Raising the Bar on Diagnostic Imaging and Measurement of Pediatric Chest Wall Deformities

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Disclosure Information

I have nothing to disclose.

Objectives

- Define Pectus Excavatum and Pectus Carinatum
- Discuss current practice for measurement and monitoring of pediatric chest wall deformities
- Define Haller Index
- Discuss risks versus benefits of CT scan versus white light scan for measurement of pediatric chest wall deformities
- Review preliminary results of white light scan pilot study and implementation into clinical practice
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Chest Wall Deformities

Pediatric chest wall deformities occur as a result of abnormal and unequal growth of costal cartilage that connects each rib to the sternum.

- Pectus Excavatum (PE)
- Pectus Carinatum (PC)
- Poland Syndrome
- Rib anomalies

Pectus Excavatum

- "Sunken or funnel" chest
- The most common type of congenital chest wall deformity (90%)
- Occurs in 1/300-400 births
- 35% of patients have family history of Pectus Excavatum
Pectus Carinatum

- “Pigeon chest” or a protrusion of the chest wall
- Asymmetric/Symmetric
- Occurs in 5-7% of chest wall deformity patients
- 25% of patients have a family history of Pectus Carinatum

Chest Wall Deformity Clinic

Subjective Data
Objective Data

Assessment & Plan

Objective Data

“Popsicle Stick Method”
Objective Data

- CT scan chest/3D reconstruction with Haller Index
- Haller Index (HI) CT scan derived measurement used to assess the severity of Pectus Excavatum
- Haller index = maximal transverse diameter/narrowest AP length of chest
- Normal Haller Index 2.5

CT Scan / Haller Index

Benefits (+)
- Haller Index (HI) is the GOLD standard for measurement of Pectus Excavatum
- CT scan with Haller Index > 3.25 is typically required for preoperative insurance approval
- Ability to evaluate anatomic structures/organs in chest

Risks (-)
- Unable to measure progression or improvement of deformity
- Expensive
- Radiation exposure
- 7.8% annual increase in CT scans from 1996-2000
- Studies demonstrate increased exposure to radiation with a projected increase risk in pediatric cancer

Optical White Light Scan

- Optical or white light scanning (WLS) may be a safe alternative to CT scan to measure and monitor the degree of severity of chest wall deformities
- LED with white light projection obtains 3D measurements of chest wall surface and shape displayed on computer for visualization
- Current pilot study at Ann & Robert H. Lurie Children’s Hospital of Chicago in the chest wall deformity clinic
Optical White Light Scan

Pilot Study

- Performed by trained certified orthotists at annual clinic visit
- Pectus Carinatum (PC) and Pectus Excavatum (PE) for measurement of progression or improvement of deformity
- PC to obtain measurements for external compression device (brace) fitting
- Measures the degree of correction after bracing or surgical intervention

Optical White Light Scan

Pilot Study

- Study data includes volumetric measurements of PE depth and PE/PC severity indices
- Hebal-Malas Index (HMI) compared to CT scan derived Haller Index (HI)

Optical White Light Scan

Pilot Study Results

- Preliminary study results demonstrate accurate and reliable 3D images using HMI index ratio
- HMI index ratio with strong correlation to CT scan derived Haller Index measurements
Optical White Light Scan

Benefits (+)
- Safe
- Quick
- Portable
- Non-invasive, Painless
- NO RADIATION
- Annual comparison of volumetric data

Risks (-)
- Small sample size and limited data
- Limited data correlation of HMI to CT scan derived Haller Index

Implications for Clinical Practice
- WLS may eliminate exposure to ionizing radiation that is derived from CT scans in the pediatric population
- WLS allows for comparison of measurements to determine the progression/improvement of chest wall deformities
- Further data collection is needed in order to establish effective comparison of optical scanning to other imaging modalities in the pediatric population

References
