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Impact of coronary dominance on the severity of coronary artery disease: a cross-sectional study

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Abstract

Objectives: To investigate whether coronary artery dominance is associated with the severity of coronary artery disease (CAD).

Design: cross-sectional study

Setting: Single centre

Participants: Between July 2015 and February 2017, 1654 patients who underwent coronary angiography (CAG) were recruited in this cross-sectional study.

Measurement and methods: Based on the CAG results, patients were classified as left dominance (LD), right dominance (RD), and co-dominance (CD). Multiple linear regression analysis was performed to test the association between severity of CAD and coronary dominance.

Results: The total Gensini score was significantly higher in RD group than Left-CD group (42.3±33.6 vs. 36.3±29.8; p=0.033). After adjusting for potential confounding factors, results of multivariate linear regression showed that right dominance was associated with the severity of CAD (β 6.699, 95% confidence interval [CI] 1.193-12.205, *p*=0.017).

Conclusions: These results suggest that right coronary dominance was associated with the severity of CAD.

Keywords: coronary dominance, Gensini score, cross-sectional study, coronary angiography

Strengths and limitations of this study

• This is the first study to demonstrate the association between right coronary artery dominance and the severity of coronary artery disease (CAD) based on a Northern Chinese population.

• The total Gensini score was significantly higher in right dominance than left-dominance and co-dominance.

• Right coronary dominance was found to be associated with the severity of CAD.

• Our study was a cross-sectional study, therefore the outcomes of patients were unavailable.

Introduction

Coronary artery disease (CAD) is one of the most common type of disease around the world[1]. It is recognised that obesity, blood pressure, smoking, diabetes, exercise, diet, cholesterol, and depression was associated with the incidence of CAD[2]. The severity of coronary artery stenosis was usually evaluated by Gensini score or SYNTAX score in clinical practice[3]. Several studies have shown that coronary artery dominance is associated with cardiovascular prognosis in patients with acute coronary syndrome[4-7]. Variation of coronary dominance includes left dominance (LD), right dominance (RD) and co-dominance (CD) based on the vascular supply of the posterior interventricular septum (IVS)[8, 9]. In the general population, RD is most prevalent of approximately 70% population, while LD occurs in about 20% of cases and co-dominance is present in 10% of cases[10]. LD was found to be associated with increased long-term mortality in patients with coronary artery disease (CAD)[11, 12]. However, little is known about the role of RD in the CAD. Previous study showed that RD, LD and CD have a prevalence of approximately 82-89%, 5-12% and 3-7% respectively in hospital population[4, 13-15]. Our pilot data also found that patient with RD had a higher proportion of CAD than LD and CD. There seems to have different distribution of coronary dominance between general population and CAD patients. Therefore, we conducted this study to investigate whether patients with right coronary dominance was associated with CAD and its severity.

Methods

Study population

1654 in-hospital patients, who underwent coronary angiography (CAG) during their hospital stay, were recruited from the database of the First Affiliated Hospital of Xi'an Jiaotong University between July 2015 and February 2017. All patients included in this study because they had standard clinical indications for CAG. Exclusion criteria were (1) previous coronary artery bypass graft operation or CAG, (2) those with chronic and systemic disease, and (3) incomplete CAG reports and medical records. All patients signed the informed consent, and their records were anonymised and de-identified before analysis. The study protocol was approved by the Ethics Committee of the First Affiliated Hospital, Xi'an Jiaotong University.

Hypertension was defined as office blood pressure over 140/90 mmHg or 24-hour ambulatory blood pressure over 135/85 mmHg[16]. Diabetes mellitus was diagnosed as patients with a fasting plasma glucose level ≥7.0 mmol/L (126 mg/dL) or two-hour post-load plasma glucose level ≥11.0 mmol/L (200 mg/dL)[17]. Smoking was defined as ever smoked 100 cigarettes or currently smoking every day or some days[18].

CAG results

All patients underwent CAG using a standard clinical technique through femoral artery or radial artery approach[19]. The CAG report was written and checked by interventional cardiologists. The phynotype of coronary dominance was divided based on the CAG. The posterior descending artery was originated by the right coronary

artery in patients with RD. The posterior descending artery diverged from left circumflex artery was defined as LD. Co-dominant anatomy was defined when the PDA originated from the right coronary artery (RCA) and a large posterolateral branch originated from the Left circumflex branch (LCx) reached near the posterior interventricular groove[10, 13]. The severity of CAD was evaluated with the Gensini score. In this scoring system, 0 indicates no abnormality, 1 represents stenosis⩽25%, 2 represents stenosis of 26-50%, 4 represents stenosis of 51-75%, 16 represents stenosis of 76-99%, and 32 represents complete occlusion. Then the score is multiplied by different factors according to the functional significance of the coronary artery. The importance of the segment was rated 5 for the left main trunk to 0.5 for the most distal segments[20, 21]. The patients were then divided into four groups according to the total score (0–12, 13–24, 25-52 and ≥53)[22].

Statistical analysis

All statistical analyses were made by SPSS version 24.0 (SPSS Inc., Xi'an Jiaotong University, China). *P*-value <0.05 was considered statistically significant. The continuous variables are presented as mean±standard. Categorical variables are presented as number and percentages. Analysis of variance and the chi-square test were used to compare variables between the subgroups of different grade of Gensini score. Gensini score was divided into first grade (0-12.5), second grade (13-24.5), third grade (25-52.5) and fourth grade (⩾53). Patients with LD or CD anatomies were placed into the Left-CD group, while those with RD anatomy were included in

the RD group. A multiple linear regression analysis was performed to test the association between severity of CAD and variables (age, gender, smoking status, diabetes mellitus, hypertension, hyperlipidaemia, heart rate, family history of CAD, SBP, DBP, and coronary dominance).

Results

Patient characteristics

The study included 1654 patients (1235 males and 419 females, mean age 59.4±10.4) who under CAG. Patients were divided into four group based on Gensini score which were 0-12 (first grade; n=347), 13-24 (second grade; n=329), 25-52 (third grade; n=486) and ≥53 (fourth grade; n=492). Age, gender, SBP, DBP, heart rate, diabetes mellitus, hypertension, smoking, hyperlipidaemia, coronary vessel disease, history of CAD and coronary dominance were compared in the four group. Baseline characteristics was shown in Table 1 according to Gensini score.

Association between Gensini score and coronary dominance

The total Gensini score was significantly higher in RD group than Left-CD group (42.3±33.6 vs. 36.3±29.8; p=0.033). Besides, patients in the RD group have a higher Gensini score than patients in the Left-CD groups in RCA (p<0.001) and posterior descending artery (p=0.013) (Table 2). In addition, RD tended to have higher proportion in third and fourth grade of Gensini score (Figure 1).

Univariate linear regression analysis showed that right dominance, age, gender, diabetes and heart rate were associated with increasing Gensini score (Table 3). After adjusted for age, gender, diabetes and heart rate, right dominance (β 6.699, 95% confidence interval [CI] 1.193-12.205, p=0.017) was positively associated with Gensini score of patients. Final multiple linear regression model also showed a positive correlation between right dominance and Gensini score (Table 4).

Discussion

Coronary dominance is usually classified as right dominance, left dominance and co-dominance according to the blood supply of the posterior interventricular septum using CAG or computed tomography coronary angiography[10]. Previous studies have showed that coronary artery dominance was closely related to cardiovascular outcomes[4]. A study of 1131 patient showed that LD was associated with an increased risk of 30-day mortality and early reinfarction after ST-elevated myocardial infarction[23]. Goldberg et al. demonstrated that LD was a risk factor for increased long-term mortality in patients with acute coronary syndrome[7]. However, little is known about the role of right dominance in the CAD. In this study, we found that patient with right dominance was associated with the severity of CAD. The results indicated that RD was more prone to have serious CAD stenosis and may serve as a marker of CAD severity.

In the general population, RD anatomy has a prevalence of approximately 70%[10].

