

Normal Pediatric Values of Carotid Artery Intima-Media Thickness (IMT) Measured by B-mode Ultrasound and Radiofrequency Echo Tracking Respecting the Consensus : A Systematic Review

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Disclosures

- N/A

INTRODUCTION

- Pediatric carotid artery Intima-Media Thickness (IMT) is a sub-clinical radiologic marker of atherosclerosis on ultrasound. It is associated with adult onset vascular disease.
- IMT helps stratify the risk of atherosclerosis in children, but lacks standardized normative charts. Unlike adults, IMT in children demonstrates physiologic change.

Objective:

- Collect IMT measurement data in children according to values based on the recommendations of recognized consensus.
- Determine normative value.

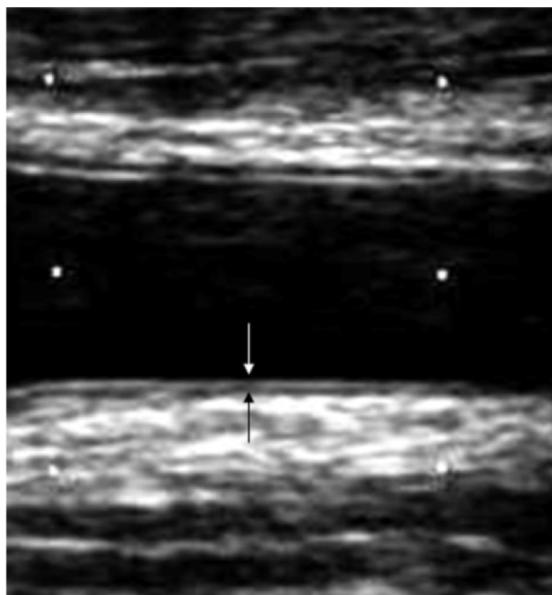


Figure 2. Image taken from the distal common carotid artery demonstrating the intimal-medial complex (between arrows). The intimal-medial thickness is measured from the border between the echolucent vessel lumen and the echogenic intima (white arrow) and the border between the echolucent media and echogenic adventitia (black arrow).

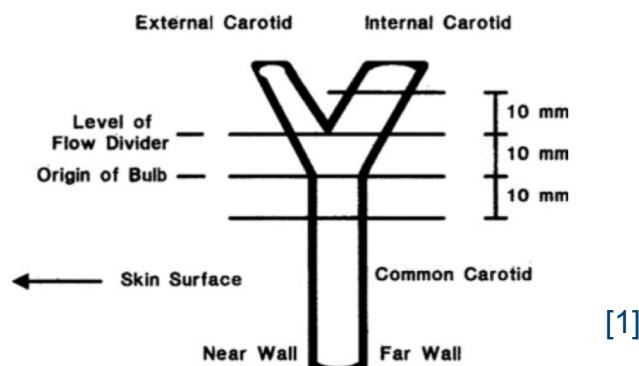


Figure 3. Schematic of the sites used to assess carotid intimal-medial thickness (reprinted with permission from Howard et al⁶⁴).

1.Urbina, E.M., et al., *Noninvasive assessment of subclinical atherosclerosis in children and adolescents: recommendations for standard assessment for clinical research: a scientific statement from the American Heart Association*, in *Hypertension*. 2009. p. 919-50.

