Reference values of the right ventricular outflow tract systolic excursion (RVOT SE) in 711 children and calculation of z-score values

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Aims:
The right ventricular outflow tract systolic excursion (RVOT SE), as an echocardiographic tool to analyze RV systolic function has recently been introduced in adults with and without acquired heart disease*. RVOT SE is an opportunity to assess part of the RV systolic function in a simple way using M-mode echocardiography*. We undertook a prospective study to determine normal values for the RVOT SE inside the pediatric age group when correlated to age and BSA, and to calculate normal z-score values. A further aim was to determine the value of RVOT SE compared to established age-related echocardiographic parameters for defining longitudinal RV systolic function, such as the tricuspid annular plane systolic excursion (TAPSE) and the tricuspid annular peak systolic velocity (S’). (measured using tissue Doppler imaging).

Methods and Results:
Study group: 711 pediatric patients (368 male; 343 female) with a normal echocardiogram; our study group encompasses neonates to adolescents (age: 1 day to 18 years; BSA: 0.14 to 2.26 m²), including 68 neonates and 112 infants. RVOT SE is defined as the systolic excursion of the endocardial surface of the anterior wall of the RVOT relative to the transducer (Figure 1). We found that the RVOT SE ranged from a mean of 3.4 mm in healthy neonates to 9.5 mm in 18 year old adolescents. As expected in adolescents the mean RVOT SE values were similar to known adult values. The RVOT SE values showed a positive correlation with age (r=0.90, p<.001) (Figure 2) and with the BSA (r=0.91, p<.001). An index was calculated for the RVOT SE for age divided by the BSA of our patients. This indexed value declines exponentially. It starts high in the neonates and declines to the adolescent age groups (Figure 3). A positive correlation was seen between RVOT SE and TAPSE (r=.93, p<.001) and between RVOT SE and S’ (r=.86, p<.001) in our patients.

Discussion:
Determination of the RVOT SE is possible on all available cardiac ultrasound systems. It can be used as a non-invasive measurement to study RV systolic function in children additionally to the recommended RV systolic measurements for performance of pediatric echo***. The role of the RVOT SE has been suggested to be important in patients with CHD. The RVOT SE has been demonstrated to directly measure the contraction of the overall RVOT region. Reference values of RVOT SE measurements for the adult population are available*. In patients with repaired tetralogy of Fallot (rTOF) RVOT aneurysm or dyskinesia is relatively common as a result of surgical reconstruction during repair. In rTOF patients both, the contraction of the RVOT and of the RV-body are important determinants of the global RV systolic function****

Conclusion:
We found a 2.7 fold increase of the z-score of the RVOT SE values from 3.5 mm in neonates to 9.5 mm in 18 year old adolescents. RVOT SE is affected by increasing age and increasing BSA with a steeper course of the curve in neonates and infants compared to children and adolescents. A weak correlation between RVOT SE and TAPSE or S’ demonstrates that the RVOT SE does not provide the same information about RV behavior as the other RV systolic function parameters. An explanation might be the different age-related increase of TAPSE, S’ and RVOT SE values in childhood. Measuring RVOT SE consequently gives us additional information of what is a “normal/impaired” systolic function for the pediatric RVOT. In clinical practice this parameter may serve as an additional tool. Together with the established longitudinal RV systolic function parameters TAPSE and S’ the RVOT SE may provide sufficient information of RV systolic function, e.g. in patients with repaired TOF.

References:

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