Role of Echocardiography in Device Closure of Congenital Septal Defects in Children

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Echocardiography is able to provide helpful information on spatial recognition of the VSD and ASD and their relationship to the surrounding anatomic structures. More recently, a series of studies have shown the reliability and advantage of echocardiography in either transcatheter or transventricular closure of congenital septal defects in children. Comprehensive echocardiographic technology has been applied in pediatric patients with secundum atrial septal defect (ASD) and ventricular septal defect (VSD). Results of the studies have shown that echocardiography plays important role in patient selection, monitoring of placement and deployment of the device, evaluation of the occlusion procedure and followup. And it has become an indispensable approach in the guidance of the device closure of congenital septal defects in children.

Key Words: echocardiography; congenital heart disease; device occlusion
Longitudinal and Circumferential Strain in the Clinical Application and Outcome Prediction in Thalassemia Patients with or without Heart Failure (Global Ventricular Strain in the Correlation with Ferritin Plasma Level and Predicting Clinical Events in Thalassemia Patients)

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Introduction
For many years, myocardial iron deposition leading to congestive heart failure remains a clinical challenge in the management of thalassemia with chronic and repeated transfusion. With the development of overt clinical heart failure, mortality rate may be as high as 50%. It has been shown that aggressive chelation may help prevent, delay or even reverse early stage myocardial dysfunction. In this regard, early identification and recognition in this patient population has become an important clinical task for both cardiologists and hematologists.

Exercise capacity and left ventricular global performance in terms of ejection fraction for those with chronically transfused patients with potential iron overload may remain unchanged until late in disease stage. Myocardial iron content quantification has only recently become possible by using MRI. However, MRI is time consuming and obviously limited by its higher cost and not widely available. In contrast, echocardiography as a more widely convenient, clinically feasible and reproducible tool equipped with novel deformation imaging analysis has enabled objective quantification of ventricular function possible in the recent years.

Materials and Methods
In our study, we reported a series of patients (n=37) diagnosed as thalassemia in which repeated transfusions may be clinically warrant. Baseline demographic data, detailed medical history and clinical events are recorded by chart review. 2D echo-based speckle-tracking technique analysis was performed which semi-automatically quantified cardiac longitudinal (from apical 4-chamber), circumferential and radial motion (both from parasternal-short axis) but manual tracking of endocardial borders. Dimensionless strain were generated and related to clinical outcomes.

Results
Of all 37 subjects enrolled in our study, 4 expired at clinical follow up with 2 subjects were related to cardiac origin. 8 developed heart failure (HF) that may necessitate medical treatment and 6 subjects had malignant cardiac arrhythmias. Subjects died from cardiac causes had overwhelmed ventricular dysfunction. Those who developed both co-morbidities (including clinical HF and malignant arrhythmias) had obviously reduction of all strains while those diagnosed as cardiomegaly without clinical events had reduced longitudinal and radial strain with relatively preserved global ejection and circumferential function. Reduced longitudinal and radial strains were both modestly related to increased serum ferritin level while this correlation was not seen in the circumferential strain.
Conclusion
In our study, reduced ventricular contractility in terms of global strain was associated with more clinical events. In addition, the degree of iron load from repeated transfusion was reflected by decreased ventricular deformation. Our data suggested that ventricular functional assessment by tissue deformation imaging may provide as a surrogate for risk stratification in subjects with thalassemia managed with repeated transfusion.
Application of Tissue Doppler Imaging in Pediatric Cardiology

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Tissue Doppler imaging (TDI) is a novel echocardiographic technique employing the Doppler principle to measure the velocity of myocardial segments and other cardiac structures. With advances of echocardiographic technique, manufacturers have equipped their scanners with filters to exclude signals from blood flow, and thus make it possible to assess the movement of cardiac structures.

TDI can be performed in either pulsed TDI or color-coded TDI, and there is a strong correlation between myocardial velocities obtained within these two modes. More complex derivatives of color-coded TDI, including strain and strain rate, may provide higher resolution in evaluation of the myocardial mechanics than that of myocardial velocity alone.

Main applications of TDI are the assessment of overall and regional left ventricular systolic and diastolic function, identification of reversible and irreversible myocardial dysfunction and ischemia, and identification of ventricular dysynchrony. Other potential applications include the assessment of right ventricular function, differential diagnosis between constrictive pericarditis and restrictive cardiomyopathy, and localization of accessory conduction pathways.

The applications of TDI in various heart diseases in children are also emerging. Quantification of ventricular function in patients with repaired tetralogy of Fallot, valvular aortic stenosis, systemic right ventricle and functionally single ventricle, and childhood cardiomyopathy had been studied. With wider use of TDI and its further application, it may hold promise in the early detection of myocardial dysfunction and in monitoring cardiac remodeling under various therapeutic strategies.

