International Journal of Biomedicine 13(4) (2023) 246-249
http://dx.doi.org/10.21103/Article13(4)_OA2

ORIGINAL ARTICLE

Cardiology

INTERNATIONAL JOURNAL OF BIOMEDICINE

Earlobe Crease in Patients with Coronary Artery Disease at Hue Central Hospital

Chi Thang Doan, Khoi Nguyen Tran

Department of Cardiology, Hue Central Hospital, Hue city, Vietnam

Abstract

Background: The aim of this study was to evaluate the relationship between earlobe crease (ELC) and the severity of coronary artery disease (CAD).

Methods and Results: A cross-sectional descriptive study was conducted on 112 patients diagnosed with CAD who underwent coronary angiography at the Department of Emergency - Interventional Cardiology (Hue Central Hospital) from March 2023 to April 2023. All patients were examined clinically for bilateral ELC. Coronary artery injury was evaluated by using the Gensini score (GS). The results are presented as median (Me) and interquartile range (IQR [Q1-Q3]). A multiple logistic regression analysis was conducted to calculate the unadjusted and adjusted odds ratios (OR) with 95% CI.

Regarding ELC appearance, 84.8% of patients had bilateral ELC and 6.3% had unilateral ELC. As for length, 52.7% had complete length, while 38.4% had incomplete length. Regarding depth, the highest percentage of patients, 38.4%, had moderate depth, and the lowest percentage, 25%, had severe depth. Grade 2b had the highest frequency of 27.7%. GS of the bilateral group (28 [16–50]) was higher than that of the unilateral/no crease group (13 [7.5–21]), $P<0.05$. In terms of length, the GS of the complete group was significantly higher (32 [20–56]) than that of the incomplete group (16 [10–35]), $P<0.05$. Similarly, the GS of the group with severe depth was higher (33 [22.5–62]) than that of the mild/moderate depth group (21.5 [11.25–40]), $P<0.05$). In univariate analysis, bilateral crease, complete length, and severe depth were predictors of damage to ≥2 coronary arteries. Multivariate logistic regression analysis showed that all 3 factors above— bilateral appearance (OR=3.791, 95% CI: 1.306 to 11.009), complete length (OR=3.896; 95% CI: 3.896 to 9.103), and severe depth (OR=3.692; 95% CI: 1.173 to 11.620)—were independent prognostic factors for lesions of ≥2 coronary arteries.

Conclusion: ELC can be regarded as a clinical sign suggesting the patient should be considered for CAD screening and prognosis.**(International Journal of Biomedicine. 2023;13(4):246-249.)**

Keywords: earlobe crease • coronary artery disease • coronary angiography

For citation: Doan CT, Tran KN. Earlobe Crease in Patients with Coronary Artery Disease at Hue Central Hospital. International Journal of Biomedicine. 2023;13(4):246-249. doi:10.21103/Article13(4)_OA2

Abbreviations

CAD, coronary artery disease; **DELC**, diagonal ELC; **ELC**, earlobe crease; **GS,** Gensini score.

Introduction

Coronary artery disease (CAD) is the leading cause of disability and death worldwide. According to WHO 2019, ischemic heart disease was the leading cause of death, accounting for 16% of total deaths globally; deaths have increased from 2 million to 8.9 million from 2000 to 2019.[1] In Vietnam, myocardial infarction is one of the highest causes of death in the country.[2] The cost for each hospital admission of myocardial infarction in Vietnam is higher than the gross domestic product per capita.[3] In addition, in developing countries, cardiovascular disease tends to affect younger patients and thus negatively impacts society regarding resources and economic efficiency.

The most common cause of CAD is atherosclerosis, associated with cardiovascular risk factors such as smoking, obesity, sedentary lifestyle, hypertension, diabetes, and dyslipidemia. The diagnosis of CAD is based on clinical presentation and diagnostic test results. However, the choice of diagnostic tests depends crucially on the experience of

medical staff and facilities. Faced with a heavy burden of disease on society, high treatment costs for the family, and severe sequelae affecting the patient's quality of life, it is not only a matter of controlling risk factors well but also finding the right healthcare solutions. Clinical signs or symptoms suggestive of CAD also contribute a significant benefit.

