## **Clinical Outcomes Following Simple or Complex** Stenting for Coronary Bifurcation Lesions: A **Meta-Analysis**

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Clinical Medicine Insights: Cardiology Volume 16: 1-10 © The Author(s) 2022 Article reuse guidelines: sagepub.com/journals-permissions DOI: 10.1177/11795468221116842 (S)SAGE

#### ABSTRACT

BACKGROUND: Stent placement remains a challenge for coronary bifurcation lesions. While both simple and complex stenting strategies are available, it is unclear which one results in better clinical outcomes. This meta-analysis aims to explore the long-term prognosis following treatment with the 2 stenting strategies.

METHOD: Randomized controlled trials found from searches of the PubMed, EMBASE, and Cochrane Central Register of Controlled Trials were included in this meta-analysis. The complex stent placement strategy was identified as the control group, and the simple stent placement strategy was identified as the experimental group. Data were synthesized with a random effects model. The quality of the randomized controlled trials was assessed by Jadad scale scores. The clinical endpoints at 6 months, 1 year, and 5 years were analyzed.

RESULTS: A total of 11 randomized controlled trials met the inclusion criteria. A total of 2494 patients were included in this meta-analysis. The odds ratio [OR] of the major adverse cardiac events (MACEs) at 6 months was 0.85 (95% confidence interval [CI] 0.53-1.35; P=.49, I<sup>2</sup> = 0%). The OR of the MACEs at 1 year was 0.61 (95% CI 0.36-1.05; P = .08, I<sup>2</sup> = 0%). The OR of the MACEs at 5 years was 0.69 (95% CI 0.51-0.92; P=.01, P=0%). Compared with the complex strategy, the simple strategy was associated with a lower incidence of MACEs at 5 years.

CONCLUSION: Compared to the complex stenting strategy, the simple stenting strategy can better reduce the occurrence of long-term MACEs for coronary bifurcation lesions.

KEYWORDS: Coronary bifurcation lesions, stent strategy, major adverse cardiac events, long-term prognosis

RECEIVED: February 10, 2022. ACCEPTED: June 11, 2022

TYPE: Meta-Analysis

FUNDING: The author(s) disclosed receipt of the following financial support for the research, authorship, and/or publication of this article: This study was supported by the National Natural Science Foundation of China (82072141), the Key R&D Program of Shandong Province (2019GSF108261), the Natural Science Foundation of Shandong Province (ZR2020MH030), and the Clinical Research Foundation of Shandong University (2020SDUCRCC014).

#### Introduction

A coronary bifurcation lesion is a coronary artery stenosis adjacent to and/or including the origin of a significant side branch (SB). It is often arbitrarily diagnosed according to the subjective judgment of an interventionalist, a factor leading to possible underdiagnosis of the condition. While coronary bifurcation lesions occur in approximately 15% of percutaneous coronary interventions (PCIs),<sup>1</sup> treatment remains challenging due to technological limitations and the occurrence of restenosis. Various stent strategies are clinically used for coronary bifurcation lesions.<sup>2</sup> The simple stent placement strategy involves implanting stents only into the main vessel (MV), with optional

\*These two authors contributed equally to this work.

DECLARATION OF CONFLICTING INTERESTS: The author(s) declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

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stenting of the SB. If SB stenting is required, the techniques include provisional T- and T-and-protrusion (TAP) stenting. In contrast, the complex stent implantation strategy involves definite, planned stenting of both the MV and the SB using various techniques, including the crush, culotte, and T-stenting techniques.

While the simple stent placement strategy has better shortand long-term prognoses than the complex strategy,<sup>3</sup> stent placement is associated with restenosis. For bare metal stents, the incidence of restenosis ranges from 16% to 44%<sup>4</sup>; for the first generation drug-eluting stents (DES), the incidence of restenosis is 5% to 15%; and for the second-generation DES, the incidence of restenosis is lower.<sup>5</sup> The incidence of restenosis is increased by the implantation of multiple stents,<sup>1</sup> such as

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Creative Commons Non Commercial CC BY-NC: This article is distributed under the terms of the Creative Commons Attribution-NonCommercial 4.0 License (https://creativecommons.org/licenses/by-nc/4.0/) which permits non-commercial use, reproduction and distribution of the work without further permission provided the original work is attributed as specified on the SAGE and Open Access pages (https://us.sagepub.com/en-us/nam/open-access-at-sage). in the complex strategy for the treatment of coronary bifurcation lesions. With the development of DES, the incidence of restenosis is further reduced.<sup>6</sup> For the complex stenting strategy, clinical trials have shown that DES can reduce the incidence of restenosis.<sup>7</sup> Furthermore, some studies indicated the complex stent strategy may have better clinical results. Thus, the best stent placement method for coronary artery bifurcation lesions remains unclear.<sup>8</sup>

The present study aims to clarify the best technique to treat coronary bifurcation lesions. We compare the cardiovascular outcomes after interventional treatment with the simple versus the complex stenting strategy for bifurcation lesions. In this meta-analysis, the clinical outcomes—the major adverse cardiovascular events (MACEs), including myocardial infarction (MI), cardiac death, stent thrombosis (ST), target lesion revascularization (TLR), and target vessel revascularization (TVR) were compared between the 2 groups. We combined the follow-up time of all eligible studies to explore the long-term prognosis of simple and complex stent placement strategies.