Intracardiac Echocardiography

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Conventional transthoracic echocardiography (TTE) is well known to be limited, particularly in patients with insufficient sound conditions. The transoesophageal echocardiographic approach (TEE) is well established to provide exceptionally high resolution images, but, however, application is impeded during interventional procedures because of patients’ supine position and the need of general anesthesia. Miniaturised ultrasound tipped catheter devices have been primarily introduced for use in blood vessels. Intravascular ultrasound (IVUS) was then employed for imaging coronary arteries as well as peripheral vessels. On the technical basis of IVUS, the new intracardiac echocardiography (ICE) can meet the demand for precise catheter placement and has become the most widely used ultrasound based imaging tool in the interventional laboratory. There are 3 commercially available ICE catheters including AcuNav (Siemens Medical Solutions, Phased array type), ViewFlex Plus (St. Jude Medical, Phased array type) and UltraICE (Boston Scientific, Rotational type). Imaging with ICE has evolved from cross-sectional imaging using a rotating transducer (similar to intravascular ultrasound) to sector-based imaging using a phased-array transducer. The ICE catheter ideal for use depends on numerous factors including type of procedure to be performed, catheter cost, operator familiarity with the system, and the need for Doppler measurements. In general, rotational ICE is useful for near-field imaging, such as during transseptal puncture (TSP), but is more limited in its far-field view, offering inadequate imaging of the left atrium (LA) from the right atrium (RA). In addition, the rotational catheter is not steerable and must be positioned in the RA through a long guide sheath. Phased-array ICE has many advantages over rotational ICE including a greater frequency range, greater depth of field, steerability, and the possibility of acquiring Doppler and color flow imaging. With their steerability, phased-array catheters can be easily advanced and positioned through short sheaths rather than through long guide sheaths. IN conclusion, ICE can provide excellent images and eliminate the need of general anesthesia, it is a very useful imaging tool in the interventional catheterization.
The Role of Real-Time 3D Echo in Congenital Heart Disease

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The evolution of echocardiography is interesting. The first echocardiography (Echo) employed in clinical practice is “M-mode Echo”. Then 2 dimensional (2D) Echo was introduced and brought the real imaging era into clinical practice. Color Flow Mapping (CFM) added new flow information to the 2D Echo. Since then, many efforts have been devoted to use 2D Echo to reconstruct a 3D image from the 2D Echo images. Further refinement of the transducer technology has made the real-time 3Dimensional(RT3D) Echo an accessible modality. Such advance means the 3D Echo is no longer a “reconstruction” product.

RT3D Echo allows the display of echocardiographic imaging in a spatial, real-time manner. We all appreciate well that the cardiovascular structure is a three-dimensional spatially oriented three-dimensional structure. The conventional way of “Brain Reconstruction” for physicians and technologists to “imagine” the cardiovascular structure in a spatial manner. Therefore we would expect the wide application of RT3D Echo will be possible for the cardiologists and related imaging health-care professionals to appreciate the morphological features of cardiovascular structure.

During the past few years, we have employed RT3D Echo for the diagnosis of various congenital heart diseases, we think that the current systems of RT3D Echo provide useful information for the aid of diagnosis and management for patients with congenital heart diseases.

Recent advance in interventional cardiology provides a new stage for RT3D Echo. During the past years, we have employed RT3D Echo during interventional catheterization procedure; we even managed to use RT3D and integrated Echo as the major modality to aid the interventional procedures. We feel that its role & application in guiding the interventional procedure can not be overlooked.

In Conclusion, the RT3D Echo is a useful relative new modality for cardiovascular imaging. It is useful not only in the diagnosis of various congenital and acquired heart diseases but also in guiding the cardiovascular interventional procedures.
Sonographic Features of Acute Appendicitis

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Case 1:

This 9 y/o boy was well before. He had abdominal pain since 9/5, 2010. There were no nausea, no vomiting and no diarrhea. Thus he was taken to LMD for help and referred to our PER under the suspicion of acute appendicitis. At PER, PE showed no fever but RLQ tenderness with rebounding pain. Lab showed leukocytosis and CRP was normal. Abdominal sono and CT were done and showed appendicitis. Then emergent appendectomy was done, and this patient was admitted for post-OP care.

Case 2:

This 6 y/o boy was well before. He had abdominal pain and vomiting since 09/02. There was no diarrhea initially. The symptoms persisted and watery diarrhea developed, so he was taken to our PER on 09/04, where PE showed abdominal tenderness. Lab showed leukocytosis and CRP = 3.3, KUB showed ileus. Abdominal sono was done and showed no appendicitis. But fever flared up and abdominal distension developed, on 09/05, where lab data showed leukocytosis and CRP = 17. Due to above he was admitted.

In ward, Under the suspicion of appendicitis, emergent CT was done and showed ruptured appendicitis. Antibiotics (cefazolin + gentamycin + metronidazole) were prescribed. But vomiting and poor bowel movement still persisted. Thus emergent appendectomy was done at night.

