

Original Research Article

Atherosclerosis in geriatric patients known to be healthy

Ahmed Bilal Genç¹, Selçuk Yaylacı^{1*}, Seyyid Bilal Açıkgöz¹, Mehmet Yıldırım¹,
Yakup Ersel Aksoy², Mehmet Bülent Vatan³, Hamad Dheir⁴, Savas Sipahi⁴

¹Department of Internal Medicine, ²Department of Radiology, ³Department of Cardiology, ⁴Department of Nephrology, Sakarya University Education and Research Hospital, Sakarya, Turkey

Received: 25 June 2019

Accepted: 03 August 2019

*Correspondence:

Dr. Selcuk Yaylacı,

E-mail: yaylakis@hotmail.com

Copyright: © the author(s), publisher and licensee Medip Academy. This is an open-access article distributed under the terms of the Creative Commons Attribution Non-Commercial License, which permits unrestricted non-commercial use, distribution, and reproduction in any medium, provided the original work is properly cited.

ABSTRACT

Background: The aim of the present study is to determine the presence of atherosclerosis in geriatric patients who are known to be healthy and examine sociodemographic and laboratory parameters affecting the presence of atherosclerosis.

Method: 90 healthy volunteers including 66(73.3%) non-geriatric ones and 24(26.7%) geriatric ones were included in the study. It was analyzed whether there was a correlation between the two groups in terms of the parameters of gender, age average, alcohol consumption, smoking, carotid intima-media thickness (CA-IMT), and pulse wave velocity (PWV). Sociodemographic and laboratory parameters of the volunteers with and without atherosclerosis in the geriatric group were examined.

Results: Among geriatric volunteers (Group 1), 13(54.2%) were male; whereas, among non-geriatric volunteers (Group 2), 41(62.1%) were male. CA-IMT was determined to be higher in Group 1 (averagely 0.80±0.12 mm) than Group 2 (averagely 0.62±0.14 mm) (p:<0.001). PWV was significantly higher in Group 1 (averagely 10.32±1.44 m/s) than Group 2 (6.26±1.09 m/s) (p:<0.001). After PWV or CA-IMT examination, atherosclerosis findings were determined in 12 healthy geriatric volunteers (50%) in Group 1.

Conclusion: It should be remembered that even though atherosclerosis can be frequently observed in geriatric individuals who are known to be healthy, it may also go unnoticed. Determination of atherosclerosis with noninvasive methods will be helpful in preventing complications that might be caused by atherosclerosis.

Keywords: Atherosclerosis, Carotid intima-media thickness, Geriatric patients, Pulse wave velocity

INTRODUCTION

Cardiovascular diseases and atherosclerosis-associated diseases such as stroke are the most important cause of morbidity and mortality all over the world, especially in industrialized communities. Atherosclerosis is characterized by thickening and hardening of artery walls and is the most important reason of heart attacks and strokes. Atherosclerotic lesion is a chronic inflammatory process. This process includes vein endothelium, monocytes/macrophages, smooth muscle cells, some growth factors, and cytokines. Epidemiology studies have

shown that among many genetic and environmental factors, increased serum cholesterol levels are alone enough for the development of atherosclerosis even in the absence of other known risk factors.¹⁻⁴

PWV is a noninvasive vascular parameter related with cardiovascular risk, atherosclerosis and peripheral vascular disease.^{5,6} It is also today's gold standard method of measuring arterial stiffness and an independent predictor of cardiovascular events. An increased PWV is accepted to be an indicator of atherosclerosis.⁷

The most important change in the early stage of atherosclerotic disease is the increase in intima-media thickness in the entire arterial bed. This condition is observed in both coronary vascular bed and peripheral arteries. Because intima-media thickness is a good indicator of early atherosclerotic changes, its ultrasonographic (CA-IMT) measurement has started to be used in detecting the presence of atherosclerotic plates, calcification degree and arterial lumen diameters, as well as asymptomatic atherosclerotic disease.⁸⁻¹⁰

The aim of the present study is to determine the presence of atherosclerosis in geriatric patients, who are known to be healthy, with the help of various methods and examine sociodemographic, laboratory and imaging parameters affecting the presence of atherosclerosis.

