

Prevalence of Ectasia in Human Coronary Arteries in Patients in Northern Greece Referred for Coronary Angiography

George D. Giannoglou, MD, PhD*, Antonios P. Antoniadis, MD, MSc,
Yiannis S. Chatzizisis, MD, MSc, Efthalia Damvopoulou, MD, MSc,
George E. Parcharidis, MD, PhD, and George E. Louridas, MD, PhD

We determined the prevalence of coronary artery ectasia (CAE) in patients who were referred to our institution for coronary angiography for any reason and investigated its potential association with angiographically significant coronary artery disease (CAD). We also examined whether CAE and CAD are topographically associated. In 10,524 consecutive patients from January 1, 1995 to December 31, 2003, the corresponding coronary angiographies were analyzed and cases of CAE were identified, recorded, and summarized. CAE was found in 287 patients (2.7%). It was markedly more prevalent in men than in women ($p < 0.0001$). Younger patients exhibited a higher prevalence of CAE ($p < 0.01$), and this was confirmed for men ($p < 0.05$) but not for women. Co-existence with CAD was noted in 250 cases of CAE (87.1%) ($p = 0.001$). CAD increased remarkably throughout the study ($p < 0.001$), whereas the prevalence of CAE remained unchanged. The prevalence of CAE was significantly greater in the right coronary artery than in the left anterior descending (LAD) coronary artery and the left circumflex artery ($p < 0.0001$), whereas CAD most commonly affected the LAD ($p < 0.0001$). Further, CAE in the right coronary artery showed a strong association with the existence of CAD in the LAD ($p = 0.015$). In conclusion, CAE is more frequent in young men who show a predilection for the right coronary arterial system. Although associated with CAD, a direct causal relation cannot be established. © 2006 Elsevier Inc. All rights reserved. (Am J Cardiol 2006;98:314–318)

In the present study, we determined the prevalence of coronary artery ectasia (CAE) in 10,524 patients who were referred for coronary angiography and investigated its potential association with angiographically significant coronary artery disease (CAD). We also examined whether CAE and CAD are topographically associated.

• • •

Data from 10,524 consecutive patients who underwent coronary angiography for any reason in our institution in Northern Greece from January 1, 1995 to December 31, 2003 were assessed through our database and retrospectively analyzed. After cases of CAE were identified by visual estimation by an expert interventional cardiologist, the demographic parameters and angiographic characteristics were recorded simultaneously and summarized. A vessel was considered to be ectatic if it exhibited a luminal diameter of >1.5 times than that of the adjacent normal segment, excluding regions with poststenotic dilation.¹ CAD was defined as stenosis that caused a $>50\%$ decrease in the coronary lumen, whereas obstructions $<50\%$ were

considered nonsignificant. The study was approved by the institutional medical ethics committee.

Statistical analyses were performed with SPSS 12.0 (SPSS, Inc., Chicago, Illinois) and GraphPad Prism 4.0 (GraphPad Software, Inc., San Diego, California). A p value < 0.05 was considered statistically significant. Because age did not fulfill the assumption of normality, it was summarized as medians and interquartile ranges, with the latter representing values between the 25th and 75th percentiles of its distribution. All remaining variables (gender, presence, and localization of CAE or CAD) were categorical and summarized as absolute values and percentages. The association between CAE and gender was investigated by Pearson's chi-square test and calculation of the odds ratio and its 95% confidence interval. Age differences between patients with CAE and those without CAE in the entire population and each gender separately were assessed with the nonparametric Mann-Whitney test. Further, the effect of age in the studied population and in each gender separately was investigated by a binary logistic regression model. The same model was also applied for the measurement of the effects of both gender and age on the presence of CAE. The comparison between the mean number of cases with CAE and CAD per year was made by Student's t test for dependent samples. The potential association between CAE and CAD as well as the differences in the prevalence of CAE and CAD among the major coronary arteries (right coronary artery, left anterior descending coronary artery [LAD], and left circumflex artery) were investigated with Pearson's chi-

The First Cardiology Department, AHEPA University Hospital, Medical School, Aristotle University of Thessaloniki, Thessaloniki, Greece. Manuscript received November 13, 2005; revised manuscript received and accepted February 9, 2006.

This study was supported by a grant from the Greek State Scholarships Foundation, Greece.