#### **Materials and Methods**

#### Inclusion criteria

The studies analyzed met the following inclusion criteria: (1) contained randomized controlled trials (RCTs), (2) used a complex stent placement strategy as the control group and a simple stent placement strategy as the experimental group, (3) had study populations consisting of patients with coronary bifurcation lesions, and (4) had follow-up periods of 6 months, 1 year, and 5 years. Reviews and non-English articles were excluded from our analysis.

#### Retrieval strategy

Literature retrieval was carried out by searching the PubMed, EMBASE, and Cochrane Central Register of Controlled Trials databases for the following search terms: "simple or complex," "stenting," and "coronary bifurcation lesions." Two researchers screened the literature by reading titles, abstracts, and full texts. If necessary, additional study details were used to determine whether studies met the inclusion criteria. Disagreements were submitted to a third reviewer for consensus. In addition, we reviewed the references from meta-analyses of simple and complex stenting strategies for the treatment of coronary bifurcation lesions to find other relevant published and unpublished studies.

#### Data extraction and clinical outcomes

Paired reviewers independently extracted data from the original trials and assessed the qualifications of all identified citations. The name of the project or the first author's last name, the time of publication, the study design, the disease population, the main end point of the study, and the follow-up time, patient's characteristics, comorbidities, procedural characteristics, well as binary variable data, were extracted. The primary outcome was any MACE, including cardiac death, ST, MI, and all-cause death. The secondary outcomes were TLR and TVR. We analyzed the primary and secondary clinical outcomes at 6 months, 1 year, and 5 years.

#### Statistical analysis and quality assessment

All data were binary variables. We combined the medical treatment effects (odds ratios [ORs] and risk ratios [RRs]) with the corresponding 95% confidence intervals (CIs) to evaluate the impact of simple and complex stent placement strategies on adverse clinical events. Data were analyzed using a random effects model. The Q and  $I^2$  tests were used for heterogeneity analysis. A *P*-value < .1 or an *I*<sup>2</sup>-value > 50% indicated greater heterogeneity. To visualize the heterogeneity, prediction intervals were used in forest plots for the primary outcomes. A sensitivity analysis was performed by omitting each study in order to evaluate the reliability and stability of all studies. When  $I^2$ was >50%, we performed a sensitivity and subgroup analysis. The methodological quality of the RCTs was assessed by the Cochrane Collaboration risk-of-bias tool. Inclusion of any studies that caused heterogeneity was determined after reading the full text. Egger's test and funnel plots were used to assess potential bias. The quality of the RCTs was assessed using the Jadad scale. The statistical analyses in this meta-analysis were performed using a combination of STATA statistical software (version 16; Stata Corp, College Station, Texas, USA) and Review Manager software (version 5.3; Copenhagen; The Nordic Cochrane Center, The Cochrane Collaboration, 2014). Lastly, the GRADE system was used to evaluate the quality of the evidence for all results.

#### Results

#### Included studies

A total of 1602 articles were retrieved from online databases. Of these, 62 articles were eliminated because of duplication. Four articles meeting the inclusion criteria were manually retrieved from the references of previous meta-analyses. Based on the title and abstract, 1529 articles were excluded, and 15 articles were identified. Finally, 4 articles were excluded based upon the full text contents. The flowchart of the literature retrieval and exclusion rationale is shown in Figure 1.

Of the 11 studies meeting the inclusion criteria, a total of 2494 patients were included in this meta-analysis. Five had a follow-up of 6 months,<sup>1,9-12</sup> 4 had a follow-up of 1 year,<sup>9,13-15</sup> and 3 had a follow-up of 5 years.<sup>8,16,17</sup> The characteristics of all studies meeting the inclusion criteria are summarized in Table 1. The risk of bias assessment of all eligible studies is shown in Figure 2.



#### The primary outcomes

The OR of MI at 6 months was 0.76 (95% CI 0.45-1.29; P = .31, P = 0%). The OR of all-cause death at 6 months was 1.13 (95% CI 0.32-4.06; P = .85, P = 0%). The OR of cardiac death at 6 months was 1.32 (95% CI 0.29-5.96; P = .72, P = 0%). The OR of MACEs at 6 months was 0.85 (95% CI 0.53-1.35; P = .49, P = 0%). There was no significant difference between the 2 stenting strategies for MACEs at 6 months (Figure 3).

The OR of MI at 1 year was 0.54 (95% CI 0.25-1.15; P=.11,  $I^2$ =0%). The OR of MACEs at 1 year was 0.61 (95% CI 0.36-1.05; P=.08,  $I^2$ =0%). The OR of all-cause death at 1 year was 1.57 (95% CI 0.52-4.77; P=.43,  $I^2$ =0%). There was no significant difference between the 2 stenting strategies for MACEs at 1 year (Figure 4).

The OR of cardiac death at 5 years was 0.92 (95% CI 0.42-2.02; P = .84,  $I^2 = 0\%$ ). The OR of MI at 5 years was 0.65 (95% CI 0.35-1.24; P = .19,  $I^2 = 0\%$ ). The OR of ST at 5 years was 1.33 (95% CI 0.56-3.14; P = .52,  $I^2 = 29\%$ ). The OR of all-cause death at 5 years was 0.58 (95% CI 0.34-1.00; P = .05,  $I^2 = 0\%$ ). The OR of MACEs at 5 years was 0.69 (95% CI 0.51-0.92; P = .01,  $I^2 = 0\%$ ). Compared with the complex strategy, the simple strategy was associated with a lower incidence of MACEs at 5 years. The simple strategy was associated with the lower incidence of all-cause death at 5 years (Figure 5).

