

Left atrial pediatric reference volumes using Real-time 3D-Echocardiography

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Objectives: Left atrium (LA) size and function play a critical role in left ventricular filling. The assessment of LA size, reservoir and conduit function have been shown to be of prognostic value regarding various heart diseases. Real-time 3D echocardiography (RT3DE) allows the evaluation of left atrial volume changes throughout the cardiac cycle without geometric assumptions. However, pediatric reference values are missing. Aim of our study was to promote the understanding of the dynamic LA function and to create normal values for the pediatric population by RT3DE.

Methods: In a multicenter prospective study, in 218 healthy children and adolescents aged 1.5-256 months, RT3DE of the LA was performed (ie 33, Philips; Vivid 7, GE). Data were analyzed using 4D LV Function by TomTec, assessing maximal and minimal LA volume (V_{max} , V_{min}). The volume and time period prior to the active contraction of the LA (V_{preA}) was determined by adapting the visual rebound of the mitral valve as well as the p-wave in ECG. Additionally, the cyclic volume change [CVC (ml)= $V_{max}-V_{min}$], active- [AE(%)= $(V_{preA}-V_{min})/CVC$] and passive emptying [PE(%)= $(V_{max}-V_{preA})/CVC$], atrial active emptying fraction [AEF(%)= $(V_{preA}-V_{min})/V_{preA}$], atrial passive emptying fraction [PEF(%)= $(V_{max}-V_{preA})/V_{max}$] and the duration of atrial systole and diastole, as well as the active and passive share in atrial systole were calculated (Fig 1a). Inter- and intraobserver variability was assessed for all parameters. Percentiles were created using the LMS method.

Results: Figure 1b exemplarily shows percentiles for V_{preA} . Throughout measurements V_{max} and V_{preA} increased with age-progression and decreasing heart rate. AE and AEF increased with age, whilst PE and PEF declined. Furthermore, length of atrial systole increased with age progression, concomitant with shortening of atrial diastole duration.

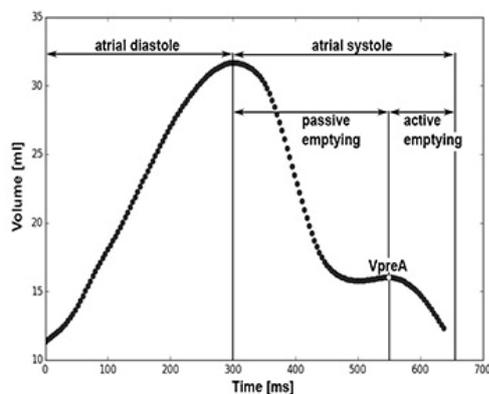


Figure 1a

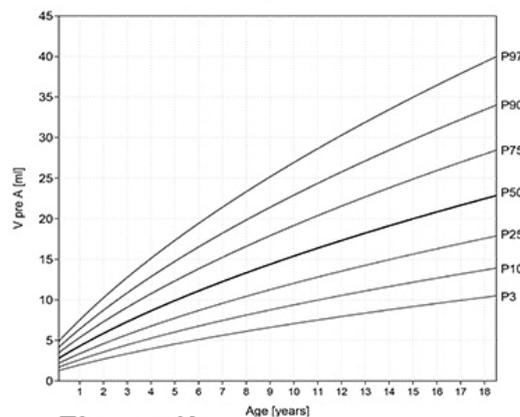


Figure 1b

Conclusion: This study is the first to provide comprehensive reference data for LA volume and function on a large pediatric population using RT3DE. RT3DE is a promising non-invasive method to assess LA function in daily clinical use.

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