* Corresponding author: Tel/fax: 0030-2310-994837.

E-mail address: yan@med.auth.gr (G.D. Giannoglou).

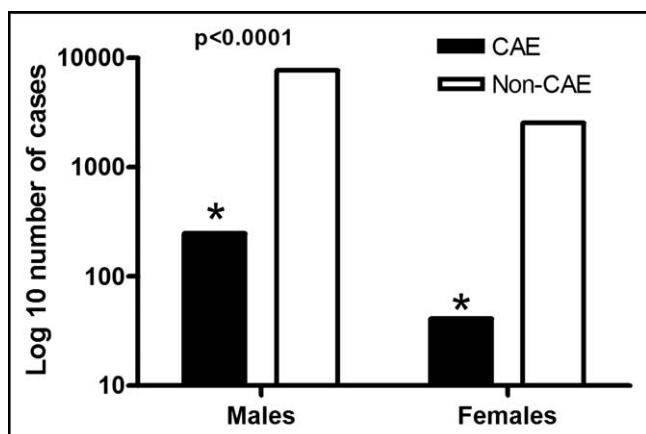


Figure 1. Prevalence of CAE in relation to gender (n = 10,511). Number of cases is expressed as a logarithmic scale.

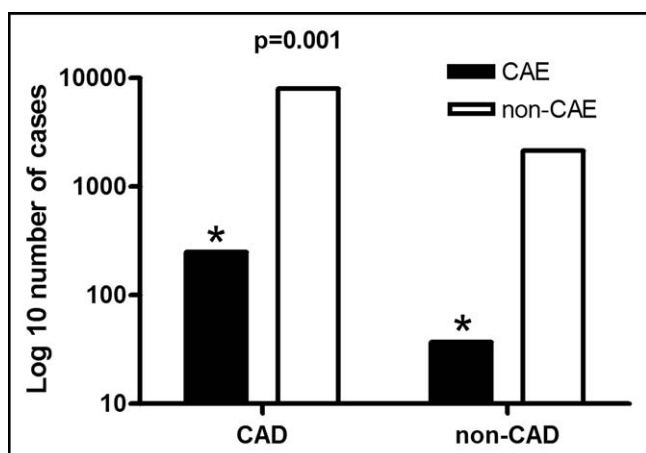


Figure 2. Prevalence of CAE and CAD in the studied population (n = 10,524). Number of cases is expressed as a logarithmic scale.

square test and expressed as an odds ratio with its 95% confidence interval. The power of all calculated chi-square tests was found to be >90% at a significance level of 0.05.

Gender data were available for 10,511 patients (7,919 men and 2,592 women). CAE was found in 287 patients, with an overall prevalence of 2.7%. Of these, 246 were men (85.7%), representing 3.1% of the total number of men, whereas 41 were women (14.3%), representing 1.6% of the total number of women. CAE was found to be markedly more prevalent in men than in women ($p < 0.0001$, odds ratio 1.99, 95% confidence interval 1.43 to 2.78; Figure 1). In other words, in our series, men exhibited a 1.99 times higher likelihood of presenting with CAE compared with women.

Age data were recorded in 6,744 patients (median 62 years, interquartile range 53 to 69), and gender data were available for 6,733. Median age was 61 years (interquartile range 52 to 68, $n = 5,133$) for men and 65 years (interquartile range 58 to 70, $n = 1,600$) for women. The age of subjects without CAE (median 62 years, interquartile range 53 to 69, $n = 6,574$) was significantly higher than of

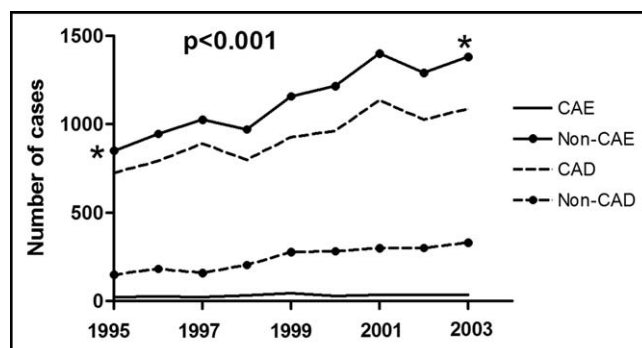


Figure 3. Frequencies of CAE (solid line), non-CAE (solid line with circle), CAD (dashed line), and non-CAD (dashed line with circle) over the 9-year study period (n = 10,524). The prevalence of CAD increased remarkably, whereas that of CAE remained unchanged.