Besides, LD and RD have a reported prevalence of approximately 5-12% and 82-89% respectively, whereas CD is found in 3-7% of individuals based on hospital population[5-7, 24, 25]. The proportion of RD, LD and CD in our study was 90.6%, 6.7% and 2.7% respectively. The phenomenon reminds us that RD group may had higher percentage in hospital population than general population.

Gensini score is a quick and easy way to quantify the severity of CAD in the clinical work. Therefore, we used this scoring system to further investigate the association between coronary dominance and CAD. In our study, the total Gensini score of RD patient was obviously higher than patient with Left-CD. After multiple lineal regression, RD showed a positive correlation with Gensini score. A previous study with a large population found that RD patient had a higher prevalence of triple vessel disease than patient with LD[25]. The result indicated that patient with RD tended to have more serious coronary stenosis. At present, the mechanisms between right dominance and severity of CAD was still not known. Therefore, further research is needed to identify factors contributing to the inferior prognosis of patients with a left dominant coronary artery system.

Some potential limitations in this study should be noted. First, our finding was based on a Northern Chinese population. Therefore, the results should not be extended to all ethnic groups. Second, our data was obtained from hospital database, so the outcomes of patients were unavailable. Finally, the study population was relatively small, which

led to a smaller group of individuals with left dominance and co-dominance.

Conclusion

The present study reported that RD patient had a significantly higher proportion of serious coronary stenosis than patient with LD and CD. Right coronary dominance was associated with the severity of CAD. A prospective, multi-centre cohort study may further validate our findings.

Contributors

All authors contributed to the study design, writing and review of the report. B.Y., J.Y., Q.M. and L.Y. collected the data. B.Z and Y.F did the primary data analysis and J.Y., B.Y. and X.M participated in further data analysis. X.M. handled supervision in our study. All authors approved the final version of the report. We also thank Qiaolong Hu, Jinni Li, Jian Kang, Chuance Yang, Li Bai, Yufeng Wang, and Wan Gao from Xi'an Jiaotong University School of Medicine for contributing to the data collection.

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Competing Interests

The Authors declare that there is no conflict of interest.

Data sharing statement

No additional data are available.

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Figure Legends

Figure 1 Distribution of RD and Left-CD group in different grade of Gensini score.

Table 1 Baseline characteristics of patients

Clinical variables	Total (n=1654)	First (n=347)	Second (n=329)	Third (n=486)	Fourth (n=492)
Age (years)	59.4±10.4	58.5±9.9	59.1±10.6	59.3±10.6	60.2±10.4
Gender					
Male	1235 (74.7)	225 (64.8)	239 (72.6)	368 (75.7)	403 (81.9)
Female	419 (25.3)	122 (35.2)	90 (27.4)	118 (24.3)	89 (18.1)
Baseline SBP (mmHg)	134.6±21.0	135.8±19.9	135.8±20.4	134.4±20.6	133.1±22.6
Baseline DBP (mmHg)	78.3±12.3	79.1±12.9	78.5±12.0	77.7±11.3	78.3±12.8
Heart rate (bpm)	75.5±13.2	74.3±12.1	75.3±14.0	75.4±12.6	76.6±14.1
CAD risk factors					
Diabetes Mellitus	321 (19.4)	33 (9.5)	65 (19.8)	102 (21.0)	121 (24.6)
Hypertension	870 (52.6)	174 (50.1)	175 (53.2)	263 (54.1)	258 (52.4)
Current smoking	841 (50.8)	156 (45.0)	170 (51.7)	262 (53.9)	253 (51.4)
Hyperlipidemia	182 (11.0)	42 (12.1)	37 (11.2)	51 (10.5)	52 (10.6)
Dignosis					
AMI	730 (44.1)	44 (12.7)	97 (29.5)	251 (51.6)	338 (68.7)
Unstable angina	311 (18.8)	67 (19.3)	83 (25.2)	81 (16.7)	80 (16.3)
CAD on CAG					
One vessel disease (⩾50%)	465 (28.1)	239 (68.9)	124 (37.7)	76 (15.6)	26 (5.3)
Multivessel disease (⩾50%)	1189 (71.9)	108 (31.1)	205 (62.3)	410 (84.4)	466 (94.7)
History					
Prior MI	134 (8.1)	9 (2.6)	16 (4.9)	49 (10.1)	60 (12.2)
Family history of CAD	475 (28.7)	107 (30.8)	98 (29.8)	126 (25.9)	144 (29.3)
Coronary dominance					
Right-	1500 (90.6)	304 (87.6)	297 (90.3)	445 (91.5)	454 (92.3)

Left-	110 (6.7)	30 (8.7)	22 (6.7)	30 (6.2)	28 (5.7)
Co-	44 (2.7)	13 (3.7)	10 (3.0)	11 (2.3)	10 (2.0)

Results are presented as mean ± standard deviation or n (%). P for difference between the 4 groups. AMI, acute myocardial infarction; CAD, coronary artery disease; CAG, coronary artery angiography; DBP, diastolic blood pressure; MI, myocardial infarction; SBP, systolic blood pressure.

Table 2 Gensini score and coronary dominance

Gensini score	RD (n=1500)	Left+CD (n=154)	P
Total score	42.3±33.6	36.3±29.8	0.033
LM	1.7±7.3	1.7±7.7	0.935
LAD	21.1±21.1	19.7±20.0	0.433
RCA	7.8±10.8	4.7±8.5	<0.001
LCX	9.1±14.5	8.2±12.4	0.424
Diagonal branch	1.3±2.7	1.1±2.4	0.402
Septal branch	0.1±0.5	0.1±0.8	0.491
OM	0.7±2.2	0.6±2.0	0.848
Posterior descending artery	0.6±2.1	0.2±1.5	0.013

LAD, left anterior descending branch; LCx, left circumflex branch; LM, left main coronary artery; OM, obtuse marginal branch; RCA, right coronary artery.

Table 3 Univariate linear regression analysis for Gensini score

Variable	β (95% CI)	P
Right Dominance	5.991 (0.474 to 11.508)	0.033
Age	0.187 (0.033 to 0.342)	0.017
Male	9.811 (6.150 to 13.472)	<0.001
Smoking	1.098 (-2.113 to 4.309)	0.503
Hypertension	1.033 (-2.182 to 4.247)	0.529
Diabetes Mellitus	8.408 (4.369 to 12.447)	<0.001
Hyperlipidemia	-2.038 (-7.167 to 3.091)	0.436
Family history of CAD	-0.652 (-4.200 to 2.896)	0.719
SBP	-0.065 (-0.142 to 0.013)	0.100
DBP	-0.008 (-0.141 to 0.125)	0.911
Heart rate	0.148 (0.025 to 0.271)	0.018

CAD, coronary artery disease; DBP, diastolic blood pressure; SBP, systolic blood pressure.

Table 4 Multivariate linear regression analysis for Gensini score

Variable	β (95% CI)	P value
Unadjusted	5.991 (0.474 to 11.508)	0.033
Model 1	6.404 (0.945 to 11.862)	0.022
Model 2	6.699 (1.193 to 12.205)	0.017
Model 3	6.829 (1.312 to 12.346)	0.015

Model 1 adjusted age and gender

Model 2 adjusted age and gender, diabetes, heart rate

Model 3 adjusted age and gender, diabetes, heart rate, smoking, hypertension, hyperlipidemia, history of CAD, SBP, DBP

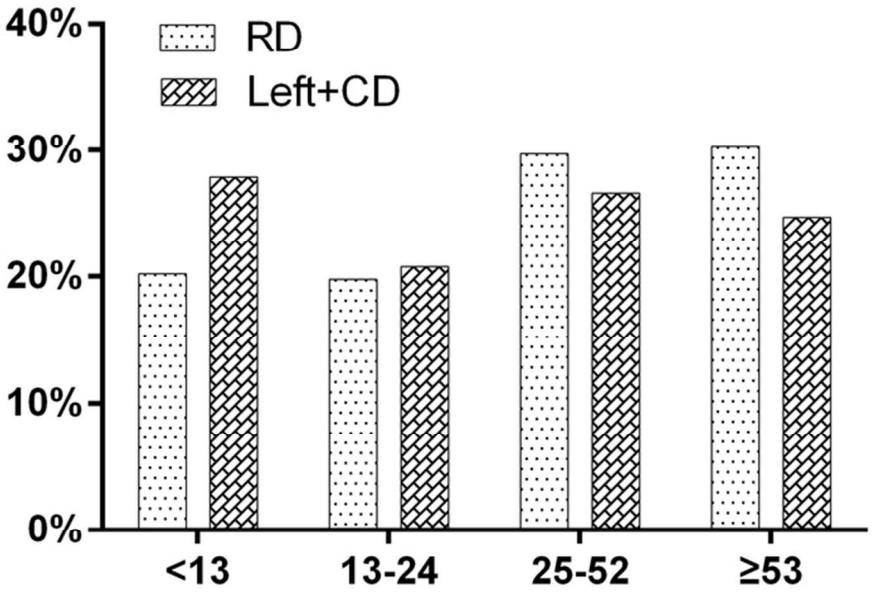

Figure 1 Distribution of RD and Left-CD group in different grade of Gensini score.

