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Impact of coronary dominance on long-term outcomes in patients undergoing left main coronary artery percutaneous coronary intervention

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Coronary dominance patterns are associated with the prevalence and severity of obstructive coronary artery disease (CAD), as well as with prognosis following percutaneous coronary intervention (PCI)[1]. The left main (LM) coronary artery supplies 75% to 100% of the left ventricular myocardium, placing the left ventricle at considerable risk in cases of significant LM stenosis, particularly in patients with left dominance[2]. Studies have indicated that left coronary dominance is associated with worse outcomes compared to right dominance in CAD populations; however, these studies are either outdated or lack sufficient statistical power[3]. Current clinical guidelines for LM PCI focus on assessment of the lesion complexity and intravascular imaging guidance to optimise stent implantation[4], without explicitly considering coronary dominance as an independent factor. This study aims to evaluate the influence of coronary dominance on long-term prognosis among a large cohort of LM PCI patients.

We analysed the relationship between coronary dominance and outcomes in consecutive patients with obstructive LM disease who underwent PCI between January 2004 and December 2016 at Fuwai Hospital, Beijing, China. The primary endpoint was 3-year major adverse cardiac events (MACE), a composite of cardiac death, myocardial infarction (MI), and target vessel revascularisation (TVR). Statistical analyses were carried out using SPSS Statistics, version 26.0 (IBM), and a two-sided p-value<0.05 was considered statistically significant.

Among 4,625 LM PCI patients, 166 (3.6%) had left dominance **(Figure 1A)**. These patients had a lower prevalence of hypertension and prior PCI and a higher incidence of isolated LM lesions, a shorter lesion length, a larger reference vessel diameter, and lower SYNTAX scores **(Supplementary Table 1, Supplementary Table 2)**. Multivariable Cox regression analyses demonstrated that age, left dominance, and incomplete revascularisation were associated with an increased risk of MACE, whereas successful lesion revascularisation was associated with a reduced risk. Additionally, left dominance and diabetes mellitus were linked to a higher risk of TVR, while successful lesion revascularisation was associated with a lower risk **(Figure 1B)**. After propensity score matching, the 3-year incidence of MACE was higher in patients with left coronary dominance compared to those without (adjusted hazard ratio [HR] 1.73; 95% confidence interval [CI]: 1.01-2.95; p=0.04), primarily driven by a higher rate of TVR (adjusted HR 3.25; 95% CI: 1.53-6.90; p=0.001) **(Figure 1C)**. The rates of all-cause death, cardiac death, and MI were comparable between the two groups **(Supplementary Table 3)**. After accounting for the competing risk of non-cardiac death, the risk of MACE in the left dominance group remained higher than that in the non-left dominance group, but the difference did not reach statistical significance **(Supplementary Figure 1)**. According to the subgroup analysis of MACE, the higher risk associated with left dominance was more significant among patients with LM bifurcation lesions and those with a residual SYNTAX score >0 **(Figure 1D)**.

Our findings demonstrate that (1) the proportion of left dominance among patients undergoing LM PCI is low, and these patients generally present with lower anatomical complexity; (2) left dominance in LM PCI patients is associated