#### The secondary outcomes

The OR of TLR at 6 months was 1.05 (95% CI 0.58-1.90 P=.88, P=0%). The OR of TVR at 6 months was 1.36 (95% CI 0.61-3.03; P=.45, P=0%). The OR of MV restenosis at 6 months was 0.64 (95% CI 0.13-3.23; P=.59, P=0%). The OR of SB restenosis at 6 months was 0.59 (95% CI 0.23-1.52; P=.27, P=0%). There was no significant difference between the 2 groups for the occurrence of restenosis of the MV and the SB (Figure 3).

The OR of TLR at 1 year was 1.98 (95% CI 1.20-3.27; P = .007, P = 17%). The OR of TVR at 1 year was 2.29 (95% CI 1.23-4.27; P = .009, P = 0%). Compared with the simple strategy, the complex strategy was associated with a lower incidence of TVR and TLR at 1 year (Figure 4).

The OR of TLR at 5 years was 1.17 (95% CI 0.47-2.90; P=.74,  $I^2=82\%$ ). The OR of TVR at 5 years was 1.07 (95% CI 0.54-2.12; P=.85,  $I^2=77\%$ ). There was no significant difference between the 2 groups for TLR and TVR at 5 years.

#### Discussion

In our meta-analysis of 11 RCTs, we compared the advantages and disadvantages of simple and complex stent strategies for treating coronary bifurcation lesions. We found that the simple strategy improved the long-term prognosis of MACEs better than the complex stenting strategy.

Table 1. The characteristics of included studies.