67x45mm (300 x 300 DPI)

STROBE 2007 (v4) Statement—Checklist of items that should be included in reports of *cross-sectional studies*

Section/Topic	Item #	Recommendation	Reported on page #
Title and abstract	1	(*a*) Indicate the study's design with a commonly used term in the title or the abstract	1
		(*b*) Provide in the abstract an informative and balanced summary of what was done and what was found	2
Introduction			
Background/rationale	2	Explain the scientific background and rationale for the investigation being reported	4
Objectives	3	State specific objectives, including any prespecified hypotheses	4
Methods			
Study design	4	Present key elements of study design early in the paper	5
Setting	5	Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection	5
Participants	6	(*a*) Give the eligibility criteria, and the sources and methods of selection of participants	5
Variables	7	Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable	5-6
Data sources/ measurement	8*	For each variable of interest, give sources of data and details of methods of assessment (measurement). Describe comparability of assessment methods if there is more than one group	5-6
Bias	9	Describe any efforts to address potential sources of bias	6-7
Study size	10	Explain how the study size was arrived at	5
Quantitative variables	11	Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen and why	6-7
Statistical methods	12	(*a*) Describe all statistical methods, including those used to control for confounding	6-7
		(*b*) Describe any methods used to examine subgroups and interactions	N/A
		(*c*) Explain how missing data were addressed	N/A
		(*d*) If applicable, describe analytical methods taking account of sampling strategy	N/A
		(*e*) Describe any sensitivity analyses	N/A
Results			

Participants	13*	(a) Report numbers of individuals at each stage of study—eg numbers potentially eligible, examined for eligibility, confirmed eligible, included in the study, completing follow-up, and analysed	7
		(b) Give reasons for non-participation at each stage	N/A
		(c) Consider use of a flow diagram	N/A
Descriptive data	14*	(a) Give characteristics of study participants (eg demographic, clinical, social) and information on exposures and potential confounders	7
		(b) Indicate number of participants with missing data for each variable of interest	N/A
Outcome data	15*	Report numbers of outcome events or summary measures	7
Main results	16	(*a*) Give unadjusted estimates and, if applicable, confounder-adjusted estimates and their precision (eg, 95% confidence interval). Make clear which confounders were adjusted for and why they were included	7-8
		(*b*) Report category boundaries when continuous variables were categorized	7-8
		(*c*) If relevant, consider translating estimates of relative risk into absolute risk for a meaningful time period	N/A
Other analyses	17	Report other analyses done—eg analyses of subgroups and interactions, and sensitivity analyses	N/A
Discussion			
Key results	18	Summarise key results with reference to study objectives	8
Limitations	19	Discuss limitations of the study, taking into account sources of potential bias or imprecision. Discuss both direction and magnitude of any potential bias	9
Interpretation	20	Give a cautious overall interpretation of results considering objectives, limitations, multiplicity of analyses, results from similar studies, and other relevant evidence	8-9
Generalisability	21	Discuss the generalisability (external validity) of the study results	10
Other information			
Funding	22	Give the source of funding and the role of the funders for the present study and, if applicable, for the original study on which the present article is based	11

*Give information separately for cases and controls in case-control studies and, if applicable, for exposed and unexposed groups in cohort and cross-sectional studies.

Note: An Explanation and Elaboration article discusses each checklist item and gives methodological background and published examples of transparent reporting. The STROBE checklist is best used in conjunction with this article (freely available on the Web sites of PLoS Medicine at http://www.plosmedicine.org/, Annals of Internal Medicine at http://www.annals.org/, and Epidemiology at http://www.epidem.com/). Information on the STROBE Initiative is available at www.strobe-statement.org.

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Setting: Single centre

Participants: Between July 2015 and February 2017, 1654 patients who underwent coronary angiography (CAG) were recruited in this cross-sectional study.

Measurement and methods: Based on the CAG results, patients were classified as left dominance (LD), right dominance (RD), and co-dominance (CD). Multiple linear regression analysis was performed to test the association between severity of coronary artery disease (CAD) and coronary dominance.

Results: The total Gensini score was significantly higher in RD group than Left-CD group (42.3±33.6 vs. 36.3±29.8; p=0.033). After adjusting for potential confounding factors, results of multivariate linear regression showed that right dominance was associated with the severity of CAD (β 6.699, 95% confidence interval [CI] 1.193-12.205, *p*=0.017).

Conclusions: These results suggest that right coronary dominance was associated with the severity of CAD.

Keywords: coronary dominance, Gensini score, cross-sectional study, coronary angiography

Strengths and limitations of this study

• This is the first study to demonstrate the association between right coronary artery dominance and the severity of coronary artery disease.

• The total Gensini score was significantly higher in right dominance than left-dominance and co-dominance.

• Our study was a cross-sectional study, so the outcomes of patients were unavailable.

Introduction

Coronary artery disease (CAD) is one of the most common type of disease around the world[1]. It is recognised that obesity, blood pressure, smoking, diabetes, exercise, diet, cholesterol, and depression was associated with the incidence of CAD[2]. The severity of coronary artery stenosis was usually evaluated by Gensini score or SYNTAX score in clinical practice[3]. Several studies have shown that coronary artery dominance is associated with cardiovascular prognosis in patients with acute coronary syndrome[4-7]. Variation of coronary dominance includes left dominance (LD), right dominance (RD) and co-dominance (CD) based on the vascular supply of the posterior interventricular septum (IVS)[8, 9]. In the general population, RD is most prevalent of approximately 70% population, while LD occurs in about 10% of cases and co-dominance is present in 20% of cases[10]. LD was found to be associated with increased long-term mortality in patients with CAD[11, 12]. However, little is known about the role of RD in the CAD. Previous study showed that RD, LD and CD have a prevalence of approximately 82-89%, 5-12% and 3-7% respectively in hospital population[4, 13-15]. There seems to have different distribution of coronary dominance between general population and CAD patients. Therefore, we conducted this study to investigate whether patients with right coronary dominance was associated with CAD and its severity.

Methods

Study population

1654 in-hospital patients, who underwent coronary angiography (CAG) during their hospital stay, were recruited from the CAG database of the First Affiliated Hospital of Xi'an Jiaotong University between July 2015 and February 2017. All patients included in this study because they had standard clinical indications for CAG. Exclusion criteria were (1) previous coronary artery bypass graft operation or CAG, (2) those with chronic and systemic disease, and (3) incomplete CAG reports and medical records. All patients signed the informed consent during hospital, and their records were anonymised and de-identified before analysis. The study protocol was approved by the Ethics Committee of the First Affiliated Hospital, Xi'an Jiaotong University.

Patient and Public Involvement

Patients were not involved in the hypothesis, design, conduct and data analysis of this study. And we will not disseminate the results of this study to participants.

Definitions

Hypertension was defined as office blood pressure over 140/90 mmHg or 24-hour ambulatory blood pressure over 135/85 mmHg[16]. Diabetes mellitus was diagnosed as patients with a fasting plasma glucose level ≥7.0 mmol/L (126 mg/dL) or two-hour post-load plasma glucose level ≥11.0 mmol/L (200 mg/dL)[17]. Smoking was defined as ever smoked 100 cigarettes or currently smoking every day or some days[18].