METHODS

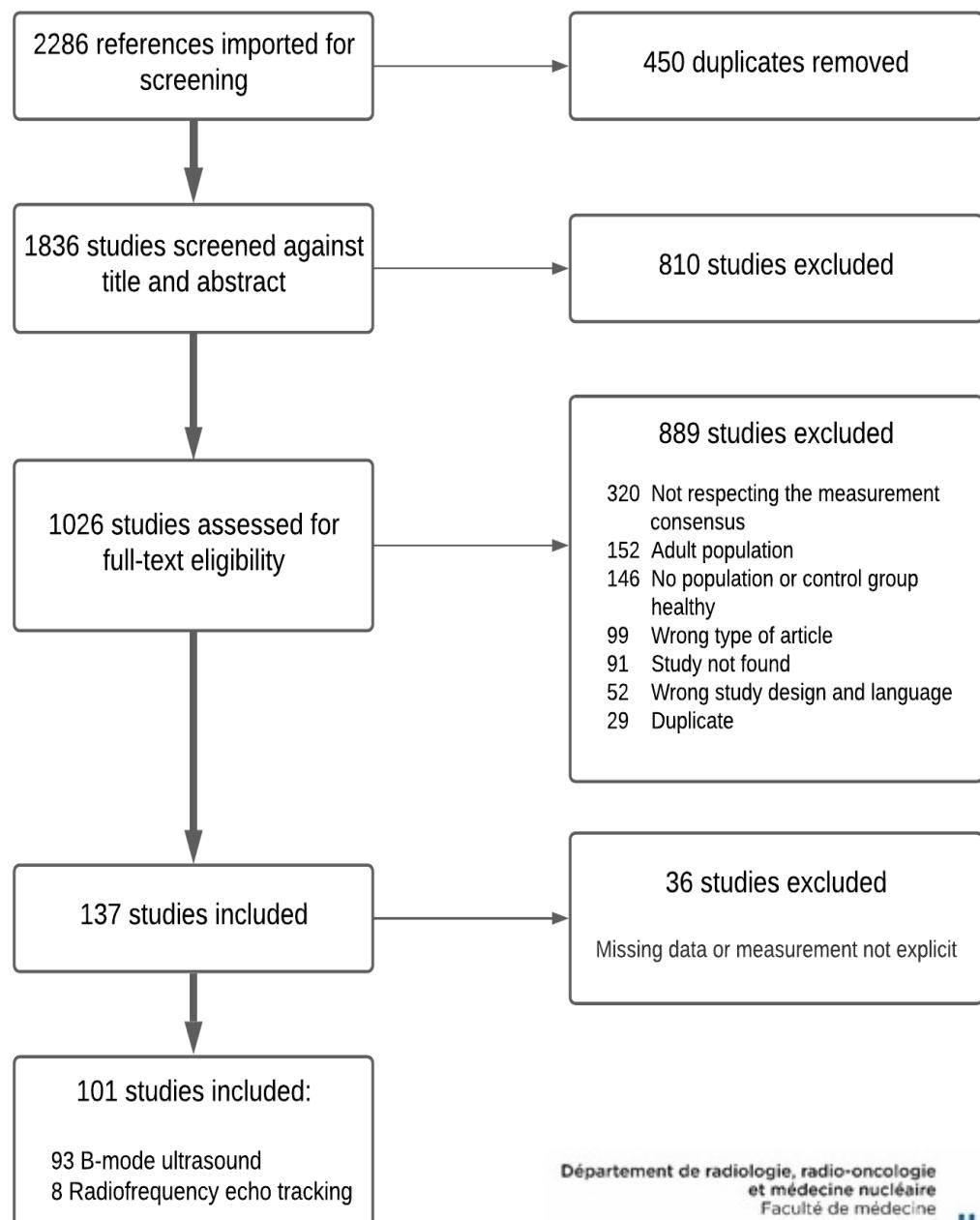
- This systematic review was performed according to PRISMA guidelines. 2286 articles written in English or French were reviewed
- MEDLINE via PubMed, Cochrane Library, Embase and Web of Science databases were searched for relevant articles
- Citations were merged using *Covidence Software*
- Study selection and data extraction were performed by two independent reviewers
- Databases were searched from inception to July 2021

❖ Inclusion criteria :

- Children 0-18 years old
- English or French studies only.
- B-mode and radiofrequency
- Measurements based on official consensus:
American Heart Association¹;
Association for European Paediatric Cardiology (AEPC)²;
Mannheim Consensus³ and;
American Society of Echocardiography⁴.