Control   Statute   Control   Statute   Control   Statute   <	VEAR SUBJECTS STUDY AGE, Y MALE, N (%) INCLUDED DESIGN	SUBJECTS STUDY AGE, Y MALE, N (%) INCLITIOED DESIGN	3 STUDY AGE, Y MALE, N (%) DESIGN (%)	AGE, Y MALE, N (%)	MALE, N (%)	MALE, N (%)		1	HYPERTENS	ion, n (%)	HYPERLIPID	EMIA, N (%)	DIABETES ME	:LLITUS, N (%)	CLINICAL OLITCOMES	POPULATION	FOLLOW-	QUALITY ASSESSMENT
123 (8)   128 (83.)   NA   NA   17 (7.13)   42 (23.0)   64 (30.1)   17 (9.16)   12 (9.16)   12 (9.16)	INTELE COMPLEX SIMPLE COMPLEX SIMPLE STENTING ST	INCLUCED COMPLEX SIMPLE COMPLEX SIMPLE STENTING	COMPLEX SIMPLE COMPLEX SIMPLE STENTING	COMPLEX SIMPLE COMPLEX SIMPLE STENTING STENTING STENTING STENTIN	SIMPLE COMPLEX SIMPLE STENTING STENTING STENTIN	COMPLEX SIMPLE STENTING STENTIN	SIMPLE	Q	COMPLEX	SIMPLE STENTING	COMPLEX	SIMPLE STENTING	COMPLEX STENTING	SIMPLE STENTING				
122 (80)   128 (85.3)   NA   NA   12 (27.5) <td>VS TAP stenting</td> <td>stenting</td> <td></td>	VS TAP stenting	stenting																
66 (66)   67 (50)   70 (70) <t< td=""><td>2016 150/150 RCT 66.3±10.6 69.1±10.3 107 (71.3) 114 (76.0)</td><td>150/150 RCT <math>66.3 \pm 10.6</math> <math>69.1 \pm 10.3</math> <math>107</math> (71.3) 114 (76.0)</td><td>RCT 66.3±10.6 69.1±10.3 107 (71.3) 114 (76.0)</td><td><math>66.3 \pm 10.6</math> <math>69.1 \pm 10.3</math> <math>107</math> (71.3) <math>114</math> (76.0)</td><td><math>69.1 \pm 10.3</math> 107 (71.3) 114 (76.0)</td><td>107 (71.3) 114 (76.0)</td><td>114 (76.0)</td><td></td><td>132 (88)</td><td>128 (85.3)</td><td>NA</td><td>NA</td><td>41 (27.3)</td><td>42 (28.0)</td><td>Cardiac death, TLR, TVR, MI</td><td>Bifurcation Lesions</td><td>1y</td><td>a</td></t<>	2016 150/150 RCT 66.3±10.6 69.1±10.3 107 (71.3) 114 (76.0)	150/150 RCT $66.3 \pm 10.6$ $69.1 \pm 10.3$ $107$ (71.3) 114 (76.0)	RCT 66.3±10.6 69.1±10.3 107 (71.3) 114 (76.0)	$66.3 \pm 10.6$ $69.1 \pm 10.3$ $107$ (71.3) $114$ (76.0)	$69.1 \pm 10.3$ 107 (71.3) 114 (76.0)	107 (71.3) 114 (76.0)	114 (76.0)		132 (88)	128 (85.3)	NA	NA	41 (27.3)	42 (28.0)	Cardiac death, TLR, TVR, MI	Bifurcation Lesions	1y	a
66 (64)   65 (63)   70 (70)   72 (70)   72 (70)   72 (70)   72 (70)   72 (70)   72 (70)   70 (71) <t< td=""><td>VS PRO</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></t<>	VS PRO																	
121 (65.4)   112 (60.5)   63 (34.1)   53 (28.6)   36 (19.5)   44 (23.8)   Carciac, brith, belons   Bifurcation   6mo.1y   4     120 (65.2)   111 (60.9)   62 (33.7)   53 (29.1)   53 (29.1)   56 (19.5)   42 (23.1)   Carciac, belons   Bifurcation   5y   3     125 (70.6)   136 (79.3)   12 (70.5)   12 (70.5)   12 (70.5)   42 (23.7)   Carciac, belons   Bifurcation   5y   3     90 (89.1)   136 (79.3)   12 (70.5)   42 (23.7)   36 (20.1)   Bifurcation   50d.   4     119 (51)   136 (79.1)   12 (70.5)   12 (70.5)   12 (70.5)   26 (25.7)   Carciac, belons   50d.   4     119 (51)   10 (51)   13 (18.6)   26 (25.7)   Carciac, belons   Bifurcation   6   6     119 (51)   10 (51)   13 (18.6)   26 (25.7)   Carciac, belons   Bifurcation   6   6     119 (51)   16 (31)   16 (17.8)   26 (12.8)   17 (39)   26 (12.8)   10 (16.9)   10 (16.9)	2016 103/97 RCT 63.5±12.1 62.9±10.8 76 (78) 87 (85)	103/97 RCT 63.5±12.1 62.9±10.8 76 (78) 87 (85)	RCT 63.5±12.1 62.9±10.8 76 (78) 87 (85)	$63.5 \pm 12.1$ $62.9 \pm 10.8$ $76$ (78) $87$ (85)	$62.9 \pm 10.8$ 76 (78) 87 (85)	76 (78) 87 (85)	87 (85)		66 (68)	65 (63)	70 (70)	72 (70)	30 (31)	26 (25)	All-cause death, MI, target vessel failure	Bifurcation Lesions	1 y	a
121 (65.4)   12 (60.5)   63 (3.4.1)   53 (28.1)   56 (19.5)   44 (23.1)   53 (28.1)   54 (28.1)   54 (28.1)   54 (28.1)   54 (28.1)   54 (28.1)   54 (28.1)   54 (28.1)   54 (28.1)   54 (28.1)   54 (28.1)   54 (28.1)   54 (28.1)   54 (28.1)   54 (28.1)   54 (28.1)   54 (28.1)   54 (28.1)   54 (28.1)   54 (28.1)																		
120 (65.2)   11 (60.9)   62 (33.7)   53 (23.1)   56 (19.6)   42 (23.1)   Cardiac MAGEs, ILS, TVA, MAGES, ILS, TVA, MAGES, ILS, TVA, MAGES, ILS, TVA, MAGES, ILS, TVA, MAGES, ILS, TVA, MAGES, ILS, TVA, MAGES, MAGE	2011 185/185 RCT 63.9±11.1 64.6±9.9 146 (78.9) 141 (7	185/185 RCT 63.9±11.1 64.6±9.9 146 (78.9) 141 (7	RCT 63.9±11.1 64.6±9.9 146 (78.9) 141 (7	63.9±11.1 64.6±9.9 146 (78.9) 141 (7	64.6±9.9 146 (78.9) 141 (7	146 (78.9) 141 (7	141 (7	6.2)	121 (65.4)	112 (60.5)	63 (34.1)	53 (28.6)	36 (19.5)	44 (23.8)	Cardiac death, MI, TVR	Bifurcation Lesions	6mo,1 y	4
125 (70.6)   138 (79.8)   113 (63.3)   122 (70.5)   42 (23.7)   38 (22.0)   All-cause dath, Mi, Lesions   Bifurcation 6mo   304, 6mo   4     90 (89.1)   93 (92.1)   Na   Na   19 (13.8)   19 (13.8)   26 (25.7)   Cardiac   Bifurcation   304, 6mo   4     90 (89.1)   93 (92.1)   Na   Na   Na   19 (13.8)   26 (25.7)   Cardiac   Bifurcation   19   5     90 (89.1)   93 (92.1)   Na   Na   Na   Second	2017 183/183 RCT 63.9±11.1 64.7±10.0 145 (78.8) 138 (75	183/183 RCT 63.9±11.1 64.7±10.0 145 (78.8) 138 (75	RCT 63.9±11.1 64.7±10.0 145 (78.8) 138 (75	63.9±11.1 64.7±10.0 145 (78.8) 138 (75	64.7±10.0 145 (78.8) 138 (75	145 (78.8) 138 (75	138 (75	5.8)	120 (65.2)	111 (60.9)	62 (33.7)	53 (29.1)	36 (19.6)	42 (23.1)	Cardiac death, MACEs, TLR, TVR, MI, ST	Bifurcation Lesions	5 y	ო
30 (89.1)   33 (92.1)   NA   19 (18.8)   26 (25.7)   Cardiac death, Mi, TLR   Biturcation   1Y   5     119 (58)   110 (53)   149 (73)   161 (78)   24 (12)   27 (13)   All-cause   Biturcation   1Y   5     119 (58)   110 (53)   149 (73)   161 (78)   24 (12)   27 (13)   All-cause   Biturcation   6mo   6     25 (57)   28 (59)   18 (41)   25 (53)   17 (39)   20 (42)   restenosis   Biturcation   6mo   6     NA   NA   NA   NA   NA   13 (21)   6 (26)   restenosis   Biturcation   6mo   6     58 (28.7)   54 (26.7)   72 (35.6)   78 (36)   13 (06)   6 (26)   restenosis   Biturcation   6mo   6     58 (28.7)   54 (26.7)   72 (35.6)   78 (36)   13 (06)   6 (26)   Cardiac   6 (07)   6   7     58 (28.7)   54 (28.7)   72 (35.6)   78 (36)   13 (06)   Cardiac   6 (07)	2009 173/177 RCT 65±10 67±10 142 (80.2) 132 (76	173/177 RCT $65\pm10$ $67\pm10$ 142 (80.2) 132 (76)	RCT 65±10 67±10 142 (80.2) 132 (76	65±10 67±10 142 (80.2) 132 (76	$67 \pm 10$ 142 (80.2) 132 (76	142 (80.2) 132 (76	132 (76	3.3)	125 (70.6)	138 (79.8)	113 (63.8)	122 (70.5)	42 (23.7)	38 (22.0)	All-cause death, MI, TVR	Bifurcation Lesions	30d, 6mo	4
90 (39.1) 93 (92.1) NA NA 19 (18.6) 26 (25.7) Gadin, Mi, Lesions 1y 5   119 (58) 110 (53) 149 (73) 161 (78) 24 (12) 27 (13) All-cause, Bifucation 6mo 6mo 6   25 (57) 28 (59) 18 (41) 25 (53) 17 (39) 20 (42) restensis Bifucation 6mo 6 6   NA NA NA NA 13 (13) 20 (42) restensis Bifucation 6mo 6	IG VS PRO	30																
119 (58)   110 (53)   149 (73)   161 (78)   24 (12)   27 (13)   death, Mi, Lesions death, Mi, Trans, Mi, Lesions   6mo   6     25 (57)   28 (59)   18 (41)   25 (53)   17 (39)   20 (42)   restenosis   Bifurcation   6mo   6     NA   NA   NA   NA   13 (21)   6 (26)   restenosis   Bifurcation   6mo   6     58 (28.7)   54 (26.7)   72 (35.6)   78 (38.6)   12 (0.6)   13 (0.6)   Geath, TLR, death, TLR,   6mo   6   7   6   7 <td>2008 101/101 RCT 66.9±10.5 66.7±9.2 79 (78.2) 80 (79.4</td> <td>101/101 RCT <math>66.9 \pm 10.5</math> <math>66.7 \pm 9.2</math> 79 (78.2) 80 (79.4)</td> <td>RCT 66.9±10.5 66.7±9.2 79 (78.2) 80 (79.4</td> <td><math>66.9 \pm 10.5</math> <math>66.7 \pm 9.2</math> 79 (78.2) 80 (79.4)</td> <td>66.7±9.2 79 (78.2) 80 (79.4</td> <td>79 (78.2) 80 (79.4</td> <td>80 (79.4</td> <td>~</td> <td>90 (89.1)</td> <td>93 (92.1)</td> <td>NA</td> <td>NA</td> <td>19 (18.8)</td> <td>26 (25.7)</td> <td>Cardiac death, MI, TLR</td> <td>Bifurcation Lesions</td> <td>1 y</td> <td>a</td>	2008 101/101 RCT 66.9±10.5 66.7±9.2 79 (78.2) 80 (79.4	101/101 RCT $66.9 \pm 10.5$ $66.7 \pm 9.2$ 79 (78.2) 80 (79.4)	RCT 66.9±10.5 66.7±9.2 79 (78.2) 80 (79.4	$66.9 \pm 10.5$ $66.7 \pm 9.2$ 79 (78.2) 80 (79.4)	66.7±9.2 79 (78.2) 80 (79.4	79 (78.2) 80 (79.4	80 (79.4	~	90 (89.1)	93 (92.1)	NA	NA	19 (18.8)	26 (25.7)	Cardiac death, MI, TLR	Bifurcation Lesions	1 y	a
119 (58)   110 (53)   149 (73)   161 (78)   24 (12)   27 (13)   All-causes death, Mi, MI   Bifurcation (each, Mi)   6mo   6     25 (57)   28 (59)   18 (41)   25 (53)   17 (39)   20 (42)   restenosis   Bifurcation   6mo   6     NA   NA   NA   NA   13 (21)   6 (26)   restenosis   Bifurcation   6mo   6     58 (28.7)   54 (26.7)   72 (35.6)   78 (38.6)   12 (0.6)   13 (0.6)   cataiac   Bifurcation   59   6     58 (28.7)   54 (26.7)   72 (35.6)   78 (38.6)   12 (0.6)   13 (0.6)   cataiac   Bifurcation   57   6     58 (28.7)   54 (26.7)   72 (35.6)   78 (38.6)   12 (0.6)   13 (0.6)   cataiac   Bifurcation   57   6     58 (28.7)   54 (26.7)   72 (35.6)   78 (38.6)   12 (0.6)   13 (0.6)   cataiac   Bifurcation   57   6     58 (28.7)   54 (26.7)   72 (35.6)   78 (38.6)   12 (0.6)	other techniques) vs Complex (Crush or other techniques) Stenting	hniques) vs Complex (Crush or other techniques) Stenting	Complex (Crush or other techniques) Stenting	ush or other techniques) Stenting	chniques) Stenting	bu												
25 (57) 28 (59) 18 (41) 25 (53) 17 (39) 20 (42) restenosis Brucation 6mo 6   NA NA NA NA 13 (21) 6 (26) restenosis Brucation 6mo 4   S8 (28.7) 54 (26.7) 72 (35.6) 78 (38.6) 12 (0.6) 13 (0.6) Cardiac Brucation 6mo 4   58 (28.7) 54 (26.7) 72 (35.6) 78 (38.6) 12 (0.6) 13 (0.6) Cardiac Brucation 57 6   58 (28.7) 54 (26.7) 72 (35.6) 78 (38.6) 12 (0.6) 13 (0.6) Cardiac Brucation 57 6   58 (28.7) 54 (26.7) 72 (35.6) 78 (38.6) 12 (0.6) 13 (0.6) Cardiac Brucation 57 6   70 (10) 13 (10) 13 (0.6) 13 (0.6) 13 (0.6) 13 (0.6) 13 (0.6) 13 (0.6) 13 (0.6) 13 (0.6) 13 (0.6) 14 (0.6) 14 (0.6) 14 (0.6) 14 (0.6) 14 (0.6) 14 (0.6) 14 (0.6) 14 (0.6) 14 (0.6) 14 (0.6) 14 (0.6) 14 (0.6) <	2006 207/206 RCT 62±10 63±10 162 (79) 159 (7)	207/206 RCT 62±10 63±10 162 (79) 159 (7)	RCT 62±10 63±10 162 (79) 159 (7)	62±10 63±10 162 (79) 159 (7)	63±10 162 (79) 159 (7)	162 (79) 159 (7	159 (7	ŝ	119 (58)	110 (53)	149 (73)	161 (78)	24 (12)	27 (13)	All-cause death, MI, TVR, ST, MI	Bifurcation Lesions	6mo	Q
NA   NA   NA   13 (21)   6 (26)   restenosis   Bifurcation   6mo   4     58 (28.7)   54 (26.7)   72 (35.6)   78 (38.6)   12 (0.6)   13 (0.6)   Cardiac   Bifurcation   5y   6     58 (28.7)   54 (26.7)   72 (35.6)   78 (38.6)   12 (0.6)   13 (0.6)   Cardiac   Bifurcation   5y   6     All-cause   All-cause   All-cause   All-cause   All-cause   All-cause   6 ach, TLR, MI   5y   6     154 (62)   142 (57)   189 (76)   188 (76)   28 (11)   31 (13)   All-cause   Bifurcation   5y   5	2004 47/44 RCT 58 $\pm$ 11 61 $\pm$ 10 38 (86) 34 (7	$47/44$ RCT 58 $\pm$ 11 61 $\pm$ 10 38 (86) 34 (7	RCT $58 \pm 11$ $61 \pm 10$ 38 (86) 34 (7	$58 \pm 11$ $61 \pm 10$ $38$ (86) $34$ (7	$61 \pm 10$ 38 (86) 34 (7	38 (86) 34 (7	34 (7	2)	25 (57)	28 (59)	18 (41)	25 (53)	17 (39)	20 (42)	restenosis	Bifurcation Lesions	6mo	9
58 (28.7) 54 (26.7) 72 (35.6) 78 (38.6) 12 (0.6) 13 (0.6) Carcliac Bifurcation 5y 6   Alexation Alexation Alexation 5y 6 13 (13) 118, 118, 118, 118, 118, 118 6   154 (62) 142 (57) 189 (76) 188 (76) 28 (11) 31 (13) All-cause Bifurcation 5y 5	2004 22/63 RCT 63±10 62±9 48 (76) 21 (9	22/63 RCT 63±10 62±9 48 (76) 21 (9	RCT 63±10 62±9 48 (76) 21 (9	63±10 62±9 48 (76) 21 (9	62±9 48 (76) 21 (9	48 (76) 21 (9	21 (9	1)	NA	NA	NA	NA	13 (21)	6 (26)	restenosis	Bifurcation Lesions	6mo	4
154 (62) 142 (57) 189 (76) 188 (76) 28 (11) 31 (13) All-cause Biturcation 5y 5 death Lesions	2013 207/206 RCT 63±10 63±10 78 (38.6) 76 (3	207/206 RCT 63±10 63±10 78(38.6) 76(3	RCT 63±10 63±10 78 (38.6) 76 (3	63±10 63±10 78 (38.6) 76 (3	63±10 78 (38.6) 76 (3	78 (38.6) 76 (3	76 (3.	7.6)	58 (28.7)	54 (26.7)	72 (35.6)	78 (38.6)	12 (0.6)	13 (0.6)	Cardiac death, All-cause death, TLR, TVR, MI	Bifurcation Lesions	5 y	Q
154 (62) 142 (57) 189 (76) 188 (76) 28 (11) 31 (13) All-cause Bifurcation 5y 5 death Lesions	VS PRO																	
	2010 245/238 RCT 64±11 64±10 193 (77) 192	245/238 RCT 64±11 64±10 193 (77) 195	RCT $64\pm11$ $64\pm10$ 193 (77) 192	$64 \pm 11$ $64 \pm 10$ $193 (77)$ $192$	$64 \pm 10$ 193 (77) 192	193 (77) 192	192	(77)	154 (62)	142 (57)	189 (76)	188 (76)	28 (11)	31 (13)	All-cause death	Bifurcation Lesions	5 y	5