CAG results

All patients underwent CAG using a standard clinical technique through femoral artery or radial artery approach[19]. The CAG report was written and checked by interventional cardiologists. The phenotype of coronary dominance was divided based on the CAG. The posterior descending artery was originated by the right coronary artery in patients with RD. The posterior descending artery diverged from left circumflex artery was defined as LD. Co-dominant anatomy was defined when the PDA originated from the right coronary artery (RCA) and a large posterolateral branch originated from the Left circumflex branch (LCx) reached near the posterior interventricular groove[10, 13]. The severity of CAD was evaluated with the Gensini score. In this scoring system, 0 indicates no abnormality, 1 represents stenosis≤25%, 2 represents stenosis of 26-50%, 4 represents stenosis of 51-75%, 16 represents stenosis of 76-99%, and 32 represents complete occlusion. Then the score is multiplied by different factors according to the functional significance of the coronary artery. The evaluation of each segment was performed as the scores multiplied by 5 for the left main trunk, by 2.5 for the proximal LAD, by 1.5 for the middle LAD, by 1 for the distal LAD, by 1 for the first diagonal branch, by 0.5 for the second diagonal branch, by 2.5 for the proximal LCX, by 1 for the distal LCX and posterior descending branch, and by 0.5 for the posterior branch. While the right coronary artery was performed as the scores multiplied by 1 for the proximal, middle and distal RAD and posterior descending branch, and by 0.5 for the posterior branch. The final score was calculated by adding the scores of each segment.[20-22]. The patients were

then divided into four groups according to the total score (0–12, 13–24, 25-52 and ≥53)[23].

Statistical analysis

All statistical analyses were made by SPSS version 24.0 (SPSS Inc., Xi'an Jiaotong University, China). *P*-value <0.05 was considered statistically significant. The continuous variables are presented as mean ± standard. Categorical variables are presented as number and percentages. Analysis of variance and the chi-square test were used to compare variables between the subgroups of different grade of Gensini score. Gensini score was divided into first grade (0-12.5), second grade (13-24.5), third grade (25-52.5) and fourth grade (≥53). Patients with LD or CD anatomies were placed into the Left-CD group, while those with RD anatomy were included in the RD group. A multiple linear regression analysis was performed to test the association between severity of CAD and variables (age, gender, smoking status, diabetes mellitus, hypertension, hyperlipidaemia, heart rate, family history of CAD, SBP, DBP, and coronary dominance).

Results

Patient characteristics

The study included 1654 patients (1235 males and 419 females, mean age 59.4±10.4) who underwent CAG. Patients were divided into four groups based on Gensini score which were 0-12 (first grade; n=347), 13-24 (second grade; n=329), 25-52 (third

grade; n=486) and ≥53 (fourth grade; n=492). Gender, SBP, DBP, heart rate, diabetes mellitus, hypertension, smoking, hyperlipidaemia, coronary vessel disease, history of CAD and coronary dominance were compared in the four group. Baseline characteristics was shown in Table 1 according to Gensini score.

Association between Gensini score and coronary dominance

The total Gensini score was significantly higher in RD group than Left-CD group (42.3±33.6 vs. 36.3±29.8; p=0.033). Besides, patients in the RD group have a higher Gensini score than patients in the Left-CD groups in RCA (p<0.001) and posterior descending artery (p=0.013) (Table 2). In addition, RD tended to have higher proportion in third and fourth grade of Gensini score (Figure 1).

Univariate linear regression analysis showed that right dominance, age, gender, diabetes and heart rate were associated with increasing Gensini score (Table 3). After adjusted for age, gender, diabetes and heart rate, right dominance (β 6.699, 95% confidence interval [CI] 1.193-12.205, *p*=0.017) was positively associated with Gensini score of patients (Table 4). Final multiple linear regression model also showed a positive correlation between right dominance and Gensini score.

Discussion

According to the blood supply of the posterior interventricular septum using CAG or computed tomography coronary angiography, coronary circulation is categorised as

right dominance, left dominance, and co-dominance[4]. Previous studies have showed that coronary artery dominance was closely related to cardiovascular outcomes[4]. A study of 1131 patient showed that LD was associated with an increased risk of 30-day mortality and early reinfarction after ST-elevated myocardial infarction[24]. Goldberg et al. demonstrated that LD was a risk factor for increased long-term mortality in patients with acute coronary syndrome[7]. However, little is known about the role of right dominance in the CAD. In this study, we found that patient with right dominance was associated with the severity of CAD. The results indicated that RD was more prone to have serious CAD stenosis and may serve as a marker of CAD severity.

In the general population, RD anatomy has a prevalence of approximately 70%[10]. Besides, LD and RD have a reported prevalence of approximately 5-12% and 82-89% respectively, whereas CD is found in 3-7% of individuals based on hospital population[5-7, 25, 26]. The proportion of RD, LD and CD in our study was 90.6%, 6.7% and 2.7% respectively. The phenomenon reminds us that RD group may had higher percentage in hospital population than general population.

Gensini score is a quick and easy way to quantify the severity of CAD in the clinical work. Therefore, we used this scoring system to further investigate the association between coronary dominance and CAD. In our study, the total Gensini score of RD patient was obviously higher than patient with Left-CD. After multiple lineal regression, RD showed a positive correlation with Gensini score. A previous study

with a large population found that RD patient had a higher prevalence of triple vessel disease than patient with LD[26]. The result indicated that patient with RD tended to have more serious coronary stenosis. At present, the mechanism between right dominance and severity of CAD was still not known. Therefore, further researches are needed to detect the underlying mechanism for developing more severe lesions in the right dominance.

Some potential limitations in this study should be noted. First, our finding was based on a Northern Chinese population. Therefore, the results should not be extended to all ethnic groups. Second, our data was obtained from hospital database, so the outcomes of patients were unavailable. Finally, the study population was relatively small, which led to a smaller group of individuals with left dominance and co-dominance.

Conclusion

The present study reported that RD patient had a significantly higher proportion of serious coronary stenosis than patient with LD and CD. Right coronary dominance was associated with the severity of CAD. A prospective, multi-centre cohort study may further validate our findings.

Contributors

All authors contributed to the study design, writing and review of the report. B.Y., J.Y., Q.M. and L.Y. collected the data. B.Z and Y.F did the primary data analysis and J.Y., B.Y. and X.M participated in further data analysis. X.M. handled supervision in our study. All authors approved the final version of the report. We also thank Qiaolong Hu, Jinni Li, Jian Kang, Chuance Yang, Li Bai, Yufeng Wang, and Wan Gao from Xi'an Jiaotong University School of Medicine for contributing to the data collection. We also acknowledge the support from the patients who participated in our research.

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Competing Interests

The Authors declare that there is no conflict of interest.

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Figure Legends

Figure 1 Distribution of RD and Left-CD group in different grade of Gensini score.