❖ Exclusion criteria :

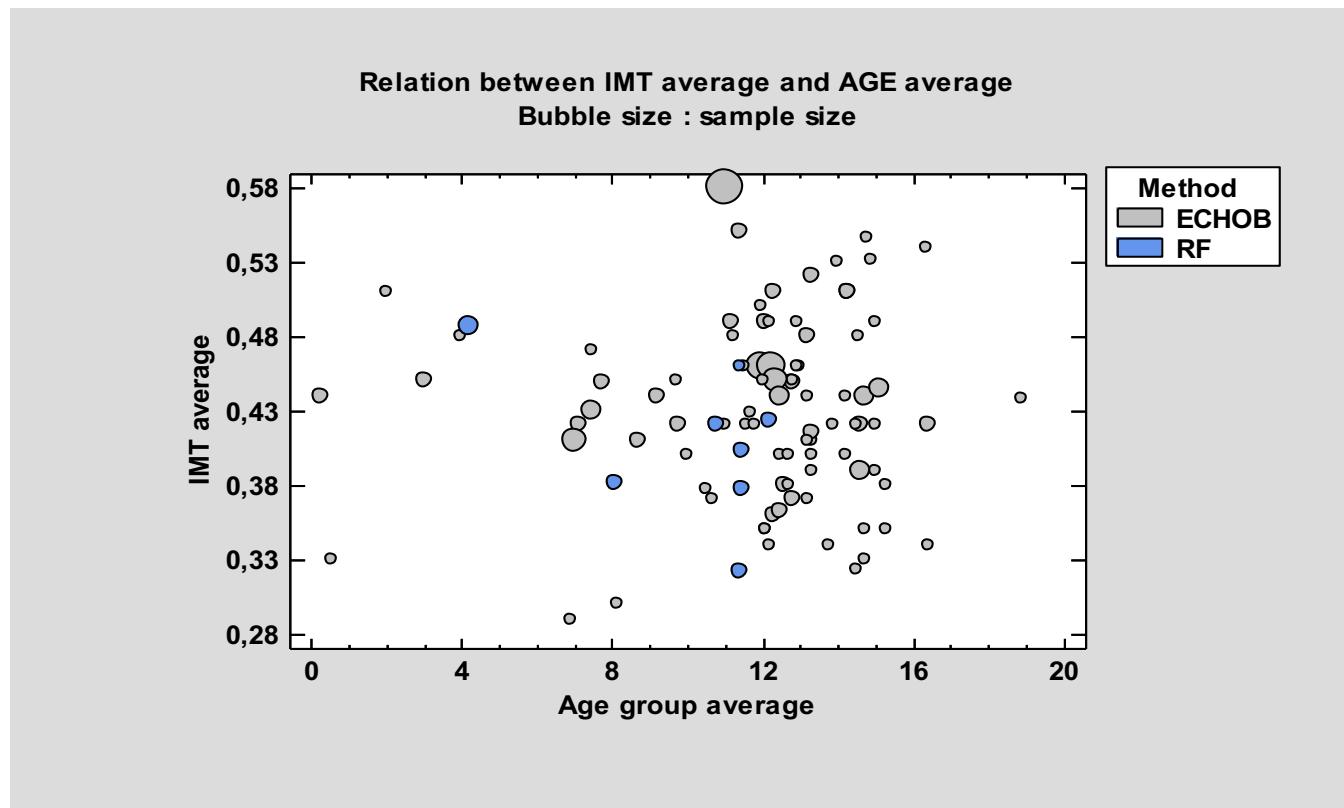
- Hypertension or obesity (BMI \geq 30kg/m² or \geq 95 percentile)
- Meta-analyses, systematic reviews, case reports
- Cadaveric studies



RESULTS

- IMT based on children's age

No correlation was found between age and IMT in our systematic review



RESULTS

• Comparison of IMT measures in girls vs boys

ECHO B

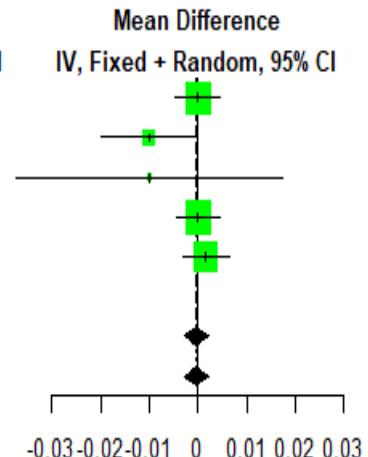
Details on meta-analytical method:

- Inverse variance method
- Restricted maximum-likelihood estimator for τ^2
- Q-profile method for confidence interval of τ^2 and

Study	GIRLS			BOYS			Weight (common)	Weight (random)	Mean Difference IV, Fixed + Random, 95% CI
	Mean	SD	Total	Mean	SD	Total			
1	0.46	0.0300	344	0.46	0.0300	298	30.6%	30.6%	0.00 [0.00; 0.00]
2	0.44	0.0400	131	0.45	0.0400	121	6.8%	6.8%	-0.01 [-0.02; 0.00]
3	0.41	0.0400	36	0.42	0.0600	24	0.9%	0.9%	-0.01 [-0.04; 0.02]
4	0.46	0.0300	376	0.46	0.0300	321	33.1%	33.1%	0.00 [0.00; 0.00]
5	0.49	0.0300	323	0.49	0.0300	279	28.6%	28.6%	0.00 [0.00; 0.01]
Total (fixed effect, 95% CI)	1210			1043			100.0%	--	-0.00 [0.00; 0.00]
Total (random effects, 95% CI)							--	100.0%	-0.00 [0.00; 0.00]

Heterogeneity: $Tau^2 = 0$; $Chi^2 = 4.82$, df = 4 ($P = 0.31$); $I^2 = 17\%$

Comparison of IMT means for girls vs boys



RF

Details on analytical method:

- Student Test (T-test)

Number of studies combined k=1

Number of observation n= 274

P-value = **0.6208**

RESULTS

- IMT normal value in children, independently of sex and age

Details on meta-analytical method:

- Inverse variance method
- Restricted maximum-likelihood estimator for τ^2
- Q-profile method for confidence interval of τ^2 and tau
- Untransformed (raw) means

EchoB

Number of studies combined k=93
Number of observation n= 9299

RF

Number of studies combined k=9
Number of observation n= 1073

Method = ECHOB

Random effects model

Heterogeneity: $I^2 = 100\%, \tau^2 = 0.0036, p = 0$

Method = RF

Random effects model

Heterogeneity: $I^2 = 99\%, \tau^2 = 0.0026, p < 0.01$

Mean IMT (confidence interval)

0.43 [0.42; 0.44]

0.41 [0.37; 0.45]

The confidence intervals indicate a wider variability for the RF technique.

DISCUSSION

- We can see a difference in the mean value of these two techniques B-mode vs RF
- Our results show that IMT was unaffected by age and gender
- The mean IMT in the pediatric population is **0,43 mm (0,42; 0,44)** for B-mode technique and **0,41 mm (0,37; 0,45)** for radiofrequency technique
- One systematic review (Torkar et al, 2020)⁵ was published on the same topic but they have not separated their results according to RF and echoB methods. No meta-analysis was done on this topic.
- **Study limitations:** (1) missing information in some articles (2) publication language other than English and French (3) B-mode technique is more prevalent; therefore, comparison with the radiofrequency technique is limited.
- **Study strengths:** (1) exhaustive and sensitive search strategy (2) Systematic review conducted as per PRISMA guidelines.

CONCLUSION

Due to study limitations, further high quality clinical studies are needed to confirm this finding and to present comparable measures, for better quality of evidence.

REFERENCE

- 1.Urbina, E.M., et al., *Noninvasive assessment of subclinical atherosclerosis in children and adolescents: recommendations for standard assessment for clinical research: a scientific statement from the American Heart Association*, in *Hypertension*. 2009. p. 919-50.
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- 3.Touboul, P.J., et al., *Mannheim carotid intima-media thickness consensus (2004-2006). An update on behalf of the Advisory Board of the 3rd and 4th Watching the Risk Symposium, 13th and 15th European Stroke Conferences, Mannheim, Germany, 2004, and Brussels, Belgium, 2006*. *Cerebrovasc Dis*, 2007. **23**(1): p. 75-80.
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