The disadvantages of the conventional crush technique were associated with crushed stent struts. In addition, this technique could lead to uncovered nonapposed stent struts occurring at or near the bifurcations, which might be related to the delayed coverage of the neointima.<sup>18</sup> In comparison, the conventional culotte technique was associated with a higher incidence of restenosis and ST.<sup>19</sup> In addition, both techniques were related to a higher incidence of SB occlusion.<sup>20</sup> Fortunately, the crush and culotte techniques have undergone improvements. One modification of the crush technique was the optimization of the stent placement procedure, where a separate step was used to crush the SB stent, followed by inserting a stent into the MV. Intermediate balloon-kiss expansion was performed before positioning a stent in the MV.<sup>21,22</sup> The culotte technique was improved by first inserting a stent into the SB, followed by pre-placing a balloon in the MV. The overlap of the 2 stents was shorter than in the conventional culotte technique. Intermediate balloon-kiss expansion was then performed before positioning a stent in the MV.<sup>23</sup> For simple stent placement strategies, the accepted criteria for the SB stent placement is based on angiographic results: a vessel severity >75% diameter stenosis, and stenosis length >5 mm.<sup>24</sup> The clinical results from the DKCRUSH studies were of great significance; the double kissing crush replaced the traditional crush in the treatment of coronary bifurcation lesions, had lower angiographic restenosis rates, and was the preferred strategy for PCI.25 In addition, for complex coronary bifurcation lesions, the double kissing crush was better than provisional stenting9.