Table 1 Baseline characteristics of patients

Clinical variables	Total (n=1654)	First (n=347)	Second (n=329)	Third (n=486)	Fourth (n=492)
Age (years)	59.4±10.4	58.5±9.9	59.1±10.6	59.3±10.6	60.2±10.4
Gender, n (%)					
Male	1235 (74.7)	225 (64.8)	239 (72.6)	368 (75.7)	403 (81.9)
Female	419 (25.3)	122 (35.2)	90 (27.4)	118 (24.3)	89 (18.1)
Baseline SBP (mmHg)	134.6±21.0	135.8±19.9	135.8±20.4	134.4±20.6	133.1±22.6
Baseline DBP (mmHg)	78.3±12.3	79.1±12.9	78.5±12.0	77.7±11.3	78.3±12.8
Heart rate (bpm)	75.5±13.2	74.3±12.1	75.3±14.0	75.4±12.6	76.6±14.1
CAD risk factors, n (%)					
Diabetes Mellitus	321 (19.4)	33 (9.5)	65 (19.8)	102 (21.0)	121 (24.6)
Hypertension	870 (52.6)	174 (50.1)	175 (53.2)	263 (54.1)	258 (52.4)
Current smoking	841 (50.8)	156 (45.0)	170 (51.7)	262 (53.9)	253 (51.4)
Hyperlipidemia	182 (11.0)	42 (12.1)	37 (11.2)	51 (10.5)	52 (10.6)
Dignosis, n (%)					
AMI	730 (44.1)	44 (12.7)	97 (29.5)	251 (51.6)	338 (68.7)
Unstable angina	311 (18.8)	67 (19.3)	83 (25.2)	81 (16.7)	80 (16.3)
CAD on CAG, n (%)					
One vessel disease (⩾50%)	465 (28.1)	239 (68.9)	124 (37.7)	76 (15.6)	26 (5.3)
Multivessel disease (⩾50%)	1189 (71.9)	108 (31.1)	205 (62.3)	410 (84.4)	466 (94.7)
History, n (%)					
Prior MI	134 (8.1)	9 (2.6)	16 (4.9)	49 (10.1)	60 (12.2)
Family history of CAD	475 (28.7)	107 (30.8)	98 (29.8)	126 (25.9)	144 (29.3)
Coronary dominance, n (%)					

Right-	1500 (90.6)	304 (87.6)	297 (90.3)	445 (91.5)	454 (92.3)
Left-	110 (6.7)	30 (8.7)	22 (6.7)	30 (6.2)	28 (5.7)
Co-	44 (2.7)	13 (3.7)	10 (3.0)	11 (2.3)	10 (2.0)

Four groups were based on Gensini score: first grade (0-12.5), second grade (13-24.5), third grade (25-52.5) and fourth grade (⩾53). Results are presented as mean ± standard deviation or n (%). AMI, acute myocardial infarction; CAD, coronary artery disease; CAG, coronary artery angiography; DBP, diastolic blood pressure; MI, myocardial infarction; SBP, systolic blood pressure.

Table 2 Gensini score and coronary dominance

	RD (n=1500)	Left+CD (n=154)	P
Age (years)	59.4±10.4	59.2±9.5	0.769
Gender, n (%)			0.242
Male	1114 (74.3)	121 (78.6)	
Female	386 (25.7)	33 (21.4)	
Baseline SBP (mmHg)	134.8±21.2	132.6±19.5	0.231
Baseline DBP (mmHg)	78.4±12.4	78.1±11.0	0.819
Heart rate (bpm)	75.4±13.1	76.5±14.8	0.341
CAD risk factors, n (%)			
Diabetes Mellitus	295 (19.7)	26 (16.9)	0.406
Hypertension	797 (53.1)	73 (47.4)	0.175
Current smoking	758 (50.5)	83 (53.9)	0.427
Hyperlipidemia	164 (10.9)	18 (11.7)	0.776
Total Gensini score	42.3±33.6	36.3±29.8	0.033
LM	1.7±7.3	1.7±7.7	0.935
LAD	21.1±21.1	19.7±20.0	0.433
RCA	7.8±10.8	4.7±8.5	<0.001
LCX	9.1±14.5	8.2±12.4	0.424
Diagonal branch	1.3±2.7	1.1±2.4	0.402
Septal branch	0.1±0.5	0.1±0.8	0.491
OM	0.7±2.2	0.6±2.0	0.848
Posterior descending artery	0.6±2.1	0.2±1.5	0.013

LAD, left anterior descending branch; LCx, left circumflex branch; LM, left main coronary artery; OM, obtuse marginal branch; RCA, right coronary artery.

Table 3 Univariate linear regression analysis for Gensini score

Variable	β (95% CI)	P
Right Dominance	5.991 (0.474 to 11.508)	0.033
Age	0.187 (0.033 to 0.342)	0.017
Male	9.811 (6.150 to 13.472)	<0.001
Smoking	1.098 (-2.113 to 4.309)	0.503
Hypertension	1.033 (-2.182 to 4.247)	0.529
Diabetes Mellitus	8.408 (4.369 to 12.447)	<0.001
Hyperlipidemia	-2.038 (-7.167 to 3.091)	0.436
Family history of CAD	-0.652 (-4.200 to 2.896)	0.719
SBP	-0.065 (-0.142 to 0.013)	0.100
DBP	-0.008 (-0.141 to 0.125)	0.911
Heart rate	0.148 (0.025 to 0.271)	0.018

CAD, coronary artery disease; DBP, diastolic blood pressure; SBP, systolic blood pressure.

Table 4 Multivariate linear regression analysis for Gensini score

Variable	β (95% CI)	P value
Unadjusted	5.991 (0.474 to 11.508)	0.033
Model 1	6.404 (0.945 to 11.862)	0.022
Model 2	6.699 (1.193 to 12.205)	0.017
Model 3	6.829 (1.312 to 12.346)	0.015

Model 1 adjusted age and gender

Model 2 adjusted age and gender, diabetes, heart rate

Model 3 adjusted age and gender, diabetes, heart rate, smoking, hypertension, hyperlipidemia, history of CAD, SBP, DBP

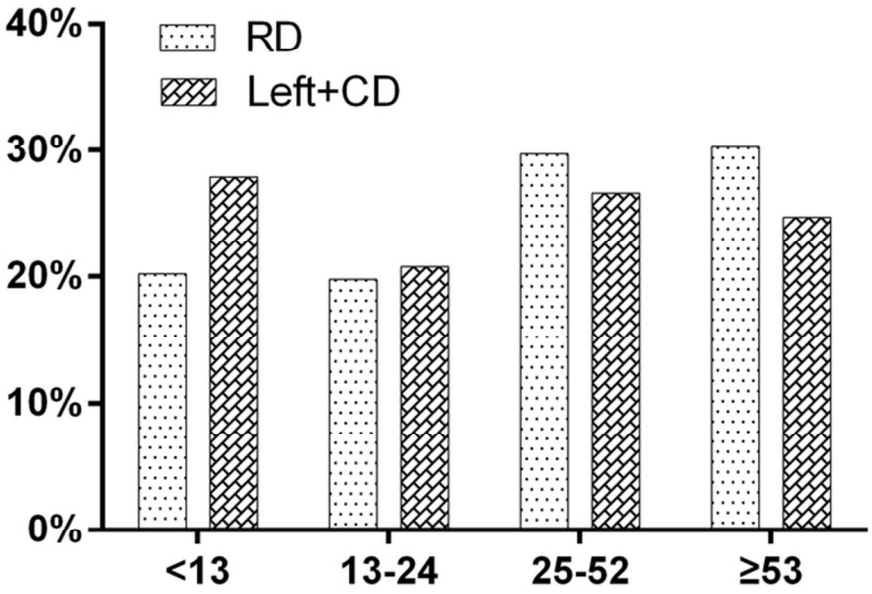

Figure 1 Distribution of RD and Left-CD group in different grade of Gensini score.

67x45mm (300 x 300 DPI)

STROBE 2007 (v4) Statement—Checklist of items that should be included in reports of *cross-sectional studies*

Section/Topic	Item #	Recommendation	Reported on page #
Title and abstract	1	(*a*) Indicate the study's design with a commonly used term in the title or the abstract	1
		(*b*) Provide in the abstract an informative and balanced summary of what was done and what was found	2
Introduction			
Background/rationale	2	Explain the scientific background and rationale for the investigation being reported	4
Objectives	3	State specific objectives, including any prespecified hypotheses	4
Methods			
Study design	4	Present key elements of study design early in the paper	5
Setting	5	Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection	5
Participants	6	(*a*) Give the eligibility criteria, and the sources and methods of selection of participants	5
Variables	7	Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable	5-6
Data sources/ measurement	8*	For each variable of interest, give sources of data and details of methods of assessment (measurement). Describe comparability of assessment methods if there is more than one group	5-6
Bias	9	Describe any efforts to address potential sources of bias	6-7
Study size	10	Explain how the study size was arrived at	5
Quantitative variables	11	Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen and why	6-7
Statistical methods	12	(*a*) Describe all statistical methods, including those used to control for confounding	6-7
		(*b*) Describe any methods used to examine subgroups and interactions	N/A
		(*c*) Explain how missing data were addressed	N/A
		(*d*) If applicable, describe analytical methods taking account of sampling strategy	N/A
		(*e*) Describe any sensitivity analyses	N/A
Results			