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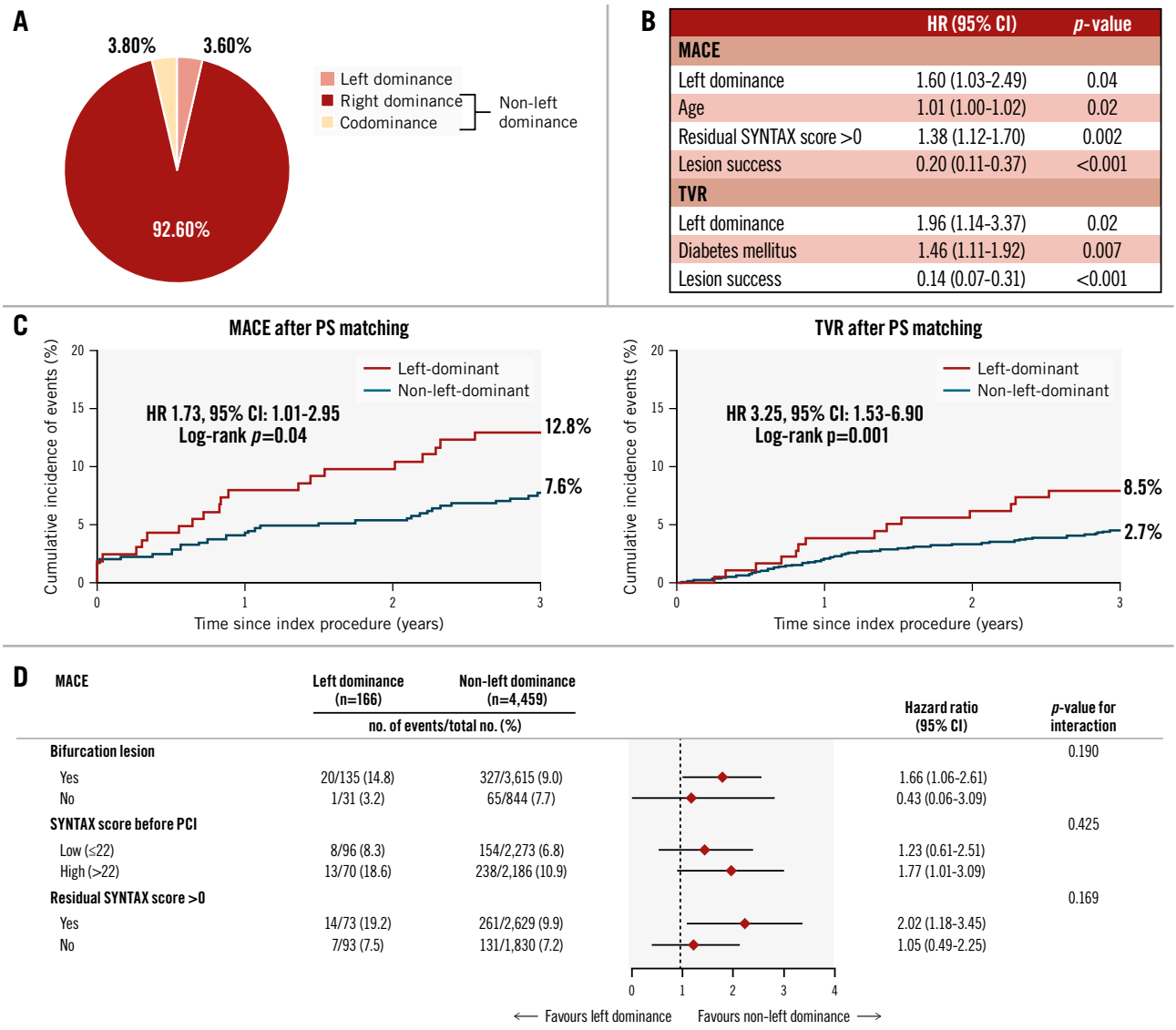

	HR (95% CI)	*p*-value
MACE		
Left dominance	1.60 (1.03-2.49)	0.04
Age	1.01 (1.00-1.02)	0.02
Residual SYNTAX score >0	1.38 (1.12-1.70)	0.002
Lesion success	0.20 (0.11-0.37)	<0.001
TVR		
Left dominance	1.96 (1.14-3.37)	0.02
Diabetes mellitus	1.46 (1.11-1.92)	0.007
Lesion success	0.14 (0.07-0.31)	<0.001

MACE	Left dominance (n=166)	Non-left dominance (n=4,459)	Hazard ratio (95% CI)	*p*-value for interaction
	no. of events/total no. (%)			
Bifurcation lesion				0.190
Yes	20/135 (14.8)	327/3,615 (9.0)	1.66 (1.06-2.61)	
No	1/31 (3.2)	65/844 (7.7)	0.43 (0.06-3.09)	
SYNTAX score before PCI				0.425
Low (≤22)	8/96 (8.3)	154/2,273 (6.8)	1.23 (0.61-2.51)	
High (>22)	13/70 (18.6)	238/2,186 (10.9)	1.77 (1.01-3.09)	
Residual SYNTAX score >0				0.169
Yes	14/73 (19.2)	261/2,629 (9.9)	2.02 (1.18-3.45)	
No	7/93 (7.5)	131/1,830 (7.2)	1.05 (0.49-2.25)	