The DELC is a 45-degree diagonal groove that runs from the ridge of the ear canal through the lobe and ends at the free edge of the earlobe. It was first described by American physician Frank in 1973 in the New England Journal of Medicine in a series of patients with CAD.[4] Since then, there have been many published reports on the association between earlobe imprinting and atherosclerosis, especially CAD. Several studies have reported earlobe crease (ELC) as an early warning sign of CAD, atherosclerosis,[5] peripheral vascular disease,[6] and cerebrovascular disease.[7,8] Realizing that this is a simple clinical sign, easy to detect and related to the prediction of CAD, helps to manage health more effectively, especially at health facilities with limited resources. We conducted the present study to evaluate the relationship between ELC and the severity of CAD.

Materials and Methods

A cross-sectional descriptive study was conducted on 112 patients diagnosed with CAD who underwent coronary angiography at the Department of Emergency - Interventional Cardiology (Hue Central Hospital) from March 2023 to April 2023.

Inclusion criteria: patients 18 years of age or older with a diagnosis of CAD with significant coronary stenosis (≥50%) of the lumen in at least one of the 3 main coronary vessels (left anterior descending artery [LAD], left circumflex artery [LCX], right coronary artery [RCA])[9] or ≥50% stenosis of the left main coronary artery.

Exclusion criteria: patients who did not consent to participate in the study, patients with severe trauma, patients with previous percutaneous coronary intervention or coronary artery bypass graft surgery, patients with myocardial bridge or cardiomyopathy, and patients with damage to the earlobe.

All patients were examined clinically for bilateral ELC. The following features on both the right and left earlobes were noted:[10]

Length: complete (the mark runs through the entire earlobe), incomplete (the mark runs through the earlobe but does not reach the outer margin).

Depth: mild (vaguely insinuated), moderate (a fold where the base of the sulcus can be observed), severe (the base of the sulcus cannot be seen).

Classification of ELC:

Grade 1: some wrinkles on the earlobe

Grade 2a: creases running over more than half of the earlobe

Grade 2b: shallow crease running through the entire earlobe

Grade 3: deep folds running through the entire earlobe

Then, we noted the common characteristics of ELC for both ears based on the ear with more severe and obvious damage. We evaluated coronary artery injury by using the Gensini score (GS).[11]

Statistical analysis was performed using the statistical software package SPSS version 21.0 (SPSS Inc, Armonk, NY: IBM Corp). The results are presented as median (Me) and interquartile range (IQR [Q1-Q3]). The Kruskal-Wallis test was used to compare the medians of the two groups. A multiple logistic regression analysis was conducted to calculate the unadjusted and adjusted odds ratios (OR) with 95% confidence intervals (95% CI). The frequencies of categorical variables were compared using a chi-square test. A probability value of $P<0.05$ was considered statistically significant.

Results

The study population comprised 112 patients diagnosed with CAD who underwent coronary angiography. Regarding appearance, 84.8% of patients had bilateral ELC and 6.3% had unilateral ELC. As for length, 52.7% had complete length, while 38.4% had incomplete length. Regarding depth, the highest percentage of patients, 38.4%, had moderate depth, and the lowest percentage, 25%, had severe depth. Grade 2b had the highest frequency of 27.7% (Table 1). GS of the bilateral group was higher [28 (16–50)] than that of the unilateral/no crease group (13 [7.5–21]), $P<0.05$ (Table 2). In terms of length, the GS of the complete group was significantly higher (32 [20–56]) than that of the incomplete group (16 [10–35]), $P<0.05$ (Table 3). Similarly, the GS of the group with severe depth was higher (33 [22.5–62]) than that of the mild/moderate depth group (21.5 [11.25–40]), $P<0.05$ (Table 4). In univariate analysis, bilateral crease, complete length, and severe depth were predictors of damage to ≥2 coronary arteries (Table 5). Multivariate logistic regression analysis showed that all 3 factors above— bilateral appearance (OR=3.791; 95% CI: 1.306 to 11.009), complete length (OR=3.896; 95% CI: 3.896 to 9.103), and severe depth (OR=3.692; 95% CI: 1.173 to 11.620)—were independent prognostic factors for lesions of ≥2 coronary arteries (Table 6).