Participants	13*	(a) Report numbers of individuals at each stage of study—eg numbers potentially eligible, examined for eligibility, confirmed eligible, included in the study, completing follow-up, and analysed	7
		(b) Give reasons for non-participation at each stage	N/A
		(c) Consider use of a flow diagram	N/A
Descriptive data	14*	(a) Give characteristics of study participants (eg demographic, clinical, social) and information on exposures and potential confounders	7
		(b) Indicate number of participants with missing data for each variable of interest	N/A
Outcome data	15*	Report numbers of outcome events or summary measures	7
Main results	16	(*a*) Give unadjusted estimates and, if applicable, confounder-adjusted estimates and their precision (eg, 95% confidence interval). Make clear which confounders were adjusted for and why they were included	7-8
		(*b*) Report category boundaries when continuous variables were categorized	7-8
		(*c*) If relevant, consider translating estimates of relative risk into absolute risk for a meaningful time period	N/A
Other analyses	17	Report other analyses done—eg analyses of subgroups and interactions, and sensitivity analyses	N/A
Discussion			
Key results	18	Summarise key results with reference to study objectives	8
Limitations	19	Discuss limitations of the study, taking into account sources of potential bias or imprecision. Discuss both direction and magnitude of any potential bias	9
Interpretation	20	Give a cautious overall interpretation of results considering objectives, limitations, multiplicity of analyses, results from similar studies, and other relevant evidence	8-9
Generalisability	21	Discuss the generalisability (external validity) of the study results	10
Other information			
Funding	22	Give the source of funding and the role of the funders for the present study and, if applicable, for the original study on which the present article is based	11

*Give information separately for cases and controls in case-control studies and, if applicable, for exposed and unexposed groups in cohort and cross-sectional studies.

Note: An Explanation and Elaboration article discusses each checklist item and gives methodological background and published examples of transparent reporting. The STROBE checklist is best used in conjunction with this article (freely available on the Web sites of PLoS Medicine at http://www.plosmedicine.org/, Annals of Internal Medicine at http://www.annals.org/, and Epidemiology at http://www.epidem.com/). Information on the STROBE Initiative is available at www.strobe-statement.org.

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Association of coronary dominance with the severity of coronary artery disease: a cross-sectional study in Shaanxi Province, China

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Abstract

Objectives: To investigate whether coronary artery dominance is associated with the severity of coronary artery disease (CAD).

Design: cross-sectional study

Setting: Single centre

Participants: Between July 2015 and February 2017, 1654 patients who underwent coronary angiography (CAG) were recruited in this cross-sectional study.

Measurement and methods: Based on the CAG results, patients were classified as left dominance (LD), right dominance (RD), and co-dominance (CD). Multiple linear regression analysis was performed to test the association between severity of coronary artery disease (CAD) and coronary dominance.

Results: The total Gensini score was significantly higher in RD group than Left-CD group (42.3±33.6 vs. 36.3±29.8; p=0.033). After adjusting for potential confounding factors, results of multivariate linear regression showed that right dominance was associated with the severity of CAD (β 6.699, 95% confidence interval [CI] 1.193-12.205, *p*=0.017).

Conclusions: These results suggest that right coronary dominance was associated with the severity of CAD.

Keywords: coronary dominance, Gensini score, cross-sectional study, coronary angiography

Strengths and limitations of this study

- This is the first study to investigate the association of right coronary dominance with the severity of coronary artery disease.
- This cross-sectional study included 1654 patients who underwent coronary angiography during their hospital stay in Northern China.
- The patients were recruited from a single centre, therefore the study population of RD group and CD group was relatively small.

Introduction

Coronary artery disease (CAD) is one of the most common type of disease around the world[1]. It is recognised that obesity, blood pressure, smoking, diabetes, exercise, diet, cholesterol, and depression was associated with the incidence of CAD[2]. The severity of coronary artery stenosis was usually evaluated by Gensini score or SYNTAX score in clinical practice[3]. Several studies have shown that coronary artery dominance is associated with cardiovascular prognosis in patients with acute coronary syndrome[4-7]. Variation of coronary dominance includes left dominance (LD), right dominance (RD) and co-dominance (CD) based on the vascular supply of the posterior interventricular septum (IVS)[8, 9]. In the general population, RD is most prevalent of approximately 70% population, while LD occurs in about 10% of cases and co-dominance is present in 20% of cases[10]. LD was found to be associated with increased long-term mortality in patients with CAD[11, 12]. However, little is known about the role of RD in the CAD. Previous study showed that RD, LD and CD have a prevalence of approximately 82-89%, 5-12% and 3-7% respectively in hospital population[4, 13-15]. There seems to have different distribution of coronary dominance between general population and CAD patients. Therefore, we conducted this study to investigate whether patients with right coronary dominance was associated with CAD and its severity.

Methods

Study population

1654 in-hospital patients, who underwent coronary angiography (CAG) during their hospital stay, were recruited from the CAG database of the First Affiliated Hospital of Xi'an Jiaotong University between July 2015 and February 2017. All patients included in this study because they had standard clinical indications for CAG. Exclusion criteria were (1) previous coronary artery bypass graft operation or CAG, (2) those with chronic and systemic disease, and (3) incomplete CAG reports and medical records. All patients signed the informed consent during hospital, and their records were anonymised and de-identified before analysis. The study protocol was approved by the Ethics Committee of the First Affiliated Hospital, Xi'an Jiaotong University.

Patient and Public Involvement

Patients were not involved in the hypothesis, design, conduct and data analysis of this study. And we will not disseminate the results of this study to participants.

Definitions

Hypertension was defined as office blood pressure over 140/90 mmHg or 24-hour ambulatory blood pressure over 135/85 mmHg[16]. Diabetes mellitus was diagnosed as patients with a fasting plasma glucose level ≥7.0 mmol/L (126 mg/dL) or two-hour post-load plasma glucose level ≥11.0 mmol/L (200 mg/dL)[17]. Smoking was defined as ever smoked 100 cigarettes or currently smoking every day or some days[18].

CAG results

All patients underwent CAG using a standard clinical technique through femoral artery or radial artery approach[19]. The CAG report was written and checked by interventional cardiologists. The phenotype of coronary dominance was divided based on the CAG. The posterior descending artery was originated by the right coronary artery in patients with RD. The posterior descending artery diverged from left circumflex artery was defined as LD. Co-dominant anatomy was defined when the PDA originated from the right coronary artery (RCA) and a large posterolateral branch originated from the Left circumflex branch (LCx) reached near the posterior interventricular groove[10, 13]. The severity of CAD was evaluated with the Gensini score. In this scoring system, 0 indicates no abnormality, 1 represents stenosis≤25%, 2 represents stenosis of 26-50%, 4 represents stenosis of 51-75%, 16 represents stenosis of 76-99%, and 32 represents complete occlusion. Then the score is multiplied by different factors according to the functional significance of the coronary artery. The evaluation of each segment was performed as the scores multiplied by 5 for the left main trunk, by 2.5 for the proximal LAD, by 1.5 for the middle LAD, by 1 for the distal LAD, by 1 for the first diagonal branch, by 0.5 for the second diagonal branch, by 2.5 for the proximal LCX, by 1 for the distal LCX and posterior descending branch, and by 0.5 for the posterior branch. While the right coronary artery was performed as the scores multiplied by 1 for the proximal, middle and distal RAD and posterior descending branch, and by 0.5 for the posterior branch. The final score was calculated by adding the scores of each segment.[20-22]. The patients were

then divided into four groups according to the total score (0–12, 13–24, 25-52 and ≥53)[23].