Figure 1. *Coronary dominance distribution and clinical outcomes in left main patients. A) Coronary dominance distribution; (B) multivariable Cox regression models for MACE and TVR; (C) propensity score matching-adjusted Kaplan-Meier cumulative event curves for MACE and TVR; (D) subgroup analyses of 3-year MACE. MACE was defined as a composite of cardiac death, MI, and TVR. Propensity score matching variables: age, sex, hypertension, hyperlipidaemia, diabetes mellitus, family history of CAD, creatinine clearance rate before PCI, prior PCI, prior MI, ACS, LVEF, isolated left main, LM lesion length, residual SYNTAX score. ACS: acute coronary syndrome; CAD: coronary artery disease; CI: confidence interval; HR: hazard ratio; IVUS: intravascular ultrasound; LM: left main; LVEF: left ventricular ejection fraction; MACE: major adverse cardiac events; MI: myocardial infarction; PCI: percutaneous coronary intervention; PS: propensity score; TVR: target vessel revascularisation*

with a higher risk of long-term adverse events – particularly TVR – compared to non-left dominance patients; and (3) this increased risk may be more pronounced in patients with higher lesion complexity or incomplete revascularisation.

In this study, the prevalence of left dominance among patients undergoing LM PCI was slightly lower than the previously reported 8% to 12% in CAD patients undergoing coronary angiography[5]. Additionally, patients with left dominance in the present LM PCI cohort demonstrated less complex demographic and anatomical characteristics compared with non-left dominance patients. This observation likely reflects the influence of patient selection in real-world clinical practices. Given the extensive myocardial territory supplied by the LM artery in left-dominant patients, interventional cardiologists tend to avoid PCI in patients with more complex anatomy within this high-risk group.

According to this observational study, the data highlight two critical aspects: first, compared with non-left-dominant patients, those with left dominance exhibited a greater need for sustained blood flow restoration and experienced a higher

rate of repeat revascularisation; and second, the risk of acute ischaemic damage was comparable between the two groups once adequate blood flow was restored. Notably, the risk in left-dominant patients was not significant among those with lower anatomical complexity, such as low SYNTAX scores or absence of LM bifurcation. Moreover, achieving complete revascularisation is particularly important, as the relatively small size and limited perfusion capacity of the right coronary artery make the maintenance of a non-stenotic left coronary artery essential. In summary, careful patient selection, optimal treatment strategies, and the achievement of satisfactory acute outcomes are crucial for effective PCI management in this population.

This study has several limitations. First, as a retrospective, single-centre analysis including only Chinese patients, it is susceptible to selection bias. Second, intravascular imaging was not mandatory during the study period, leading to limited utilisation, which might have influenced long-term outcomes. Third, variations in operator experience and technique had the potential to impact outcomes. Future large-scale, prospective studies are needed to further elucidate the influence of coronary artery dominance on the long-term prognosis of LM patients.

In this large-scale retrospective study, LM patients with left dominance undergoing PCI were associated with a significantly higher risk of long-term adverse events, particularly for TVR. Among patients with a higher lesion complexity and incomplete revascularisation, this risk may be further increased.

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Conflict of interest statement

The authors have no conflicts of interest to declare.

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Supplementary data

Supplementary Table 1. Baseline characteristics.
Supplementary Table 2. Lesion and procedural characteristics.
Supplementary Table 3. Clinical outcomes up to 3 years.
Supplementary Figure 1. Competing risks analysis of MACE.

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Supplementary data

Supplementary Table 1. Baseline characteristics.

