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RESEARCH LETTER

Adult Atopic Dermatitis is Associated with Increased Aortic Stiffness

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Dear Editor,

We read with interest the article by Kwa and Silverberg [1] entitled "Association Between Inflammatory Skin Disease and Cardiovascular and Cerebrovascular Co-morbidities in US Adults: Analysis of Nationwide Inpatient Sample Data" published in this journal. In their extensive survey, the authors give paramount clinical data that chronic inflammatory dermatologic disorders obviously raise the incidence of cardiovascular diseases in large patient cohorts. Besides that current study, recently published, large, population-based surveys have also reached the same conclusion that arterial hypertension was the most common feature of atopic dermatitis (AD)-related increased cardiovascular morbidity [2, 3]. However, none of these studies attempted to clarify the underlying causes. Interestingly, aortic stiffness measurement-directed interdisciplinary trials among psoriatic patients have proved that psoriasis is associated with increased aortic stiffness compared with age- and gender-matched, otherwise healthy controls [4]. So far AD has not been investigated in a similar way.

In general cardiology practice, stiffness is considered a pivotal marker of aortic elastic properties that independently predicts cardiovascular disease morbidity and mortality [5]; thus the determination of aortic stiffness among atopic patients (as was done for psoriatic persons) seemed to be a logical approach to elucidate the cardiovascular interference of AD. We measured aortic stiffness parameters (aortic stiffness index, strain and distensibility) in young adult probands with AD [mean age 30.5 ± 10.8 years, 11 women and eight men, body mass index (BMI) 28.3 ± 3.5 kg/m^2] and without AD (mean age 29.3 ± 2.9 years, 11 women and eight men, BMI 29.5 ± 4.8 kg/m^2). AD disease severity was evaluated with the SCORing Atopic Dermatitis (SCORAD) index [6]. Although none of the AD patients or controls had known hypertension or were on antihypertensive treatment, three out of 19 AD patients and two out of 19 controls had high blood pressure values at the time of examination. A total of 16% ($n = 3$), 68% ($n = 13$), 16% ($n = 3$) of AD patients were classified as having mild (SCORAD < 35), moderate ($35 <$ SCORAD < 60) and severe (SCORAD > 60) stages of AD, respectively.

Each participant underwent physical examination, systolic and diastolic blood pressure (SBP and DBP, respectively) measurement, electrocardiography (ECG) measurements and transthoracic two-dimensional echocardiography (2DE). 2DE was accomplished with Toshiba Artida echocardiography equipment (Toshiba, Tokyo, Japan) in the left lateral decubitus position from multiple windows. Systolic and diastolic ascending aortic diameters (SD and DD, respectively) were measured on M-mode tracings at a level 3 cm above the aortic valve

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from the parasternal long-axis view, according to a method described elsewhere [7]. Sector angles, depth and gain were individualized to provide the most accurate measurement. The SD was considered at the time of maximum anterior motion of the aorta, while DD was measured at the peak of QRS complex on the simultaneously recorded ECG. Exclusion criteria comprised coronary or valvular heart disease, atrial fibrillation or other arrhythmologic problems, heart failure, unstable angina pectoris, acute myocardial infarction and even lipid metabolism abnormality, diabetes mellitus or anemia. Aortic stiffness index (β) was used to characterize aortic elasticity, which represents the slope of the exponential function relating the relative arterial pressure and the distention ratio of the artery and presents the entire deformation behavior of the vascular wall. The following formula served the calculation: $\beta = \ln(\text{SBP/DBP})/(\Delta D/\text{DD})$, where '$\Delta D$' is the pulsatile change in aortic diameter (SD − DD) and 'ln' is the natural logarithm [8]. Aortic distensibility (inverse of aortic stiffness) was calculated with the following formula: $2 \times (\text{SD} - \text{DD})/[(\text{SBP} - \text{DBP}) \times \text{DD}]$. Aortic strain expressed as a percentage change of the aortic root was calculated as (SD − DD)/DD.

Statistical calculation (Statistica 9.1; StatSoft Inc., Tulsa, USA) set the minimum group size to 15 probands. Mann–Whitney and Fisher's exact tests using SPSS 12.0 software were applied for the statistical analysis of the identical values between the two groups.