METHODS

A subgroup analysis was conducted including the healthy group for the project titled “Correlation of Salusin Alpha and Beta Levels with Atherosclerosis in Hemodialysis Patients” and numbered 215S173, which was carried out at Sakarya University Training and Research Hospital Nephrology Clinic, with the support of the Scientific and Technological Research Council of Turkey. 90 healthy volunteers including 66 (73.3%) non-geriatric ones and 24 (26.7%) geriatric ones were included in the study. It was analyzed whether there was a correlation between the two groups in terms of the parameters of gender, age average, alcohol consumption, smoking, CA-IMT, and PWV. Sociodemographic and laboratory parameters of the volunteers with and without atherosclerosis in the geriatric group were examined.

Measurement of carotid intima-media layer thickness

CIMT measurement was performed via B-mode examination and by using Toshiba Aplio 400 brand and model high-level color Doppler Ultrasonography device and a linear probe with high-resolution central frequency of 7.5mHz (5-12mHz). The process was performed by a single radiologist by giving approximately 20-45° angle towards the neck while the patient was lying in the supine position. In the proximal (1 cm after bifurcation), medium (4 cm after bifurcation) and distal (first 1 cm of bulb) sections of arteria carotis communis (ACC), intima media thickness was measured from posterior wall and arithmetic mean of the three measurements was taken. Assessments were planned to be done from the locations having laminar flow instead of the locations where large plaques were present or turbulence flow was determined. According to the planned measurement type, left and right CIMT was determined and their mean was recorded as CIMT.

Pulse wave analysis

Measurements were done by using the ambulatory blood pressure monitoring system (Mobil-O-Graph NG, I.E.M,

Stolberg, Germany) that shows the brachial oscillometric blood pressure waves. After the patients rested for approximately 15 minutes, their measurements were taken by connecting a cuff to the left brachial artery level in the sitting position.

The data were evaluated using SPSS (Statistical Package for Social Sciences) version 22.0 for statistical analyses. Distribution features of numeric variables were evaluated with Shapiro-Wilk test. Normally distributed numeric variables were indicated as mean±standard deviation; whereas numeric variables showing no normal distribution were indicated as median (minimum-maximum). On the other hand, categorical data were indicated as frequency (%). The groups were compared using Mann-Whitney U and independent sample t test. The value of $p < 0.05$ was accepted to be statistically significant.

RESULTS

Among geriatric volunteers (Group 1), 13 (54.2%) were male and 11 (45.8%) were female (age average was 73.5 ± 5.3 years); whereas, among non-geriatric volunteers (Group 2), 41 (62.1%) were male and 25 (37.9%) were female (age average was 45.8 ± 9.9 years). It was determined that there was no difference between the groups in terms of gender ($p: 496$).

When evaluating the volunteers included in the study in terms of alcohol consumption and smoking, it was determined that there was no alcohol consumption in Group 1, but there was active smoking in 1 volunteer. On the other hand, there was alcohol consumption in 2 volunteers and active smoking in 27 volunteers in Group 2. It was determined that there was no difference between the groups in terms of alcohol consumption; however, smoking was significantly higher in Group 2 (respectively, $p: 0.317$ and $p: 0.001$).

When evaluating CA-IMT, it was found that average CA-IMT was 0.80 ± 0.12 mm in Group 1 and 0.62 ± 0.14 mm in Group 2. Average CA-IMT was significantly higher in Group 1 than the volunteers in Group 2 ($p: < 0.001$). The number of patients with CA-IMT above 0.9 mm which was evaluated as presence of atherosclerosis was 7 in Group 1 (29.2%) and 2 in Group 2 (3.0%). When examining the presence of atherosclerosis according to CA-IMT, it was observed that the prevalence of atherosclerosis was significantly higher in Group 1 than Group 2 ($p: < 0.001$) ($p: 0.001$).

