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Clinical Implication of Torsion and Strain Using 2D Speckle Tracking Echocardiagraphy in Congenital and Pediatric Population

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Due to advance of pediatric cardiac surgery during past several centuries, survival started to increase with currently a survival rate into adulthood of many patients born with a congenital heart defect (CHD). Although long-term survival seems promising, follow-up is still complicated in corrected CHD patients characterized by a varying degree of impairment of ventricular performance. Furthermore it is not enough and sometime impossible to evaluate the ventricular function with conventional method in the patients with various morphologic ventricles in these patients.

Torsion provides new insight into both systolic and diastolic function compared with conventional methods. Although left ventricular (LV) torsion and strain are important components of LV function in adult population, there are few studies in children and adolescents.[1)2)]

In this issue of the Journal, Kim et al.,[3)] their study using speckle-tracking echocardiography demonstrated the rotation and torsion data in normal children between 2–16 years of the age. They also tried to compare the difference of rotation and torsion between the preschool group and the school group by dividing the patients according to age. As authors mentioned, they could not achieve meaningful difference between two age groups or powerful normal data because of small sample size. However this investigation itself seems to be meaningful attempt in congenital and pediatric cardiologic field.

In adult population, there is clear left ventricle twist because of opposite rotational motional motion of base and apex, whereas in children both segments rotate in the same direction but for different amounts and with a longer deformational delay compares with adults.[4)] During childhood, distinct patterns of apicobasal twisting was reported to be seen with maturation.[5)] Counterclockwise apical rotation was almost constant during childhood, whereas the age-related increase in LV torsion during childhood resulted from a striking change in basal rotation, initially counterclockwise in infancy to neutral in early childhood and showing the adult clockwise pattern in adolescence. Younger hearts tend to twist, untwist, and deform faster. LV untwisting changed significantly in both timing and magnitude with maturation. In infants, untwisting occurs later and at a lower velocity than in older subjects, with little isovolumic untwisting indicating more clearly that uncoiling in the infant heart occurs too late to contribute to the intraventricular pressure gradient at mitral valve opening, a situation that we term "ineffective untwisting." Myocardial fibers connect points at the base and apex that are farther and farther apart circumferentially with growth. By this growth process, basal rotation becomes more prominent, consequently increasing net LV torsion.[6)]

Recently, some data of torsion or twisting using speckle-tracking echocardiography in congenital or pediatric cardiology field have been reported.[7-11)] Torsion may be an interesting marker to guide in children with hypertrophic cardiomyopathy. The global performance index including 3 elements of myocardial deformation, torsion and dyssynchrony is suggested to be a sensitive tool in the early detection of subtle LV dysfunction in patient with congenital and acquired heart disease. Twisting and torsion are reduced in children with single LV after Fontan operation and the time to peak twist and apical-basal delay were longer in the wide QRS group of them.

Translation into clinical use of LV twisting and untwisting parameters in assessing pediatric cancer survivors of different

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ages has been facilitated by the recent publication of normal references in infants, children, and adolescent. Impairment of LV twisting and untwisting motion is evident in patients after anthracycline therapy.[10)11)]

However still more studies would be warranted to demonstrate rotation and torsion of various morphologic ventricles after cardiac surgery in pediatric and grown up congenital population. Furthermore, studies are required to establish normal data of rotation and torsion during cardiac maturation. Therefore, this study demonstrated uncommon normal data of rotation and torsion using 2D speckle tracking echocardiography in children population and this data may be useful for further studies in patients with congenital cardiac anomalies.

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