (ml) | 3.686 | 1.324 | 0.243 | 0.878 | 0.868 | 0.200 | 0.064 | 0.053 |
| AO CO (L/min) | 1.224 | 0.902 | 0.247 | 0.759 | 0.601 | 0.200 | 0.971 | 0.234 |