When examining PWV, it was found that average PWV was 10.32 ± 1.44 m/s in Group 1 and 6.26 ± 1.09 m/s in Group 2.

Average PWV was significantly higher in Group 1 than the volunteers in Group 2 ($p: < 0.001$). When evaluating the presence of atherosclerosis according to the obtained and expected PWV results, it was determined that atherosclerosis was present in 9 volunteers in Group 1 (37.5%) and 3 volunteers in Group 2 (4.5%) ($p: < 0.001$).

Table 1: Analysis of sociodemographic and laboratory parameters of the volunteers with and without atherosclerosis in the geriatric group.

	Atherosclerosis + (n:12)	Atherosclerosis - (n:12)	p
Age	75.5±5.6	71.5±4.3	0.060
Gender F/M	8(66.7%)/4(33.3%)	3(25.0%)/9(75.0%)	0.041
BMI	29.0±5.1	26.9±3.1	0.254
*Systolic Blood Pressure	145.6±18.5	115.6±19.3	0.001
*Diastolic Blood Pressure	90.6±16.0	73.5±11.1	0.006
*Average Blood Pressure	116.0±15.8	85.7±27.8	0.004
*Pulse Pressure	55.0±13.9	42.0±13.3	0.030
Urea	31.4±10.5	36.5±10.1	0.261
Creatinine	0.84±0.16	0.98±0.24	0.126
Sodium	140.0±1.9	139.1±1.9	0.336
Potassium	4.6±0.2	4.5±0.2	0.090
*Calcium	9.1±0.2	9.4±0.3	0.030
Phosphorus	2.8±0.5	2.7±0.5	0.613
Inferior	14 (7-35)	20 (14-58)	0.133
Glucose	91.5±15.5	103.2±16.2	0.099
Total Protein	7.1±0.5	7.3±0.6	0.288
Albumin	4.0±0.1	4.0±0.2	1.00
Uric Acid	5.2±1.1	5.2±1.1	0.957
Crp	3.3 (3.1-12.7)	3.1 (3.1-28.3)	0.211
PTH	93.9 (39.8-166.3)	63.2 (50.0-98.5)	0.401
Ferritin	37.0 (7.0-119.0)	81.1 (8.0-267.0)	0.182
Total Cholesterol	209.7±38.8	207.0±38.5	0.875
LDL	147.0±30.8	145.5±36.8	0.916
HDL	49.0±9.3	51.9±13.0	0.566
Triglyceride	139.9±38.4	115.2±58.5	0.258
Hemoglobin	13.1±1.2	13.7±1.7	0.345
Neu/Lymp	1.88 (1.22-3.64)	1.63 (0.59-4.51)	0.251

A significant difference was determined in parameters indicated with * in the volunteers with and without atherosclerosis in the geriatric group.

As a result of PWV and/or CA-IMT examination, atherosclerosis findings were determined in 12 volunteers in Group 1 (50%). Table 1 shows sociodemographic and laboratory parameters of the volunteers with and without atherosclerosis in the geriatric group.

DISCUSSION

90 healthy volunteers including 24 (26.7%) geriatric ones were including in the present study and the presence of atherosclerosis was investigated with noninvasive methods. As a result of CA-IMT and PWV measurements, atherosclerosis findings were determined in 12 volunteers (50%) in the geriatric group. It was determined that there was a statistically significant difference between the volunteers with and without atherosclerosis in the geriatric group in terms of Systolic Blood Pressure, Diastolic Blood Pressure, Average Blood Pressure, Pulse Pressure and Calcium levels; whereas, there was no significant difference between other parameters. In the literature, the correlation of blood

pressure and pulse pressure with atherosclerosis is clearly emphasized. It is indicated that atherosclerosis might be correlated with calcium treatments and calcium levels. In a study conducted with elderly women, it was concluded that calcium support may not significantly increase the risk of atherosclerotic vascular disease.¹⁰⁻¹⁷

In a study examining 516 patients older than 60 years (in terms of gender, systemic arterial hypertension, dyslipidemia, diabetes mellitus, smoking and obesity), atherosclerotic complications were observed in 110 patients (21.3%); 45 patients (29.6%) were male, 65 patients (17.9%) were female and it was observed that atherosclerotic complication significantly increased among male patients.³ In the present study, unlike the aforementioned study, it was determined that atherosclerosis findings were statistically higher in female geriatric volunteers.