Table 1.

General characteristics of both ears in the study subjects.

ECL		n	%
Appearance	Bilateral	95	84.8
	Unilateral	7	6.3
	No crease	10	8.9
Length	Complete	59	52.7
	Incomplete	43	38.4
	No crease	10	8.9
Depth	Mild	31	27.7
	Moderate	43	38.4
	Severe	28	25
	No crease	10	8.9
Grade	1	17	15.2
	2a	26	23.2
	2b	31	27.7
	3	28	25
	No crease	10	8.9

Table 2.

Distribution of the number of damaged coronary artery branches and GS with the presence of ELC.

Lesion branches	ELC				*P*-value
	Bilateral		Unilateral / No crease		
	n	%	n	%	
1 branch	26	27.4	10	58.8	0.01
≥ 2 branches	69	72.6	7	41.2	
GS, Me (Q1;Q3)	28 (16–50)		13 (7.5–21)		<0.05

Table 3.

Distribution of the number of damaged coronary artery branches and GS with length of ELC.

Lesion branches	ELC				*P*-value
	Complete		Incomplete / No crease		
	n	%	n	%	
1 branch	11	18.6	25	47.2	<0.01
≥ 2 branches	48	81.4	28	52.8	
GS, Me (Q1;Q3)	32 (20–56)		16 (10–35)		<0.05

Table 4.

Distribution of the number of damaged coronary artery branches and GS with depth of ELC.

Lesion branches	ELC				*P*-value
	Severe		Mild/ Moderate/ No crease		
	n	%	n	%	
1 branch	4	14.3	32	38.1	<0.02
≥ 2 branches	24	85.7	52	61.9	
GS, Me (Q1;Q3)	33 (22.5–62)		21.5 (11.25– 40)		<0.05

Table 5.

Univariate logistic regression: associations between risk factors and ELC classification with lesions ≥ 2 coronary arteries.

Variable	OR	95% CI	*P*-value
Sex (male)	2.566	0.692 to 9.513	>0.05
Age (≥ 70)	0.633	0.233 to 1.716	>0.05
Obesity	1.376	0.512 to 3.679	>0.05
Hypertension	3.114	0.922 to 10.513	>0.05
Diabetes	1.211	0.446 to 3.291	>0.05
Dyslipidemia	1.821	0.678 to 4.886	>0.05
Smoking	0.369	0.113 to 1.382	>0,05
Bilateral ELC	4.862	1.474 to 16.036	<0.05
Complete length	4.727	1.781 to 12.548	<0.05
Severe depth	5.176	1.467 to18.266	<0.05

Table 6.

Multivariate logistic regression: associations between ELC classification and lesions ≥ 2 coronary arteries

Characteristics	OR	95% CI	*P*-value
Bilateral ELC	3.791	1.306 to 11.009	<0.05
Complete length	3.896	3.896 to 9.103	<0.05
Severe depth	3.692	1.173 to 11.620	<0.05

Discussion

Regarding the number of lesion branches, the lesion of 2 branches and or more in each feature of the ELC can be seen in the group with a bilateral crease at 72.6%, in the group with complete length at 81.4%, and the group with a severe depth at 85.7%.

