

IS INCREASED AORTIC STIFFNESS ASSOCIATED WITH ADVANCED ISCHEMIC STROKE?

EUN JOO CHO, MD, PHD

DIVISION OF CARDIOLOGY, ST. PAUL'S HOSPITAL, THE CATHOLIC UNIVERSITY OF KOREA COLLEGE OF MEDICINE, SEOUL, KOREA

REFER TO THE PAGE 12-17

Survivors of a transient ischemic attack (TIA) or stroke have an increased risk of another stroke, which is a major source of increased mortality and morbidity. Among the estimated 700,000 people with stroke in the United States each year, 200,000 of them are among persons with a recurrent stroke. The number of people with TIA, and therefore at risk for stroke, is estimated to be much greater.¹⁾ Therefore, efforts that identify the risk and determinants of recurrent stroke, might be helpful to provide the data to generate evidence-based recommendations to reduce this risk. One of the efforts to identify those risks might be an investigation for marker of disease progression.

Aortic stiffness has been known as an independent predictor of all cause and cardiovascular mortality in hypertensive patients.²⁾

Aging and genetic factors are responsible for structural and functional changes of the arterial wall, leading to decreased elasticity and increased stiffness.^{3,4)} The plausible explanation about relationship between arterial stiffness and stroke is that the increased arterial stiffness responsible for increase in systolic blood pressure and decrease in diastolic blood pressure, thus increasing pulse pressure (PP).⁵⁾ Although PP has been associated with stroke in some longitudinal studies,^{6,7)} aortic stiffness, non-invasively measured with pulse wave velocity is an independent predictor of fatal stroke in patients with essential hypertension.⁸⁾ Also, aortic stiffness is associated with ischemic stroke, independent of thickness of aortic arch plaques and other stroke risk factors. This suggests that aortic stiffness may add prognostic information when assessing the risk of ischemic stroke in the elderly.⁹⁾

There are evidences that aortic stiffness increase in subjects of increased cardiovascular risks. Eren et al.¹⁰⁾ found that aortic stiffness is increased in patients with hypertension, diabetes,

or both even after the exclusion of coronary artery disease. Aortic stiffness and left ventricular diastolic dysfunction are also associated in these patients.

In a longitudinal study, aortic stiffness is an independent predictor of progression to hypertension in non-hypertensive individuals.¹¹⁾ Therefore, aortic stiffness could provide useful information as a surrogate marker not only for cardiovascular risk but also for future development of cardiovascular risk itself.

In recent study, Yoon et al.¹²⁾ found that increased aortic stiffness is associated with advanced cerebrovascular ischemia. Although there was no information about the current medication that might affect arterial stiffness and about whether presence of target organ damage such as microalbuminuria or left ventricular hypertrophy, and even the research was cross-sectional design, it is decisive that increased aortic stiffness represents more aggressive disease manifestation.

We need future investigation about usefulness of aortic stiffness as a predictor of future ischemic stroke or as a predictor of recurrent cerebrovascular event in patients with previous TIA or stroke. Furthermore development of its cut-off value for prediction of development or recurrence of ischemic stroke might helpful for real clinical practice.

REFERENCES

1. Goldstein LB, Adams R, Becker K, Furberg CD, Gorelick PB, Hademenos G, Hill M, Howard G, Howard VJ, Jacobs B, Levine SR, Mosca L, Sacco RL, Sherman DG, Wolf PA, del Zoppo GJ. *Primary prevention of ischemic stroke: a statement for healthcare professionals from the Stroke Council of the American Heart Association. Circulation* 2001; 103:163-82.
2. Laurent S, Boutouyrie P, Asmar R, Gautier I, Laloux B, Guize L, Ducimetiere P, Benetos A. *Aortic stiffness is an independent predictor of all-cause and cardiovascular mortality in hypertensive patients. Hypertension* 2001;37:1236-41.
3. Safar ME. *Pulse pressure in essential hypertension: clinical and therapeutic implications. J Hypertens* 1989;7:769-76.
4. Laurent S, Kingwell B, Bank A, Weber M, Struijker-Boudier H. *Clinical applications of arterial stiffness: therapeutics and pharmacology.*

• Received: March 4, 2013 • Revised: March 7, 2013 • Accepted: March 8, 2013

• Address for Correspondence: Eun Joo Cho, Division of Cardiology, St. Paul's Hospital, The Catholic University of Korea College of Medicine, 180 Wangsan-ro, Dongdaemun-gu, Seoul 130-709, Korea Tel: +82-2-958-2388, Fax: +82-2-958-7250, E-mail: choej4oct@gmail.com

• This is an Open Access article distributed under the terms of the Creative Commons Attribution Non-Commercial License (<http://creativecommons.org/licenses/by-nc/3.0>) which permits unrestricted non-commercial use, distribution, and reproduction in any medium, provided the original work is properly cited.

- Am J Hypertens* 2002;15:453-8.
5. O'Rourke MF, Nichols WW. *Aortic diameter, aortic stiffness, and wave reflection increase with age and isolated systolic hypertension. Hypertension* 2005;45:652-8.
 6. Nielsen WB, Lindenstrøm E, Vestbo J, Jensen GB. *Is diastolic hypertension an independent risk factor for stroke in the presence of normal systolic blood pressure in the middle-aged and elderly? Am J Hypertens* 1997;10:634-9.
 7. Domanski MJ, Davis BR, Pfeffer MA, Kastantin M, Mitchell GE. *Isolated systolic hypertension: prognostic information provided by pulse pressure. Hypertension* 1999;34:375-80.
 8. Laurent S, Katsahian S, Fassot C, Tropeano AI, Gautier I, Laloux B, Boutouyrie P. *Aortic stiffness is an independent predictor of fatal stroke in essential hypertension. Stroke* 2003;34:1203-6.
 9. Sugioka K, Hozumi T, Sciacca RR, Miyake Y, Titova I, Gaspard G, Sacco RL, Homma S, Di Tullio MR. *Impact of aortic stiffness on ischemic stroke in elderly patients. Stroke* 2002;33:2077-81.
 10. Eren M, Gorgulu S, Uslu N, Celik S, Dagdeviren B, Tezel T. *Relation between aortic stiffness and left ventricular diastolic function in patients with hypertension, diabetes, or both. Heart* 2004;90:37-43.
 11. Dernellis J, Panaretou M. *Aortic stiffness is an independent predictor of progression to hypertension in nonhypertensive subjects. Hypertension* 2005;45:426-31.
 12. Yoon HJ, Kim KH, Lee SH, Yim YR, Lee KJ, Park KH, Sim DS, Yoon NS, Hong YJ, Park HW, Kim JH, Ahn Y, Jeong MH, Cho JG, Park JC. *Differences of aortic stiffness and aortic intima-media thickness according to the type of initial presentation in patients with ischemic stroke. J Cardiovasc Ultrasound* 2013;21:12-7.