In the study conducted with 306 patients aged 70 years and over for the purpose of examining the prevalence of

atherosclerosis with magnetic resonance angiography; it was determined that there were distinct vascular anomalies in 26% of cases with no distinct vascular disease.¹⁸ In the present study, atherosclerosis findings (50%) were determined in healthy volunteers with noninvasive methods, which makes us think that it can be appropriate to screen the healthy geriatric population with noninvasive methods even if they don't actually suffer from a distinct vascular disease.

Primary prevention of atherosclerotic disease depends on an optimal management of main risk factors. Diabetes, hypertension, and dyslipidemia are primary risk factors for atherosclerosis, and they should be managed carefully and treated according to guidelines. However, it is problematical to apply guidelines in geriatric cases due to limited number of geriatric studies, comorbid diseases, multiple drug use, and undesired drug reactions.¹⁹ In the present study, no difference was determined in glucose and cholesterol levels of the healthy geriatric volunteers with and without atherosclerosis findings. There is no clear information about treatment approaches for patients in this group in the literature, as well.

CA-IMT is an indicator that is commonly used for atherosclerosis worldwide. CA-IMT can be measured in a simple, noninvasive, relatively cheap and repeatable way. It is a strong indicator of cerebral and cardiovascular events that may develop in the future.⁸⁻¹⁰ PWV is a noninvasive vascular parameter associated with cardiovascular risk, atherosclerosis and peripheral vascular disease and an independent predictor of cardiovascular events. An increased PWV is accepted to be an indicator of atherosclerosis.⁵⁻⁷ In the present study, the presence of atherosclerosis findings in healthy volunteers by using these two noninvasive methods was investigated. Atherosclerosis findings were determined in a total of 12 geriatric volunteers (50%) including 7 volunteers (29.2%) according to CA-IMT and 9 volunteers (37.5%) according to PWV. Because of this high rate, it is thought that it is necessary to investigate the geriatric population in terms of the presence of atherosclerosis independently from diabetes, hypertension and obesity even if they are healthy.

CONCLUSION

Even though the present study has a limited number of cases, we have shown that atherosclerosis is a serious problem in the geriatric population that is known (seems) to be healthy. It also is thought that; Systolic Blood Pressure, Diastolic Blood Pressure, Average Blood Pressure, Pulse Pressure and Calcium levels should be taken into consideration in this group. Because atherosclerosis findings were determined at the rate of 50% in the geriatric population as a result of CA-IMT and PWV examinations which are among noninvasive methods, it is thought that it is necessary to make examinations with noninvasive methods in terms of atherosclerosis risk.