Table 1

Topography of ectasia in coronary arteries studied*

Ectatic Artery	n (%)
Right coronary artery	147 (44.4%)
Left circumflex artery	82 (24.8%)
LAD	81 (24.5%)
Intermediate branch	2 (0.6%)
Left main coronary artery	13 (3.9%)
First diagonal branch	2 (0.6%)
First obtuse marginal branch	2 (0.6%)
Posterior descending artery	2 (0.6%)
Total	331 (100.0%)

* In some patients, ectasia was found in >1 coronary artery.

those with CAE (median 60 years, interquartile range 50 to 68, $n = 170$; $p < 0.01$). Binary logistic regression showed that the presence of CAE (y) was inversely correlated with age (x) ($y = -0.02x - 2.49$, odds ratio 0.981, 95% confidence interval 0.968 to 0.994, $p < 0.01$; $n = 6,733$). Therefore, for each extra year of age, the chance of presenting with CAE decreased significantly by a factor of 0.981. In other words, the younger the age, the higher the likelihood for the occurrence of CAE. In addition, the age of men without CAE (median 61 years, interquartile range 52 to 68, $n = 4,988$) was significantly higher than that of men with CAE (median 59 years, interquartile range 49 to 67, $p < 0.05$; $n = 145$), whereas no statistically significant age difference was recorded between women with CAE (median 65 years, interquartile range 52.5 to 70, $n = 25$) and women without CAE (median 65 years, interquartile range 58 to 70, $n = 1,575$). By applying binary logistic regression in men and women separately, the following equations were revealed: $y = -0.017x - 2.54$ (odds ratio 0.983, 95% confidence interval 0.969 to 0.997, $p < 0.05$; $n = 5,133$) and $y = -0.016x - 3.14$ (odds ratio 0.984, 95% confidence interval 0.944 to 1.026, $p = 0.45$; $n = 1,600$), respectively. Therefore, although younger age was a factor associated with an increased likelihood of CAE in men, it had no significant effect in women. The effects of gender (x_1) and age (x_2) on the development of CAE (y) was pre-