Comparison between each subgroup of characteristics of the crease with the number of damaged coronary artery branches showed that in lesions of 2 branches and more, the group with bilateral ELC was higher than the unilateral/no crease group, 72.6% and 41.2%, respectively; the difference is statistically significant (P<0.05). The median GS of the bilateral group was significantly higher at 28 points than that of the unilateral/no crease group at 13 points (P<0.05). Similarly, the percentage of the complete length group with lesions of 2 branches and more, 81.4%, was higher than that of the incomplete/no crease group, 52.8%, and the median GS of the 2 groups was 32 and 16 points, respectively; this difference is statistically significant (P<0.05). And finally, about crease depth, patients with severe depth had a significantly higher percentage of lesion in 2 branches, 85.7%, than those with moderate/mild/no crease, 61.9% (P<0.05), and the median GS was 33 versus 21.5 points, respectively.

Compared with a study by Wu et al.,[12] the rate of CAD and the rate of damaged 2 vessels in the group with a crease was significantly higher than in the group without a crease. A study performed by Arefi et al.[13] also showed similar results with the lesions of 2 branches and 3 branches of the coronary artery in the group with a crease significantly higher than the group without a crease (P<0.05). Thilo et al.[14] showed that the rate of 1- and 2-vessel lesions in the crease group with grade 2/3 was higher than in the group with grade 0/1, but the rate of 3-vessel lesions between 2 grades differed. Kahyaoglu et al.[15]showed that the median value of GS in the group with a crease was higher than the group without a crease, and the difference was statistically significant (P<0.05).

In general, the results of our study are quite similar to the above studies, and show that subjects with multivessel CAD have a higher rate of CAD related to ELC. When we tested the predictability of multivessel CAD of the ELC patients by logistic regression, it was found that the bilateral crease, the complete length, and the severe depth could predict damage of multivessel CAD, independent of other risk factors, with ORs of 4.862 (95% CI: 1.474 to 16.036), 4.727 (95% CI: 1.781 to 12.548) and 5.176 (95% CI: 1.467 to 18.266), respectively, when performed with the model including male, age ≥70, obesity, hypertension, diabetes, and smoking (P<0.05).

Compared with the study of Shmilovich et al. on 430 subjects with coronary angiography, the results of logistic regression are that the ELC can predict damage to 2 vessels and more with OR of 1.9 (95% CI: 1.2 to 3.1) when adjusted for age >70 years, male sex, smoking, hypertension, diabetes mellitus, dyslipidemia, and any chest pain symptoms (P<0.05).[16]

In conclusion, ELC can be regarded as a clinical sign suggesting the patient should be considered for CAD screening and prognosis.

Competing Interests

The authors declare that they have no competing interests.