In the DKCRUSH-II study, researchers compared the MACEs between the double kissing double crush technique and the provisional stenting strategy. The clinical endpoints were followed up at 1, 6, 8, and 12 months. Although the aim of this study was to demonstrate the best strategy for coronary bifurcation lesions, the 2 techniques demonstrated no significant difference in MACEs.9 The 5-year follow-up results of Chen et al<sup>16</sup> showed that the double kissing crushing stenting strategy had a lower incidence of TLR; however, the 5-year MACEs was not statistically significant, which may indicate the need for a larger sample size to illustrate the best strategy. The Nordic study was also a long-term follow-up study, comparing the clinical outcomes of the simple and complex stenting strategies at 5 years.<sup>17</sup> Even though the simple strategy had a better trend, there was no significant difference in the clinical endpoint for the 2 strategies. In the CACTUS study, similar conclusions were drawn, and the complex stent placement strategy did not show any superiority.10 Therefore, the simple, optional SB stenting implantation strategy was still recommended for the treatment of coronary bifurcation lesions.<sup>17</sup> However, the long-term follow-up data from the 2 studies illustrated differences in the patients' illnesses, such as the severity of the SB stenosis, leading to significant differences in the TLR, which could explain the heterogeneity of the 5-year TLR in our meta-analysis. In addition, the functional assessment of bifurcation lesion is very significant. According to the latest research results, fractional flow reserve (FFR) has a certain degree of potential for assessing the functional assessment of bifurcation lesion. The evaluation results of FFR for coronary bifurcation lesions may provide a certain degree of reference for whether to adopt simple or complex strategies.<sup>26</sup>