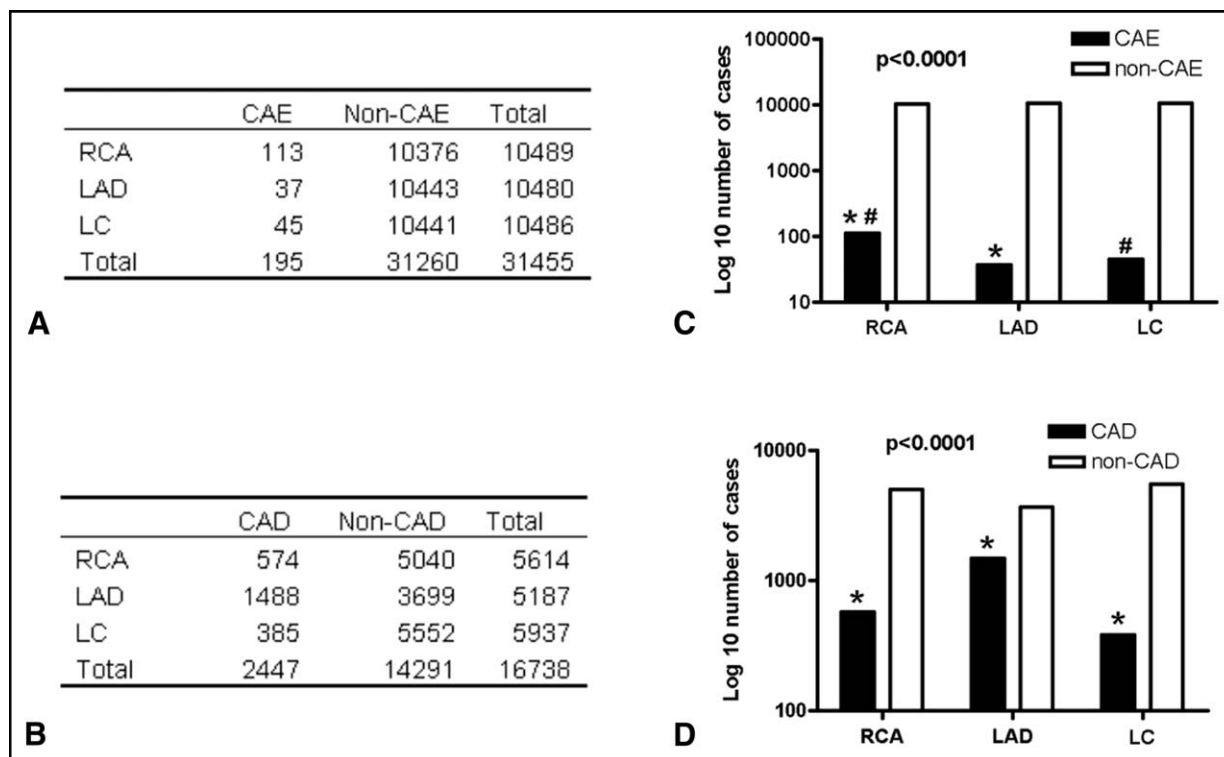


Figure 4. Frequency of CAE and CAD in each major coronary vessel. Cases of CAE or CAD in >1 artery within the same patient were not included. (A, C) The prevalence of CAE was significantly greater in the right coronary artery (RCA) than in the the LAD and left circumflex artery (LC; $p < 0.0001$). (B, D) With regard to CAD, the LAD was most commonly affected, followed by the RCA and LC ($p < 0.0001$). Number of cases is expressed as a logarithmic scale.

dicted by the following model: $y = 0.534x_1 - 0.017x_2 - 3.08$ (x_1 odds ratio 0.586, 95% confidence interval 0.380 to 0.904; x_2 odds ratio 0.983, 95% confidence interval 0.970 to 0.997, $p < 0.05$; $n = 6,733$). Thus, for men and women of the same age, the probability for women to present with CAE was almost half that of men. Similarly, regardless of gender, for each extra year of age, the likelihood of CAE decreased significantly by a factor of 0.983.

CAE with normal or nonsignificantly obstructed coronary arteries was present in 37 of 287 cases of CAE (12.9%) (Figure 2). Co-existence of CAE and CAD was found in the remaining 250 cases of CAE (87.1%). In the group of patients without CAE ($n = 10,237$), CAD was present in 8,087 subjects (79%), and nonsignificant lesions or normal coronary arteries were found in the remaining 2,150 (21%). In consequence, patients with CAE exhibited higher rates of CAD than those without CAE, a difference that was statistically significant (odds ratio 1.8, 95% confidence interval 1.27 to 2.55, $p = 0.001$; Figure 2).

The mean number of cases with CAE per year was markedly lower than that with CAD (31.9 ± 7.0 vs 926.2 ± 140.6 , $p < 0.0001$). Figure 3 presents the temporal variation of the prevalence of CAE and CAD over the 9-year study period. In contrast to CAE, whose prevalence remained relatively steady over the entire study period, the CAD burden increased markedly ($p < 0.001$).

CAE involved 1 coronary artery in 219 patients (76.3%), 2 in 41 (14.3%), and 3 in 27 (9.4%). Table 1 presents the frequency of CAE in the entire coronary arterial tree. Figure 4 shows the prevalence of CAE and CAD in each major coronary artery and its minor branches. Cases of CAE or CAD in >1 artery within the same patient were excluded. As depicted, the prevalence of CAE was significantly greater in the right coronary artery than in the LAD (odds ratio 3.07, 95% confidence interval 2.12 to 4.46, $p < 0.0001$) and left circumflex artery (odds ratio 2.53, 95% confidence interval 1.79 to 3.57, $p < 0.0001$), whereas the difference between the LAD and left circumflex artery was insignificant (odds ratio 0.82, 95% confidence interval 0.53 to 1.27, $p = 0.44$). With regard to CAD, the LAD was most commonly affected, followed by the right coronary and left circumflex arteries. The LAD exhibited a greater likelihood for CAD than the right coronary artery (odds ratio 3.53, 95% confidence interval 3.18 to 3.92, $p < 0.0001$) and left circumflex artery (odds ratio 5.8, 95% confidence interval 5.15 to 6.54, $p < 0.0001$). To assess the possible topographic association between CAE and CAD, we investigated the co-existence of CAE and CAD in the right coronary artery, LAD, and left circumflex artery and these entities were not associated in any separate artery (Figure 5). Conversely, in the same patients, the presence of CAE in the right coronary artery was strongly associ-