SBP and DBP values did not differ between AD patients and controls (127.5 ± 13.3 mmHg vs 125.7 ± 13.0 mmHg, $p = 0.68$, and 78.5 ± 9.7 mmHg vs 74.4 ± 7.3 mmHg, $p = 0.15$, respectively). Mean aortic diastolic diameter (25.8 ± 4.9 mm) and aortic stiffness index (8.28 ± 8.95) were significantly higher ($p = 0.04$ and $p = 0.05$, respectively), while aortic strain (0.103 ± 0.055) was considerably lower ($p = 0.03$) in the AD group compared with controls (22.9 ± 2.4 mm, 4.11 ± 1.47, 0.142 ± 0.051, respectively).

The core findings of the current study (increased aortic stiffness index and decreased aortic strain of AD patients compared with healthy volunteers) strongly support the results of the article by Kwa and Silverberg [1] and further advocate that adult AD is associated with increased cardiovascular risk. Chronic inflammation (e.g., psoriasis, inflammatory bowel disease [9], rheumatoid arthritis [10], obesity [5]) has been shown to be associated with altered aortic stiffness parameters, and AD may influence aortic elasticity with this property, too.

To the best of our knowledge this is the first study to elucidate the linkage between impaired aortic elasticity and adult AD and to give hints about the possible pathophysiology of chronic AD-associated cardiovascular changes. There is a potential limitation of the study as no correlation has been investigated in the relationship of aortic stiffness parameters and AD severity. According to the stratification with the SCORAD index, the vast majority of our patients belonged to the moderate severity group, and the number of mildly and severely eczematous probands remained too small to allow any statistical calculation. Although echocardiographic estimation of aortic elastic properties are useful and correlate with pulse-wave velocity, they are not considered as the gold standard for measurement of arterial stiffness, which should be considered as a limitation of our study [11].

Compliance with Ethical Standards

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Conflict of interest GS, AA, VJ, HG, LK, TF and AN have no conflicts of interest.

Ethical standards The clinical study was approved by the institutional review board of the Albert Szent-Györgyi Medical Centre, University of Szeged, and has been performed in accordance with the ethical standards of the Declaration of Helsinki.

Informed consent Informed consent was obtained from all AD patients and control participants included in the study.

References

1. Kwa MC, Silverberg JI. Association between inflammatory skin disease and cardiovascular and cerebrovascular co-morbidities in US adults: analysis of nationwide inpatient sample data. Am J Clin Dermatol. 2017. https://doi.org/10.1007/s40257-017-0293-x.
2. Silverberg JI, Greenland P. Eczema and cardiovascular risk factors in 2 US adult population studies. J Allergy Clin Immunol. 2015;135(721–28):e6.
3. Silverberg JI. Association between adult atopic dermatitis, cardiovascular disease, and increased heart attacks in three population-based studies. Allergy. 2015;70:1300–8.
4. Yiu KH, Yeung CK, Chan HT, et al. Increased arterial stiffness in patients with psoriasis is associated with active systemic inflammation. Br J Dermatol. 2011;164:514–20.
5. Nemes A, Gavallér H, Csajbók É, et al. Obesity is associated with aortic enlargement and increased stiffness: an echocardiographic study. Int J Cardiovasc Imaging. 2008;24:165–71.
6. de Bruin Weller MS, Rockmann H, Knulst AC, et al. Evaluation of the adult patient with atopic dermatitis. Clin Exp Allergy. 2013;43:279–91.
7. Nemes A, Galema TW, Geleijnse ML, et al. Aortic valve replacement for aortic stenosis is associated with improved aortic distensibility at long-term follow-up. Am Heart J. 2007;153:147–51.
8. Henry WL, DeMaria A, Gramiak R, et al. Report of the American Society of Echocardiography Committee on nomenclature and standards in two-dimensional echocardiography. Circulation. 1980;62:212–7.
9. Zanoli L, Rastelli S, Granata A, et al. Arterial stiffness in inflammatory bowel disease: a systematic review and meta-analysis. J Hypertens. 2016;34:822–9.

10. Provan SA, Angel K, Semb AG, et al. Early prediction of increased arterial stiffness in patients with chronic inflammation: a 15-year follow up study of 108 patients with rheumatoid arthritis. J Rheumatol. 2011;38:606–12.

11. Nemes A, Takács R, Gavallér H, Várkonyi TT, Wittmann T, Forster T, Lengyel C. Correlations between arteriograph-derived pulse wave velocity and aortic elastic properties by echocardiography. Clin Physiol Funct Imaging. 2011;31:61–5.