In a previous meta-analysis, the simple stenting strategy played a beneficial role in reducing the incidence of early acute MI compared to the complex stenting strategy.<sup>27</sup> Niccoli et al<sup>28</sup> also showed that the simple strategy reduced the risk of early MI; however, for MACEs, there was no significant difference between the 2 strategies. In contrast to the previous meta-analyses, we combined the follow-up times to demonstrate which strategy had a better long-term prognosis. In our meta-analysis, we discussed whether the simple stent placement strategy was better than the complex strategy at 6 months, 1 year, and 5 years, and our results showed that the simple stent 5 years.

In the treatment of coronary bifurcation lesions, ST is a common problem. Even though the technique of the complex stent implantation strategy has improved, it still faces challenges. The crush and the culotte techniques have different characteristics; however, they are both associated with a higher risk of ST. For the simple stent placement strategy, techniques include provisional T- and TAP stenting. Compared with TAP stenting, the culotte technique was associated with a lower incidence of angiographic restenosis. However, the temporary stent placement strategy is currently recommended for the treatment of coronary bifurcation lesions.13 In our meta-analysis, there was no significant difference between the 2 strategies for MV and SB restenosis in 1 year. With the wide clinical application of drug-eluting balloons and DES, the incidence of restenosis and ST may be further reduced. Further clinical trials are required for confirmation.

Although the studies included in this meta-analysis are RCTs, we cannot deny the limitations of this meta-analysis, of this, the longer follow-up period will increase the accuracy of the conclusion of meta-analysis.

#### Conclusions

In conclusion, the simple stent placement strategy is superior to other strategies in improving the long-term prognosis of patients with coronary bifurcation disease; nonetheless, both stenting strategies have their own advantages. This study compared the MACEs of simple stent strategy and complex stent strategy of different follow-up time in detail, which provided a certain degree of reference value for clinicians in the treatment of coronary bifurcation lesions.

#### **Author Contributions**

Qun Zhang and Hengshan Huan wrote the draft. Bailu Wang provided methodology and software. Yu Han, Han Liu, and



Selective reporting (reporting bias)

