CEP Clin Exp Pediatr Vol. 68, No. 1, 104–105, 2025
https://doi.org/10.3345/cep.2024.01466

Adolescent hypertension and carotid intima-media thickness: significance of submillimetric differences

To the editor

Barzin et al.[1] published in the recent issue a study titled "Comparative analysis of adolescent hypertension definitions for predicting early-adulthood carotid artery intima-media thickness: Tehran lipid and glucose study." The main objective of the study was to investigate the prevalence of hypertension (HTN) among adolescents according to 3 different accepted definitions for childhood HTN (for details the reader should refer to the original study).[1] Barzin et al.[1] compared the performance of each of the 3 definitions in predicting a high carotid intima-media thickness (CIMT), used as surrogate marker for preclinical atherosclerosis. The study showed a difference in CIMT between 4 blood pressure (BP) groups only when 4th report definition was applied, revealing a significant difference between the high-normal BP and normal BP (0.58±0.09 mm vs. 0.55±0.09 mm, $P<0.05$).[1] The prospective cohort study included 921 individuals aged 10–17 years.[1] Participants were categorized into normal BP, high-normal BP, HTN stage 1, and HTN stage 2 groups based on the childhood HTN definitions of the 4th report, European Society of Hypertension, and American Academy of Pediatrics Clinical Practice Guidelines.[1] From the methodological description it appears that the authors measured the CIMT for most patients at one predetermined section, the far wall of the common carotid artery (CCA) and for a subset of subjects also at the internal carotid artery (ICA) and the carotid bifurcation. That is not plausible as it introduces a major methodological heterogeneity into the measurements rendering the results between the included subjects not comparable: Intermediate stages occur between increased CIMT and atherosclerotic plaque (for ultrasound not distinguishable) and that occur commonly at the bifurcation and the origin of the ICA and less at the CCA, where generally the measurements occur.[2] Furthermore, it is unclear from the methodological description from which *side* and *site* the CIMT value was used: initially the authors stated that an average CIMT value obtained from 3 locations of both CCAs was used, only to finish that the CIMT from the left CCA was utilized.

If only the left side was used, importantly to mind and what the authors need to consider for their results, that left side CIMT are reported higher than right side CIMT.[2] A further important source of measurement heterogeneity was introduced by the authors by not synchronizing with the cardiac cycle, namely the end-diastolic phase.[2-4] Using CIMT as surrogate marker has advantages, as it is a safe, noninvasive and cost-effective examination. Yet, CIMT is a delicate biomarker and requires high-precision measurements, as submillimetric differences are sufficient to categorize subjects into different CIMT categories upon which important clinical as well pathophysiological deductions are formulated. There are 2 major recommendations as to CIMT protocols: one is to perform measurement at the far wall of the CCA (foremost for the higher spatial resolution)[2] and the second is to perform a composite CIMT measurement including different segments of the carotid artery (CA), e.g., CCA, bulb and ICA.[5-8] The latter will arguably capture the asymmetric nature of atherosclerosis[9,10] in a more accurate manner respect a single CIMT measurement location. However, whatever the pros and cons of these 2 recommended measurement protocols[2,5] are, it is of paramount importance to apply for the same cohort the same measurement protocol to guarantee the uniformity of measurements of the included subjects. The cardiac synchronization is of critical importance as vessel diameter and consequently CIMT are subject to obvious variations during the cardiac cycle with reported mean CIMT differences between the 2 cardiac phases of 0.037 to 0.041 mm.[3,4] In conclusion: When CIMT as surrogate marker is used an utmost detailed measurement protocol is required, and all procedural steps need reporting. The CIMT results and related conclusions of this study should be considered within the above-mentioned methodological limitations.[1]

Received: 22 September 2024, Revised: 14 November 2024, Accepted: 19 November 2024

Christian Saleh, MD

University of Basel, Basel, Switzerland

Corresponding author: Christian Saleh, MD.
University of Basel, Basel, Switzerland
✉ Email: chs12us75010@yahoo.com,
https://orcid.org/0000-0002-5225-5414

Footnotes

Conflicts of interest: No potential conflict of interest relevant to this article was reported.

Funding: This study received no specific grant from any funding agency in the public, commercial, or not-for-profit sectors.

ORCID:
Christian Saleh https://orcid.org/0000-0002-5225-5414

References

1. Barzin M, Yaghoobpoor S, Mahdavi M, Abiri B, Valizadeh M, Azizi F, et al. Comparative analysis of adolescent hypertension definitions for predicting early-adulthood carotid artery intima-media thickness: Tehran lipid and glucose study. Clin Exp Pediatr 2024;67:694-703.
2. Touboul PJ, Hennerici MG, Meairs S, Adams H, Amarenco P, Bornstein N, et al. Mannheim carotid intima-media thickness and plaque consensus (2004-2006-2011). An update on behalf of the advisory board of the 3rd, 4th and 5th watching the risk symposia, at the 13th, 15th and 20th European Stroke Conferences, Mannheim, Germany, 2004, Brussels, Belgium, 2006, and Hamburg, Germany, 2011. Cerebrovasc Dis 2012;34:290-6.
3. Polak JF, Johnson C, Harrington A, Wong Q, O'Leary DH, Burke G, et al. Changes in carotid intima-media thickness during the cardiac cycle: the multi-ethnic study of atherosclerosis. J Am Heart Assoc 2012;1:e001420.
4. Polak JF, Meisner A, Pencina MJ, Wolf PA, D'Agostino RB. Variations in common carotid artery intima-media thickness (cIMT) during the cardiac cycle: implications for cardiovascular risk assessment. J Am Soc Echocardiogr 2012; 25:1023-8.
5. Bots ML, Evans GW, Riley WA, Grobbee DE. Carotid intima-media thickness measurements in intervention studies: design options, progression rates, and sample size considerations: a point of view. Stroke 2003;34:2985-94.
6. del Sol AI, Moons KG, Hollander M, Hofman A, Koudstaal PJ, Grobbee DE, et al. Is carotid intima-media thickness useful in cardiovascular disease risk assessment? The Rotterdam Study. Stroke 2001;32:1532-8.
7. Nambi V, Chambless L, Folsom AR, He M, Hu Y, Mosley T, et al. Carotid intima-media thickness and presence or absence of plaque improves prediction of coronary heart disease risk: the ARIC (Atherosclerosis Risk In Communities) study. J Am Coll Cardiol 2010;55:1600-7.
8. Chambless LE, Heiss G, Folsom AR, Rosamond W, Szklo M, Sharrett AR, et al. Association of coronary heart disease incidence with carotid arterial wall thickness and major risk factors: the Atherosclerosis Risk in Communities (ARIC) Study, 1987-1993. Am J Epidemiol 19975;146:483-94.
9. KolaszyŃSka O, Lorkowski J. Symmetry and asymmetry in atherosclerosis. Int J Occup Med Environ Health 2023; 36:693-703.
10. Tajik P, Meijer R, Duivenvoorden R, Peters SAE, Kastelein JJ, Visseren FJ, et al. Asymmetrical distribution of atherosclerosis in the carotid artery: identical patterns across age, race, and gender. Eur J Prev Cardiol 2012;19:687-97.

How to cite this article: Saleh C. Adolescent hypertension and carotid intima-media thickness: significance of submillimetric differences. Clin Exp Pediatr 2025; 68:104-5.