	Left dominance (N=166)	**Non-left dominance (N=4459)**	***P* value**
Age, years	60.0±10.5	60.3±10.4	0.75
Male sex	78.3 (130)	78.6 (3507)	0.92
BMI, kg/m^{2*}	25.3±3.4	25.7±3.2	0.17
Hypertension	48.8 (81)	58.5 (2608)	0.01
Hyperlipidaemia	54.8 (91)	59.4 (2649)	0.24
Diabetes mellitus	21.7 (36)	28.4 (1265)	0.06
Current smoking	32.5 (54)	33.8 (1508)	0.73
Family history of CAD	20.5 (34)	18.4 (819)	0.49
Creatinine, mmol/L†	78.7±18.1	80.5±18.5	0.23
Creatinine clearance rate before PCI†	93.3±31.2	92.0±28.0	0.56
Prior PCI	18.1 (30)	26.1 (1162)	0.02
Prior CABG	1.8 (3)	2.5 (110)	0.59
Prior MI	23.5 (39)	26.0 (1159)	0.47
Prior stroke	7.8 (13)	10.2 (457)	0.31
Peripheral vascular disease	8.4 (14)	6.9 (309)	0.46
Clinical presentation			
Silent ischaemia	4.2 (7)	6.5 (289)	0.24
Stable angina	35.5 (59)	39.0 (1740)	0.37
Unstable angina	53.0 (88)	44.9 (2000)	0.04
STEMI	3.0 (5)	4.2 (187)	0.45
NSTEMI	4.2 (7)	5.4 (243)	0.49
LVEF, %§	62.8±7.8	63.0±11.9	0.83
EF≤35%	2.4 (4)	0.6 (26)	
EF≤40%	3.0 (5)	1.9(84)	

Values are % (n) and mean±SD. *5 data missing; †107 data missing; §226 data missing. BMI=body mass index; CABG=coronary artery bypass graft; CAD=coronary artery disease; LVEF=left ventricular ejection fraction; MI=myocardial infarction; NSTEMI=non-ST-elevation myocardial infarction; PCI=percutaneous coronary intervention; STEMI=ST-elevation myocardial infarction.

Supplementary Table 2. Lesion and procedural characteristics.

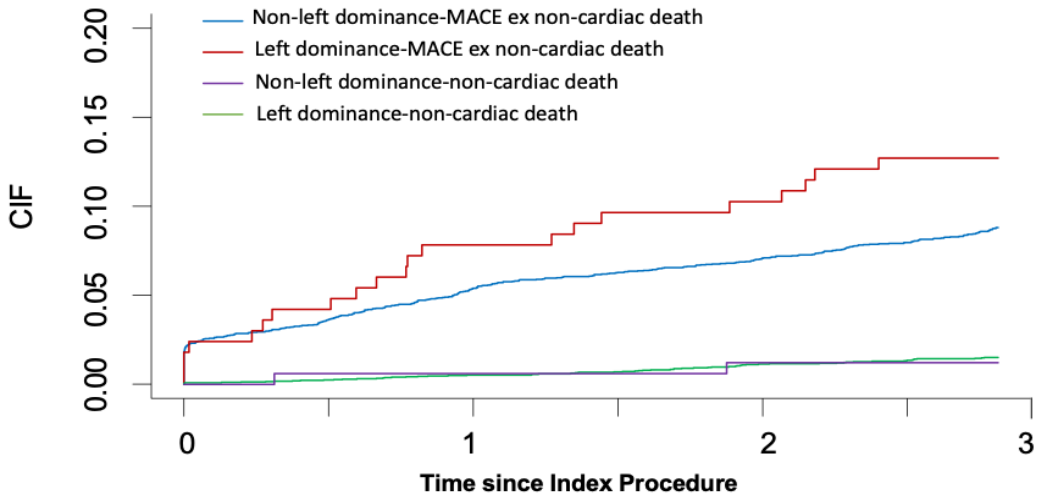
	Left dominance (N=166)	**Non-left dominance (N=4459)**	**P value**
Angiographic finding			
Isolated left main	12.7 (21)	7.1 (315)	0.006
Left main plus 1-vessel disease	19.9 (33)	19.0 (848)	0.78
Left main plus 2-vessel disease	38.6 (64)	39.4 (1755)	0.84
Left main plus 3-vessel disease	28.9 (48)	34.6 (1541)	0.13
Lesion location			
Ostial/shaft	15.1 (25)	19.1 (850)	0.20
Distal bifurcation	84.9 (141)	80.9 (3609)	0.20
Lesion type			
De novo	95.8 (159)	97.1 (4330)	0.32
Restenosis	4.2 (7)	2.9 (129)	0.32
Calcific lesion	14.5 (24)	13.0 (581)	0.59
Thrombotic lesion	0.6 (1)	1.4 (63)	0.68
Total occlusion lesion	2.4 (4)	5.2 (230)	0.11
Bifurcation lesion*	81.3 (135)	81.1 (3615)	0.94
LM lesion length	18.0±12.8	24.1±19.0	<0.001
LM RVD, mm	3.8±0.5	3.6±0.5	<0.001
LM DS, %	82.4±10.2	83.4±10.4	0.25
SYNTAX before PCI	21.7±6.7	22.9±7.3	0.03
Transradial approach	74.1 (123)	75.8 (3379)	0.62
Two-stent strategy	38.5(52)	26.8 (968)	0.003
Culotte	6.7 (9)	2.9 (105)	0.012
Crush	25.2 (34)	18.1 (655)	0.04
kissing stent	2.2 (3)	2.0(73)	0.87
T-stent	4.4 (6)	3.7 (135)	0.67
Number of stents per LM lesion	2.01±0.98	2.20±1.16	0.02
Number of stents per patient	2.28±1.80	2.57±2.07	<0.001
Guidance with IVUS	54.8 (91)	40.8 (1821)	<0.001
IABP	12.0 (20)	6.5 (288)	0.005
Procedural complications†	1.2 (2)	2.0 (88)	0.48
Residual SYNTAX score	2.9±4.4	4.2±5.6	0.002
Residual SYNTAX score > 0	44.0 (73)	59.0 (2629)	<0.001
Residual SYNTAX score > 8	10.8 (18)	17.1 (761)	0.04
Lesion success	100 (166)	99.3 (4426)	0.27