Acute appendicitis was a difficult disease to diagnose in children, thus we should be much alert about this acute abdomen disease. Detailed history taking and physical examination are necessary. Sonography or CT scan is not always indicated but may be done under certain conditions close check of the clinical condition is very important in the proper care for children with acute appendicitis.
Sonographic Diagnosis of Kidney Duplication in the Neonate

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Duplication of the renal collecting system is the most common congenital anomaly of the urinary tract, either complete or partial. Autopsy studies report an estimated incidence of 0.8 to 5 percent. In complete duplication, the kidney has two separate pelvicalyceal systems and two ureters. Ectopic insertion of the ureter can result in obstruction or vesicoureteral reflux (VUR). Partial duplication is more common than complete duplication. In these cases, the kidney has two separate pelvicalyceal systems with either a single ureter or two ureters that unite prior to insertion into the bladder. Obstructive ureteroceles are associated with the upper pole ureter in 80% of cases, although obstruction of the upper pole may also occur secondary to isolated vesicoureteric junction obstruction. After birth, the classical radiological workup of abnormal duplex kidneys is based on ultrasonography (US) and voiding cystourethrogram (VCUG). The aim of US is to confirm the diagnosis, whereas VCUG is performed to detect VUR and to evaluate the ureterocele.

We report a 5 D/O boy with history antenatal hydronephrosis. The postnatal sonography showed left severe hydronephrosis with hydroureter and ureterocele with duplex kidney. Incomplete duplication was diagnosed after a series of images study.
Echocardiography in Pulmonary Artery Thrombosis

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Pulmonary arterial thrombosis (PAT) is a rare disorder. The diagnosis of PAT is not easy and often invasive modalities are necessary to confirm the definite diagnosis. Therefore a reliable non-invasive diagnostic imaging tool is necessary for early differential diagnosis. Being a non-invasive, portable and non-radiological exposure diagnostic tool, echocardiography carries the advantage for clinical approach to the diagnosis of PAT.

Recently we have experienced a case with PAT and evaluated by echo, computed tomography (CT) and angiography. The patient is a 34 years old male who has underwent right lung Xerograph transplantation and was on maintenance immunosuppressive drugs.

Progressive worsening of exertional dyspnea was noted. Cardiac catheterization showed progressive larger thrombosis in right pulmonary artery with moderate pulmonary arterial hypertension. Because of worsening of the symptoms and progressive enlargement of the right pulmonary arterial thrombose, the patient underwent thromotomy and thromboectomy in the right pulmonary artery in July 2010. The patient has a smooth post operative course and continue follow up on an outpatient basis.

The patient has underwent several times of integrated echocardiography. The 2D mode clearly showed thrombosis in the main branch of right pulmonary artery without Doppler flow signals. Post-thrombectomy integrated echocardiography revealed clearance of the lumen in the right pulmonary artery. We conclude that integrated echocardiography provides an useful imaging for the diagnosis and follow of proximal pulmonary arterial thrombose.
The Usefulness of Ultrasonography for Early Detection and Postoperative Follow-up of Solid Pseudopapillary Tumor of the Pancreas in Children: Report of 6 Cases

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Background: Solid pseudopapillary tumor of the pancreas (SPT) is an extremely rare indolent pancreatic neoplasm in children. It occurs most frequently in young females and is an unusual low-grade malignancy that rarely metastasizes. Early detection of SPT is valuable for radical surgical resection because of its excellent prognosis. Methods: We retrospectively reviewed six patients with SPT managed in Mackay Memorial Hospital between September 1989 and September 2009. The clinical presentations and manifestations, the findings of ultrasonography, the treatment methods and the outcome of follow-up were analyzed. Results: The mean age at diagnosis of the patients was 13 years (range from 11 to 16). All of the patients were females. Abdominal pain and palpable abdominal mass were the most common presenting symptoms (both: 4 of 6, 66%). The remaining clinical presentations include vomiting (3 of 6, 50%) and hyperglycemia (1 of 6, 17%). Abdominal ultrasonography was performed initially in five of the patients. The ultrasonographic findings were well-encapsulated mass with varying solid and cystic components with or without calcification. The mean maximal measured diameter of tumors was 9.3 cm (range from 5 to 20 cm). The tumor was located in tail of pancreas in five patients and in body and tail in one patient. Distal pancreatectomy was performed in all of the six patients. One patient received splenectomy due to invasion to spleen. All patients had benign SPT. The postoperative follow-up by abdominal ultrasonography was arranged in all patients. There was no tumor-related death, but one had liver metastasis. Conclusion: SPT mostly occurs in young female. Most common presentations of SPT are abdominal pain, palpable abdominal mass and vomiting. For early detection of SPT, abdominal ultrasonography should be considered. Radical surgical resection is the most effective method for treatment. Although most SPTs exhibit benign behavior, postoperative follow-up by abdominal ultrasonography is advisable due to the possibility of malignant change. Key words: Solid pseudopapillary tumor, Pancreatic neoplasm, Abdominal ultrasonography