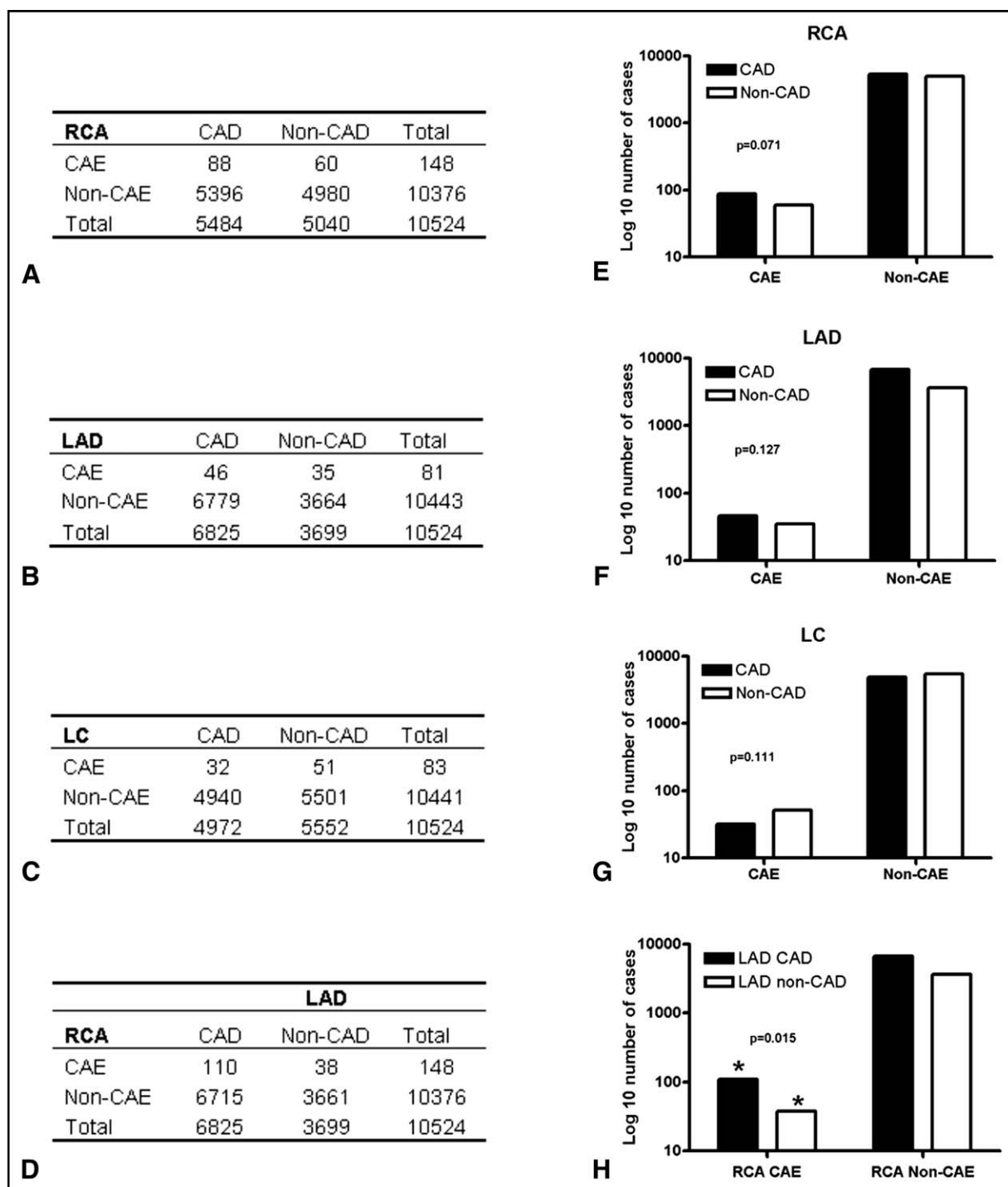


Figure 5. Frequency of coexistence of CAE and CAD in each major coronary vessel ($n = 10,524$). CAE and CAD were not associated in the right coronary artery (A, E), LAD (B, F), and left circumflex artery (C, G). (D, H) However, within the same patient, the presence of CAE in the right coronary artery was strongly associated with the presence of CAD in the LAD ($p = 0.015$). Number of cases is expressed as a logarithmic scale. Abbreviations as in Figure 2.

ated with that of CAD in the LAD (odds ratio 1.58, 95% confidence interval 1.09 to 2.29, $p = 0.015$).