Supplementary Table 3. Clinical outcomes up to 3 years.

	Left dominance (N=166)	**Non-left dominance (N=4459)**	**Unadjusted Hazard Ratio (95% CI)**	**Log-rank P value**	**PS match adjusted* Hazard Ratio (95% CI)**	**P value**
MACE	21 (12.7)	392 (8.8)	1.46 (0.94,2.27)	0.09	**1.73 (1.01,2.95)**	0.04
All-cause death	7(4.2)	159(3.6)	1.19 (0.56,2.53)	0.66	1.10 (0.46,2.62)	0.83
Cardiac death	5(3.0)	93(2.1)	1.45 (0.59,3.57)	0.42	1.50 (0.51,4.38)	0.46
MI	5(3.0)	176(3.9)	0.76 (0.31,1.85)	0.55	0.62 (0.24,1.62)	0.32
TV-MI	5(3.0)	162(3.6)	0.83 (0.34,2.01)	0.67	0.78 (0.29,2.09)	0.63
Stroke	4(2.4)	63(1.4)	1.73 (0.63,4.75)	0.28	3.01 (0.75,12.04)	0.10
Any revascularisation	14(8.4)	357(8.0)	1.06 (0.62,1.81)	0.84	1.36 (0.72,2.55)	0.34
TVR	14(8.4)	212(4.8)	**1.78 (1.04,3.06)**	0.03	**3.25 (1.53,6.90)**	0.001
TLR	9(5.4)	134(3.0)	1.82 (0.92,3.56)	0.08	**3.39 (1.31,8.78)**	0.008
Definite and probable ST	2(1.2)	64(1.4)	0.85 (0.21,3.46)	0.82	0.70 (0.14,3.10)	0.60
Major bleeding	6(3.6)	144(3.2)	1.13 (0.50,2.55)	0.77	1.29 (0.50,3.36)	0.60

MI=myocardial infarction; TV-MI=target-vessel myocardial infarction; TVR=target-vessel revascularisation; TLR=target-lesion revascularisation; ST=stent thrombosis; CAD=coronary artery disease; ACS=acute coronary syndromes; LVEF=left ventricular ejection fraction.

*Model adjusted for age; male sex; hypertension; Hyperlipidaemia; diabetes mellitus; family history of CAD; creatinine clearance rate before PCI; prior PCI; prior MI; ACS; LVEF; isolated left main; LM lesion length; residual SYNTAX score



Supplementary Figure 1. Competing risks analysis of MACE.