Funding: No funding sources

Conflict of interest: None declared

Ethical approval: The study was approved by the Institutional Ethics Committee

REFERENCES

1. Tetik SS, Tanrıverdi B. Aterosklerozun patofizyolojisi ve risk faktörleri. *Marmara Pharmaceutical J.* 2017;21(1):1-9.
2. Félix-Redondo FJ, Grau M, Fernández-Bergés D. Cholesterol and cardiovascular disease in the elderly. *Facts and gaps. Aging Dis.* 2013 Mar 1;4(3):154-69.
3. Alencar YM, de Carvalho Filho ET, Paschoal SM, Curiati JA, Ping WC, Litvoc J. Risk factors for atherosclerosis in an elderly outpatient population in the city of São Paulo. *Arq Bras Cardiol.* 2000;74(3):181-96.
4. Wang JC, Bennett M. Aging and atherosclerosis: mechanisms, functional consequences, and potential therapeutics for cellular senescence. *Circ Res.* 2012;6;111(2):245-59.
5. Szmigielski C, Styczyński G, Sobczyńska M, Milewska A, Placha G, Kuch-Wocial A. Pulse wave velocity correlates with aortic atherosclerosis assessed with transesophageal echocardiography. *J Hum Hypertens.* 2016;30(2):90-4. doi: 10.1038/jhh.2015.35.
6. Xu Y, Wu Y, Li J, Ma W, Guo X, Luo Y, et al. The predictive value of brachial-ankle pulse wave velocity in coronary atherosclerosis and peripheral artery diseases in urban Chinese patients. *Hypertens Res.* 2008;31(6):1079-85.
7. Kırış A, Bostan M, Korkmaz L, Ağaç MT, Acar Z, Kaplan Ş, et al. Carotid-femoral pulse wave velocity in patients with isolated coronary artery ectasia: an observational study. *Anatol J Cardiol.* 2012;12(4): 313-9.
8. Nezu T, Hosomi N, Aoki S, Matsumoto M. Carotid Intima-Media Thickness for Atherosclerosis. *J Atheroscler Thromb.* 2016;23(1):18-31.
9. Naqvi TZ, Lee MS. Carotid intima-media thickness and plaque in cardiovascular risk assessment. *JACC Cardiovasc Imaging.* 2014 Oct;7(10):1025-38.
10. Polak JF, O'Leary DH. Carotid Intima-Media Thickness as Surrogate for and Predictor of CVD. *Glob Heart.* 2016 ;11(3):295-312.e3.
11. Safar ME, Blacher J, Jankowski P. Arterial stiffness, pulse pressure, and cardiovascular disease—is it possible to break the vicious circle? *Atherosclerosis.* 2011 Oct;218(2):263-71.
12. Schiffrin EL. Canadian Institutes of Health Research Multidisciplinary Research Group on Hypertension. Beyond blood pressure: the endothelium and atherosclerosis progression. *Am J Hypertens.* 2002 Oct;15(10 Pt 2):115S-22S.
13. DeBarmore B, Lin FC, Tuttle LA, Olsson E, Hinderliter A, Klein JL, et al. Association of ambulatory blood pressure variability with coronary

- artery calcium. *J Clin Hypertens (Greenwich)*. 2018 Feb;20(2):289-96.
14. Kalamogias A, Siasos G, Oikonomou E, Tsalamandris S, Mourouzis K, Tsigkou V, et al. Basic Mechanisms in Atherosclerosis: The Role of Calcium. *Med Chem*. 2016;12(2):103-13.
 15. Anderson JJ, Klemmer PJ. Risk of high dietary calcium for arterial calcification in older adults. *Nutrients*. 2013 Sep 30;5(10):3964-74.
 16. Reid IR. Cardiovascular effects of calcium supplements. *Nutrients*. 2013 Jul 5;5(7):2522-9.
 17. Lewis JR, Calver J, Zhu K, Flicker L, Prince RL. Calcium supplementation and the risks of atherosclerotic vascular disease in older women: results of a 5-year RCT and a 4.5-year follow-up. *J Bone Miner Res*. 2011 Jan;26(1):35-41.
 18. Hansen T, Wikström J, Johansson LO, Lind L, Ahlström H. The prevalence and quantification of atherosclerosis in an elderly population assessed by whole-body magnetic resonance angiography. *Arterioscler Thromb Vasc Biol*. 2007;27(3):649-54.
 19. Feldman RD, Harris SB, Hegele RA, Pickering JG, Rockwood K. Applying Atherosclerotic Risk Prevention Guidelines to Elderly Patients: A Bridge Too Far? *Can J Cardiol*. 2016 May;32(5):598-602.

Cite this article as: Genç AB, Yaylacı S, Açıkgöz SB, Yıldırım M, Aksoy YE, Vatan MB, et al. Atherosclerosis in geriatric patients known to be healthy. *Int J Res Med Sci* 2019;7:3699-703.