References

1. Zhang L, Tong Z, Han R, Guo R, Zang S, Zhang X, Yuan R, Yang Y. Global, Regional, and National Burdens of Ischemic Heart Disease Attributable to Smoking From 1990 to 2019. J Am Heart Assoc. 2023 Feb 7;12(3):e028193. doi: 10.1161/JAHA.122.028193.
2. Nguyen HL, Bui QT, Tran HV, Hoang MV, Le TT, Ha DA, Nguyen VT, Nguyen ND, Tran HH, Goldberg RJ. Characteristics, in-hospital management, and complications of acute myocardial infarction in northern and Central Vietnam. Int J Cardiol. 2022 Oct 1;364:133-138. doi: 10.1016/j.ijcard.2022.06.044.
3. Nguyen TP, Nguyen T, Postma M. Economic Burden Of Acute Myocardial Infarction In Vietnam. Value in Health. 2015;18(7):A389. doi: 10.1016/j.jval.2015.09.857
4. Frank ST. Aural sign of coronary-artery disease. N Engl J Med. 1973 Aug 9;289(6):327-8. doi: 10.1056/nejm197308092890622.
5. Kaukola S. The diagonal ear-lobe crease, a physical sign associated with coronary heart disease. Acta Med Scand Suppl. 1978;619:1-49.
6. Korkmaz L, Agac MT, Acar Z, Erkan H, Gurbak I, Kurt IH, et al. Earlobe crease may provide predictive information on asymptomatic peripheral arterial disease in patients clinically free of atherosclerotic vascular disease. Angiology. 2014 Apr;65(4):303-307. doi: 10.1177/0003319713479651
7. Glavic J, Cerimagic D, Lovrencic-Huzjan A, Vukovic V, Demarin V. Frank's sign as a risk factor for cerebrovascular disease. Atherosclerosis. 2008 Jan;196(1):477-478. doi: 10.1016/j.atherosclerosis.2007.05.023
8. Nazzal S, Hijazi B, Khalila L, Blum A. Diagonal Earlobe Crease (Frank's Sign): A Predictor of Cerebral Vascular Events. Am J Med. 2017 Nov;130(11):1324.e1-1324.e5. doi: 10.1016/j.amjmed.2017.03.059.
9. Rana JS, Dunning A, Achenbach S, Al-Mallah M, Budoff MJ, Cademartiri F, et al. Differences in prevalence, extent, severity, and prognosis of coronary artery disease among patients with and without diabetes undergoing coronary computed tomography angiography: results from 10,110 individuals from the CONFIRM (COronary CT Angiography EvaluatioN For Clinical Outcomes): an InteRnational Multicenter Registry. Diabetes Care. 2012 Aug;35(8):1787-94. doi: 10.2337/dc11-2403. Epub 2012 Jun 14.
10. Rodríguez-López C, Garlito-Díaz H, Madroñero-Mariscal R, Sánchez-Cervilla PJ, Graciani A, López-Sendón JL, López-de-Sá E. Earlobe crease shapes and cardiovascular events. Am J Cardiol. 2015 Jul 15;116(2):286-93. doi: 10.1016/j.amjcard.2015.04.023.
11. Gensini GG. A more meaningful scoring system for determining the severity of coronary heart disease. Am J Cardiol. 1983 Feb;51(3):606. doi: 10.1016/s0002-9149(83)80105-2.
12. Wu XL, Yang DY, Zhao YS, Chai WH, Jin ML. Diagonal earlobe crease and coronary artery disease in a Chinese population. BMC Cardiovasc Disord. 2014 Apr 4;14:43. doi: 10.1186/1471-2261-14-43.
13. Arefi R, Namazi MH, Safi M, Saadat H, Vakili H, Pishgahi M, Alipour Parsa S. Value of Transverse Groove on the Earlobe and Hair Growth on the Ear to Predict the Risk for Coronary Artery Disease and Its Severity among Iranian Population, in Tehran City. Galen Med J. 2020 May 22;9:e1443. doi: 10.31661/gmj.v9i0.1443.
14. Thilo C, Meisinger C, Heier M, von Scheidt W, Kirchberger I. Diagonal earlobe crease and long-term survival after myocardial infarction. BMC Cardiovasc Disord. 2021 Dec 16;21(1):597. doi: 10.1186/s12872-021-02425-4.
15. Kahyaoglu M, Gecmen C, Candan O, Gucun M, Karaduman A, Guner A, Cakmak EO, Bayam E, Yilmaz Y, Celik M, Izgi IA. Presence of ear lobe crease may predict intermediate and high-risk patients with acute non-ST elevation acute coronary syndrome. J Cardiovasc Thorac Res. 2020;12(3):172-178. doi: 10.34172/jcvtr.2020.30.
16. Shmilovich H, Cheng VY, Rajani R, Dey D, Tamarappoo BK, Nakazato R, Smith TW, Otaki Y, Nakanishi R, Gransar H, Paz W, Pimentel RT, Hayes SW, Friedman JD, Thomson LE, Berman DS. Relation of diagonal ear lobe crease to the presence, extent, and severity of coronary artery disease determined by coronary computed tomography angiography. Am J Cardiol. 2012 May 1;109(9):1283-7. doi: 10.1016/j.amjcard.2011.12.024.

***Corresponding author**: Dr. Chi Thang Doan, Department of Cardiology, Hue Central Hospital, Hue city, Vietnam. E-mail: thangdoanchi1981@gmail.com*