

# Carotid Artery Intima-Media Thickness Change During The Cardiac Cycle In Children

## BACKGROUND

- Atherosclerosis is associated with increased arterial stiffness<sup>1</sup> and carotid artery intima-media thickness (CIMT)<sup>2</sup>.
- CIMT varies during the cardiac cycle with it being thicker at end diastole (measured with the electrocardiogram gated at "QRS") when the lumen is smallest<sup>3</sup>.

## AIM

- The aim of the study was to assess if CIMT change during the cardiac cycle can be used as a marker of arterial stiffness in addition.
- If so, CIMT assessment alone can serve as a marker of both vessel function (stiffness) and structure (atherosclerosis)<sup>4</sup>.

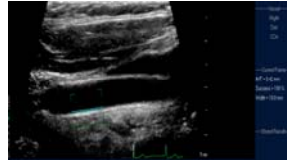
## METHODS

- This study was approved by the Children's Mercy Hospital Institutional Review Board.
- We analyzed the relationship between change in CIMT and change in arterial distensibility during the cardiac cycle in 18 children, 10-18 years of age.
- The far wall, right and left common carotid artery "QRS CIMT" (end diastole) and "Non-QRS CIMT" (systole) were measured using semi automated, edge-detection software (Q lab). A total of 50 measurements were taken for "QRS CIMT" and 50 for "Non-QRS CIMT" for each child and averaged.

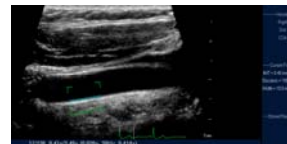
## METHODS

- Common carotid artery lumen diameter was measured using electronic calipers. A total of 50 lumen measurements were taken at "QRS" and 50 at "Non-QRS" for each child.

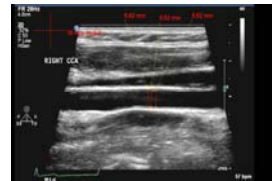
- CIMT with cursor at "QRS" on the EKG



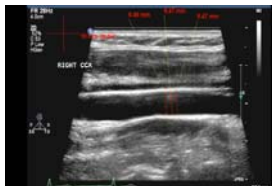
- CIMT with cursor at "non-QRS" on the EKG



- Arterial Lumen Diameter with cursor at "QRS" on the EKG



- Arterial Lumen Diameter with cursor at "non-QRS" on the EKG

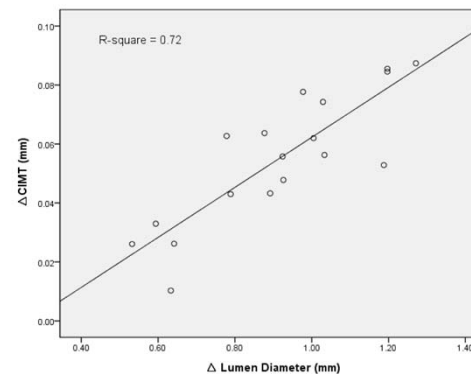


## RESULTS

- "QRS CIMT" was thicker than "Non-QRS CIMT"  $0.50 \pm 0.01$  (mm) vs.  $0.45 \pm 0.01$  (mm),  $p < 0.01$ .
- "Non-QRS" lumen diameter was larger than the "QRS" lumen diameter  $6.56 \pm 0.03$  (mm) vs.  $5.64 \pm 0.03$  (mm),  $p < 0.01$ .

- There was a strong correlation between change in CIMT and change in lumen diameter during the cardiac cycle ( $R^2=0.72$ ) suggesting that a larger change in CIMT during the cardiac cycle correlated to a less stiff artery (see figure below).

Relation Between Change in CIMT and Change in Lumen Diameter



## CONCLUSIONS

- Change in CIMT during the cardiac cycle is a measure of arterial stiffness in children.
- CIMT assessment alone can serve as a marker of vessel function (stiffness) and structure (atherosclerosis).

## REFERENCES

1. Wunsch R, de Sousa G, Toschke AM, Reinehr T. Intima-media thickness in obese children before and after weight loss. *Pediatrics* 2006;118:2334-40.
2. Hurst RT, Ng DW, Kendall C, Khandheria B. Clinical use of carotid intima-media thickness: review of literature. *J Am Soc Echocardiogr* 2007;20:907-14.
3. Menees S, Zhang D, Le J, Chen J, Raghuv eer G. Variations in carotid artery intima-media thickness during the cardiac cycle in children. *J Am Soc Echocardiogr* 2010;23:58-63.
4. Gonzalez J, Wood JC, Dorey FJ, Wren TAL, Gilsanz V. Reproducibility of carotid intima-media thickness measurements in young adults. *Radiology* 2008;247:465-471.