...

The prevalence of CAE among our patients ($n = 287$, 2.7%) was within the range of prevalence rates reported in previous studies (1.2% to 4.9%).¹⁻⁷ Apart from the Coronary Artery Surgery Study (CASS), the largest study on CAE, in which

20,087 patients were studied,¹ no such large series have been published. The highest frequency of CAE ever reported was ~12% in an Indian population⁸; however, this divergence could be attributed to different demographic characteristics of the studied population.

According to our results, CAE was significantly predominant in men compared with women (3.1% of total men vs

1.6% of total women, $p < 0.0001$). This gender difference has been reported previously^{9,10} and could be attributed to the lower incidence of CAD in women, although the relation between CAE and CAD is doubtful. In addition, the percentages in the present study are higher than those in a study conducted in Singapore (2.0% of men vs 0.6% of women)³; in contrast, an even higher percentage of CAE among men (4.2%), but a lower percentage among women (1.09%), was recorded in a Spanish population.⁴ Moreover, the higher likelihood of men having CAE compared with women is generally consistent with the study in Spain in which male gender was demonstrated as an independent predictor CAE.⁴

In our series, age constituted a significant factor that was inversely associated with the presence of CAE. A similar finding of significantly younger age among patients with CAE compared with those without CAE has been previously reported, although this association has not been proved to be independent of other risk factors for CAD.⁴ However, in our study, this association between younger age and CAE was confirmed only for men, whereas its effect in women was insignificant. Whether this selective effect of age in men has to do with the pathophysiology of CAE or is due to the presence of some unknown confounding factors remains elusive.

1. Swaye PS, Fisher LD, Litwin P, Vignola PA, Judkins MP, Kemp HG, Mudd JG, Gosselin AJ. Aneurysmal coronary artery disease. *Circulation* 1983;67:134–138.
2. Markis JE, Joffe CD, Cohn PF, Feen DJ, Herman MV, Gorlin R. Clinical significance of coronary arterial ectasia. *Am J Cardiol* 1976; 37:217–222.
3. Lam CSP, Ho KT. Coronary artery ectasia: a ten year experience in a tertiary hospital in Singapore. *Ann Acad Med Singapore* 2004;33:419–422.
4. Pinar Bermudez E, Lopez Palop R, Lozano Martinez-Luengas I, Cortes Sanchez R, Carrillo Saez P, Rodriguez Carreras R, Pico Aracil F, Valdes Chavarri M. Coronary ectasia: prevalence, and clinical and angiographic characteristics. *Rev Esp Cardiol* 2003;56: 473–479.
5. Sadr Ameli MA, Sharifi M. The natural history of ectatic coronary artery disease. *Iranian Heart J* 2001;2:12–16.
6. Nyamu P, Ajit MS, Joseph PK, Venkitachalam L, Sugirtham NA. The prevalence and clinical profile of angiographic coronary ectasia. *Asian Cardiovasc Thorac Ann* 2003;11:122–126.
7. Gronke S, Diet F, Kilter H, Bohm M, Erdmann E. Characteristics of patients with coronary ectasias with and without stenotic coronary artery disease. *Dtsch Med Wochenschr* 2005;130:2375–2379.
8. Sharma SN, Kaul U, Sharma S, Wasir HS, Manchanda SC, Bahl VK, Talwar KK, Rajani M, Bhatia ML. Coronary arteriographic profile in young and old Indian patients with ischaemic heart disease: a comparative study. *Indian Heart J* 1990;42:365–369.
9. Swanton RH, Thomas ML, Coltart DJ, Jenkins BS, Webb-Peploe MM, Williams BT. Coronary artery ectasia—a variant of occlusive coronary arteriosclerosis. *Br Heart J* 1978;40:393–400.
10. Hartnell GG, Parnell BM, Pridie RB. Coronary artery ectasia, its prevalence and clinical significance. *Br Heart J* 1985;54:392–395.