Analysis of Radiation Exposure Reduction After Implementing Multidetector CT in an Early Onset Scoliosis Treatment Algorithm

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Introduction

- Vertical Expandable Prosthetic Titanium Rib (VEPTR) is frequently used to treat early onset scoliosis (EOS) with associated thoracic deformities and thoracic insufficiency syndrome (TIS)

- CT scans
  - Are a common evaluation technique for EOS with TIS
  - Involve radiation exposure to young children

- Minimizing radiation exposure in children is a patient safety priority

Objective

To quantify and compare the effective dose (ED) of radiation exposure from chest CT scans using a multi-detector CT (MDCT)(Toshiba Aquilion One) versus the older CT scanner (GE Lightspeed Ultra) at our institution.

Methods

- CT scans from initial evaluation of prospective VEPTR treatment patients were reviewed for
  - Scanner parameters
    - voltage (kV)
    - current (mA)
    - spiral pitch
    - computed tomography dose index (CTDI) (mGy)
    - dose length product (DLP) (mGycm)

- Patient parameters: Patient age, height, weight, and BMI at the time of each scan were collected

Methods

- Effective dose (ED) (milliSieverts (mSv)) was calculated:

$$ED = DLP \times \text{age-based conversion factor}$$

- Age and height matched sub-groups were created
- Non-paired t-test was used for between group comparisons

Results

	Older scanner *	Newer scanner (MDCT) *
Current (mA)	190	169.4
Spiral pitch	0.75	0.828
Voltage (kV)	120	100

* 23 scans on each scanner

Results

- Lightspeed (older CT) and Aquilion One (newer CT, MDCT) scanned populations were different in overall group height, weight, BMI, and age averages
- For effective dose (ED) comparison, chest CT scans were compared only for age and height matched subsets of patients from these two scanner groups (n=7 for Lightspeed; n=9 for Aquilion One)

	Lightspeed	**Aquilion One**
ED (mSv)	20.1 ± 8.7	6.4 ± 3.4 *

* $p < 0.05$

Conclusions

- Effective radiation dose, assessed using calculated ED, was reduced to one-third prior values using a multi-detector CT scanner
- This resulted from a combination of lower voltage, reduced current based on calculated tissue densities, and increased spiral pitch factor

Conclusions

- CT scans provide valuable information for evaluation and operative planning for children with TIS undergoing VEPTR treatment.
- These children have various comorbidities which may lead to numerous CT scans over time in treatment
- Multi-detector CT scanning technology allows us to significantly reduce radiation exposure in this pediatric population

Bibliography

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Disclosure

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NTD: Nothing to Disclose