Statistical analysis

All statistical analyses were made by SPSS version 24.0 (SPSS Inc., Xi'an Jiaotong University, China). *P*-value <0.05 was considered statistically significant. The continuous variables are presented as mean ± standard. Categorical variables are presented as number and percentages. Analysis of variance and the chi-square test were used to compare variables between the subgroups of different grade of Gensini score. Gensini score was divided into first grade (0-12.5), second grade (13-24.5), third grade (25-52.5) and fourth grade (≥53). Patients with LD or CD anatomies were placed into the Left-CD group, while those with RD anatomy were included in the RD group. A multiple linear regression analysis was performed to test the association between severity of CAD and variables (age, gender, smoking status, diabetes mellitus, hypertension, hyperlipidaemia, heart rate, family history of CAD, SBP, DBP, and coronary dominance).

Results

Patient characteristics

The study included 1654 patients (1235 males and 419 females, mean age 59.4±10.4) who underwent CAG. Patients were divided into four groups based on Gensini score which were 0-12 (first grade; n=347), 13-24 (second grade; n=329), 25-52 (third

grade; n=486) and ≥53 (fourth grade; n=492). Gender, SBP, DBP, heart rate, diabetes mellitus, hypertension, smoking, hyperlipidaemia, coronary vessel disease, history of CAD and coronary dominance were compared in the four group. Baseline characteristics was shown in Table 1 according to Gensini score.

Association between Gensini score and coronary dominance

The total Gensini score was significantly higher in RD group than Left-CD group (42.3±33.6 vs. 36.3±29.8; p=0.033). Besides, patients in the RD group have a higher Gensini score than patients in the Left-CD groups in RCA (p<0.001) and posterior descending artery (p=0.013) (Table 2). In addition, RD tended to have higher proportion in third and fourth grade of Gensini score (Figure 1).

Univariate linear regression analysis showed that right dominance, age, gender, diabetes and heart rate were associated with increasing Gensini score (Table 3). After adjusted for age, gender, diabetes and heart rate, right dominance (β 6.699, 95% confidence interval [CI] 1.193-12.205, *p*=0.017) was positively associated with Gensini score of patients (Table 4). Final multiple linear regression model also showed a positive correlation between right dominance and Gensini score.

Discussion

According to the blood supply of the posterior interventricular septum using CAG or computed tomography coronary angiography, coronary circulation is categorised as

right dominance, left dominance, and co-dominance[4]. Previous studies have showed that coronary artery dominance was closely related to cardiovascular outcomes[4]. A study of 1131 patient showed that LD was associated with an increased risk of 30-day mortality and early reinfarction after ST-elevated myocardial infarction[24]. Goldberg et al. demonstrated that LD was a risk factor for increased long-term mortality in patients with acute coronary syndrome[7]. However, little is known about the role of right dominance in the CAD. In this study, we found that patient with right dominance was associated with the severity of CAD. The results indicated that RD was more prone to have serious CAD stenosis and may serve as a marker of CAD severity.

In the general population, RD anatomy has a prevalence of approximately 70%[10]. Besides, LD and RD have a reported prevalence of approximately 5-12% and 82-89% respectively, whereas CD is found in 3-7% of individuals based on hospital population[5-7, 25, 26]. The proportion of RD, LD and CD in our study was 90.6%, 6.7% and 2.7% respectively. The phenomenon reminds us that RD group may had higher percentage in hospital population than general population.

Gensini score is a quick and easy way to quantify the severity of CAD in the clinical work. Therefore, we used this scoring system to further investigate the association between coronary dominance and CAD. In our study, the total Gensini score of RD patient was obviously higher than patient with Left-CD. After multiple lineal regression, RD showed a positive correlation with Gensini score. A previous study

with a large population found that RD patient had a higher prevalence of triple vessel disease than patient with LD[26]. The result indicated that patient with RD tended to have more serious coronary stenosis. At present, the mechanism between right dominance and severity of CAD was still not known. Therefore, further researches are needed to detect the underlying mechanism for developing more severe lesions in the right dominance.

Some potential limitations in this study should be noted. First, our finding was based on a Northern Chinese population. Therefore, the results should not be extended to all ethnic groups. Second, our data was obtained from hospital database, so the outcomes of patients were unavailable. Finally, the study population was relatively small, which led to a smaller group of individuals with left dominance and co-dominance.

Conclusion

The present study reported that RD patient had a significantly higher proportion of serious coronary stenosis than patient with LD and CD. Right coronary dominance was associated with the severity of CAD. A prospective, multi-centre cohort study may further validate our findings.

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Contributors

All authors contributed to the study design, writing and review of the report. B.Y., J.Y., Q.M. and L.Y. collected the data. B.Z and Y.F did the primary data analysis and J.Y., B.Y. and X.M participated in further data analysis. X.M. handled supervision in our study. All authors approved the final version of the report.

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Competing Interests

None declared.

Data sharing statement

No additional data are available.

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Figure Legends

Figure 1 Distribution of RD and Left-CD group in different grade of Gensini score.

Table 1 Baseline characteristics of patients

Clinical variables	Total (n=1654)	First (n=347)	Second (n=329)	Third (n=486)	Fourth (n=492)
Age (years)	59.4±10.4	58.5±9.9	59.1±10.6	59.3±10.6	60.2±10.4
Gender, n (%)					
Male	1235 (74.7)	225 (64.8)	239 (72.6)	368 (75.7)	403 (81.9)
Female	419 (25.3)	122 (35.2)	90 (27.4)	118 (24.3)	89 (18.1)
Baseline SBP (mmHg)	134.6±21.0	135.8±19.9	135.8±20.4	134.4±20.6	133.1±22.6
Baseline DBP (mmHg)	78.3±12.3	79.1±12.9	78.5±12.0	77.7±11.3	78.3±12.8
Heart rate (bpm)	75.5±13.2	74.3±12.1	75.3±14.0	75.4±12.6	76.6±14.1
CAD risk factors, n (%)					
Diabetes Mellitus	321 (19.4)	33 (9.5)	65 (19.8)	102 (21.0)	121 (24.6)
Hypertension	870 (52.6)	174 (50.1)	175 (53.2)	263 (54.1)	258 (52.4)
Current smoking	841 (50.8)	156 (45.0)	170 (51.7)	262 (53.9)	253 (51.4)
Hyperlipidemia	182 (11.0)	42 (12.1)	37 (11.2)	51 (10.5)	52 (10.6)
Dignosis, n (%)					
AMI	730 (44.1)	44 (12.7)	97 (29.5)	251 (51.6)	338 (68.7)
Unstable angina	311 (18.8)	67 (19.3)	83 (25.2)	81 (16.7)	80 (16.3)
CAD on CAG, n (%)					
One vessel disease (⩾50%)	465 (28.1)	239 (68.9)	124 (37.7)	76 (15.6)	26 (5.3)
Multivessel disease (⩾50%)	1189 (71.9)	108 (31.1)	205 (62.3)	410 (84.4)	466 (94.7)
History, n (%)					
Prior MI	134 (8.1)	9 (2.6)	16 (4.9)	49 (10.1)	60 (12.2)
Family history of CAD	475 (28.7)	107 (30.8)	98 (29.8)	126 (25.9)	144 (29.3)
Coronary dominance, n (%)					

Right-	1500 (90.6)	304 (87.6)	297 (90.3)	445 (91.5)	454 (92.3)
Left-	110 (6.7)	30 (8.7)	22 (6.7)	30 (6.2)	28 (5.7)
Co-	44 (2.7)	13 (3.7)	10 (3.0)	11 (2.3)	10 (2.0)

Four groups were based on Gensini score: first grade (0-12.5), second grade (13-24.5), third grade (25-52.5) and fourth grade (⩾53). Results are presented as mean ± standard deviation or n (%). AMI, acute myocardial infarction; CAD, coronary artery disease; CAG, coronary artery angiography; DBP, diastolic blood pressure; MI, myocardial infarction; SBP, systolic blood pressure.

Table 2 Gensini score and coronary dominance

	RD (n=1500)	Left+CD (n=154)	P
Age (years)	59.4±10.4	59.2±9.5	0.769
Gender, n (%)			0.242
Male	1114 (74.3)	121 (78.6)	
Female	386 (25.7)	33 (21.4)	
Baseline SBP (mmHg)	134.8±21.2	132.6±19.5	0.231
Baseline DBP (mmHg)	78.4±12.4	78.1±11.0	0.819
Heart rate (bpm)	75.4±13.1	76.5±14.8	0.341
CAD risk factors, n (%)			
Diabetes Mellitus	295 (19.7)	26 (16.9)	0.406
Hypertension	797 (53.1)	73 (47.4)	0.175
Current smoking	758 (50.5)	83 (53.9)	0.427
Hyperlipidemia	164 (10.9)	18 (11.7)	0.776
Total Gensini score	42.3±33.6	36.3±29.8	0.033
LM	1.7±7.3	1.7±7.7	0.935
LAD	21.1±21.1	19.7±20.0	0.433
RCA	7.8±10.8	4.7±8.5	<0.001
LCX	9.1±14.5	8.2±12.4	0.424
Diagonal branch	1.3±2.7	1.1±2.4	0.402
Septal branch	0.1±0.5	0.1±0.8	0.491
OM	0.7±2.2	0.6±2.0	0.848
Posterior descending artery	0.6±2.1	0.2±1.5	0.013

LAD, left anterior descending branch; LCx, left circumflex branch; LM, left main coronary artery; OM, obtuse marginal branch; RCA, right coronary artery.

Table 3 Univariate linear regression analysis for Gensini score

Variable	β (95% CI)	P
Right Dominance	5.991 (0.474 to 11.508)	0.033
Age	0.187 (0.033 to 0.342)	0.017
Male	9.811 (6.150 to 13.472)	<0.001
Smoking	1.098 (-2.113 to 4.309)	0.503
Hypertension	1.033 (-2.182 to 4.247)	0.529
Diabetes Mellitus	8.408 (4.369 to 12.447)	<0.001
Hyperlipidemia	-2.038 (-7.167 to 3.091)	0.436
Family history of CAD	-0.652 (-4.200 to 2.896)	0.719
SBP	-0.065 (-0.142 to 0.013)	0.100
DBP	-0.008 (-0.141 to 0.125)	0.911
Heart rate	0.148 (0.025 to 0.271)	0.018

CAD, coronary artery disease; DBP, diastolic blood pressure; SBP, systolic blood pressure.

Table 4 Multivariate linear regression analysis for Gensini score

Variable	β (95% CI)	P value
Unadjusted	5.991 (0.474 to 11.508)	0.033
Model 1	6.404 (0.945 to 11.862)	0.022
Model 2	6.699 (1.193 to 12.205)	0.017
Model 3	6.829 (1.312 to 12.346)	0.015

Model 1 adjusted age and gender

Model 2 adjusted age and gender, diabetes, heart rate

Model 3 adjusted age and gender, diabetes, heart rate, smoking, hypertension, hyperlipidemia, history of CAD, SBP, DBP

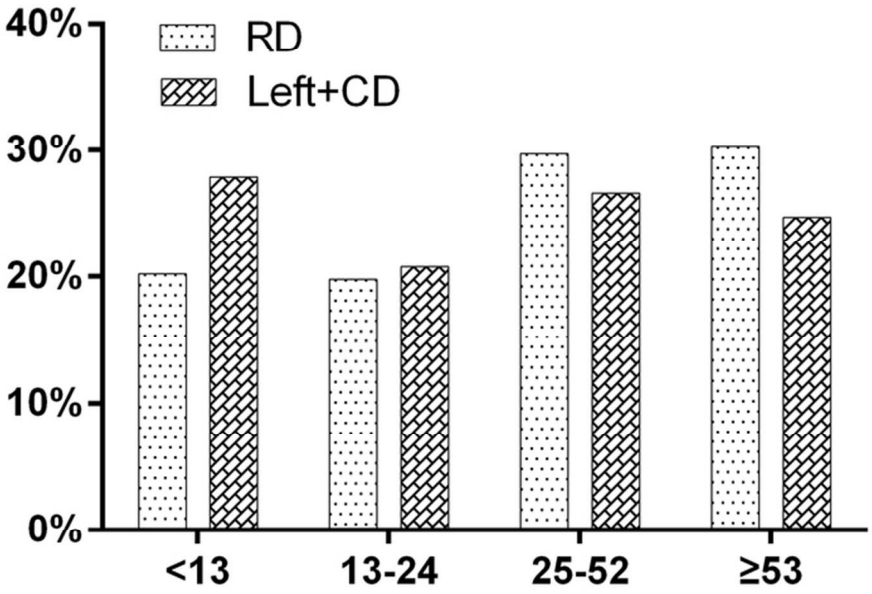

Figure 1 Distribution of RD and Left-CD group in different grade of Gensini score.

67x45mm (300 x 300 DPI)

STROBE 2007 (v4) Statement—Checklist of items that should be included in reports of *cross-sectional studies*

Section/Topic	Item #	Recommendation	Reported on page #
Title and abstract	1	(*a*) Indicate the study's design with a commonly used term in the title or the abstract	1
		(*b*) Provide in the abstract an informative and balanced summary of what was done and what was found	2
Introduction			
Background/rationale	2	Explain the scientific background and rationale for the investigation being reported	4
Objectives	3	State specific objectives, including any prespecified hypotheses	4
Methods			
Study design	4	Present key elements of study design early in the paper	5
Setting	5	Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection	5
Participants	6	(*a*) Give the eligibility criteria, and the sources and methods of selection of participants	5
Variables	7	Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable	5-6
Data sources/ measurement	8*	For each variable of interest, give sources of data and details of methods of assessment (measurement). Describe comparability of assessment methods if there is more than one group	5-6
Bias	9	Describe any efforts to address potential sources of bias	6-7
Study size	10	Explain how the study size was arrived at	5
Quantitative variables	11	Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen and why	6-7
Statistical methods	12	(*a*) Describe all statistical methods, including those used to control for confounding	6-7
		(*b*) Describe any methods used to examine subgroups and interactions	N/A
		(*c*) Explain how missing data were addressed	N/A
		(*d*) If applicable, describe analytical methods taking account of sampling strategy	N/A
		(*e*) Describe any sensitivity analyses	N/A
Results			

Participants	13*	(a) Report numbers of individuals at each stage of study—eg numbers potentially eligible, examined for eligibility, confirmed eligible, included in the study, completing follow-up, and analysed	7
		(b) Give reasons for non-participation at each stage	N/A
		(c) Consider use of a flow diagram	N/A
Descriptive data	14*	(a) Give characteristics of study participants (eg demographic, clinical, social) and information on exposures and potential confounders	7
		(b) Indicate number of participants with missing data for each variable of interest	N/A
Outcome data	15*	Report numbers of outcome events or summary measures	7
Main results	16	(*a*) Give unadjusted estimates and, if applicable, confounder-adjusted estimates and their precision (eg, 95% confidence interval). Make clear which confounders were adjusted for and why they were included	7-8
		(*b*) Report category boundaries when continuous variables were categorized	7-8
		(*c*) If relevant, consider translating estimates of relative risk into absolute risk for a meaningful time period	N/A
Other analyses	17	Report other analyses done—eg analyses of subgroups and interactions, and sensitivity analyses	N/A
Discussion			
Key results	18	Summarise key results with reference to study objectives	8
Limitations	19	Discuss limitations of the study, taking into account sources of potential bias or imprecision. Discuss both direction and magnitude of any potential bias	9
Interpretation	20	Give a cautious overall interpretation of results considering objectives, limitations, multiplicity of analyses, results from similar studies, and other relevant evidence	8-9
Generalisability	21	Discuss the generalisability (external validity) of the study results	10
Other information			
Funding	22	Give the source of funding and the role of the funders for the present study and, if applicable, for the original study on which the present article is based	11

*Give information separately for cases and controls in case-control studies and, if applicable, for exposed and unexposed groups in cohort and cross-sectional studies.

Note: An Explanation and Elaboration article discusses each checklist item and gives methodological background and published examples of transparent reporting. The STROBE checklist is best used in conjunction with this article (freely available on the Web sites of PLoS Medicine at http://www.plosmedicine.org/, Annals of Internal Medicine at http://www.annals.org/, and Epidemiology at http://www.epidem.com/). Information on the STROBE Initiative is available at www.strobe-statement.org.