Other bias

Unclear risk of bias

. 0% 25%

50%

High risk of bias

75%

100%





Low risk of bias

	Simple Ste	enting	Comple	x Sten	ting	Risk Ratio	Risk Ratio
Study or Subgroup	Events	Total	Events	Total	Weight	M-H, Random, 95% C	I M-H, Random, 95% Cl
CACTUS 2009	16	173	19	177	55.0%	0.86 [0.46, 1.62]	
DKCRUSH-112011	2	185	7	185	9.8%	0.82 [0.18, 3.65]	<b>_</b>
Nordic2006	4	207	6	206	14.0%	0.66 [0.19, 2.32]	
Pan2004	1	47	0	44	2.2%	2.81 [0.12, 67.27]	
Total (95% CI)		634		675	100.0%	0.85 [0.53, 1.35]	•
Total events	29		39				
Heterogeneity: Tau <sup>2</sup> =	0.00; Chi <sup>2</sup> =	0.70, 0	df = 4 (P =	0.95);	$ ^2 = 0\%$		
Test for overall effect:	Z = 0.70 (P	= 0.49	)				
MACEs							
CACTUS 2009	1	47	0	44	16.2%	2.81 [0.12, 67.27]	
Colombo2004	1	173	0	177	16.0%	3.07 [0.13, 74.82]	
Nordic2006	0	22	1	63	16.3%	0.93 [0.04, 21.97]	
Pan2004	2	207	3	206	51.5%	0.66 [0.11, 3.93]	
Total (95% CI)		449		490	100.0%	1.13 [0.32, 4.06]	-
Total events	4		4				
Heterogeneity: Tau <sup>2</sup> =	0.00; Chi <sup>2</sup> =	1.06, 0	df = 3 (P =	0.79);	I <sup>2</sup> = 0%		
Test for overall effect:	Z = 0.19 (P	= 0.85)	)				
All-cause death							
DKCRUSH-II2011	2	185	1	185	39.9%	2.00 [0.18, 21.87]	— <b> </b> ■
Nordic2006	2	207	2	206	60.1%	1.00 [0.14, 7.00]	
T-4-1 (0501 01)		000		004	400.00	4 00 50 00 5	
I otal (95% CI)	4	392		391	100.0%	1.32 [0.29, 5.96]	
Heterogeneity: Tau <sup>2</sup> =	4 0.00: Chi <sup>2</sup> =	0.20	3 df = 1 (P =	0.66)	$ ^2 = 0\%$		
Test for overall effect:	Z = 0.36 (P	= 0.72	)	0.00),	. 070		
Cardiac death							
Curaide death							
CACTUS 2009	11	172	13	177	58 9%	0.87 10 /0 1 001	_ <b>_</b>
Colombo2004	1	22	6	63	8.3%	0.48 [0.06, 3.75]	
DKCRUSH-II2011	6	185	2	185	14.0%	3.00 [0.61, 14.67]	
Nordic2006	4	207	2	206	12.4%	1.99 [0.37, 10.75]	
Pan2004	1	47	2	44	6.3%	0.47 [0.04, 4.98]	
Total (95% CI)		634		675	100.0%	1.05 [0.58, 1.90]	•
Total events	23		25				
Heterogeneity: Tau <sup>2</sup> =	0.00; Chi <sup>2</sup> =	3.49, 0	if = 4 (P =	0.48);	l² = 0%		
Test for overall effect:	Z = 0.15 (P	= 0.88)					
TLR							
CACTUS 2009	15	173	19	177	67.0%	0.81 [0.42, 1.54]	
Colombo2004	2	22	7	63	12.4%	0.82 [0.18, 3.65]	
DKCRUSH-II2011	4	185	6	185	17.8%	0.67 [0.19, 2.32]	
Nordic2006	0	207	1	206	2.7%	0.33 [0.01, 8.10]	
Fall2004	0	47	0	44		Notestinable	
Total (95% CI)		634		675	100.0%	0.76 [0.45, 1.29]	◆
Total events	21		33				
Heterogeneity: Tau <sup>2</sup> =	0.00; Chi <sup>2</sup> =	• 0.35, 0	df = 3 (P =	: 0.95);	$I^2 = 0\%$		
rescior overall effect:	∠ = 1.01 (P	- 0.31)	,				
MI							
							_
Pan2004	2	41	4	39	33.4%	0.48 [0.09, 2.45]	
Colombo2004	3	21	12	55	66.6%	0.65 [0.21, 2.09]	
Total (95% CI)		62		94	100.0%	0.59 [0.23. 1.52]	-
Total events	5		16				
Heterogeneity: Tau <sup>2</sup> =	0.00; Chi <sup>2</sup> =	0.10, c	if = 1 (P =	0.76);	l² = 0%		
Test for overall effect:	Z = 1.10 (P	= 0.27)					
SB restenosis							
Pan2004	1	41	2	39	46.6%	0.48 [0.04, 5.04]	
Colombo2004	1	21	3	53	53.4%	0.84 [0.09, 7.64]	
		60		00	100.0%	0 64 10 43 3 003	
Total (95% CI)	2	62	5	92	100.0%	0.04 [0.13, 3.23]	
Heterogeneity: Tau <sup>2</sup> =	∠ 0.00: Chi <sup>2</sup> =	0.12	if = 1 (P =	0.73)	l² = 0%		
Test for overall effect:	Z = 0.53 (P	= 0.59)			- /0		
MV restenosis		,					
111 1 1030010313							
Colombo2004	2	22	7	63	28.7%	0.82 [0.18, 3.65]	
DKCRUSH-II2011	8	185	3	185	37.3%	2.67 [0.72, 9.89]	±
Nordic2006	4	207	4	206	34.0%	1.00 [0.25, 3.93]	<b>F</b>
Total (95% CI)		414		454	100 0%	1.36 [0.61 3.02]	-
Total events	14	-714	14		100.070	1.50 [0.51, 5.05]	F
Heterogeneity: Tau <sup>2</sup> =	0.00; Chi <sup>2</sup> =	1.66, c	if = 2 (P =	0.44);	l² = 0%		
Test for overall effect:	Z = 0.75 (P	= 0.45)					Simple Stenting Core 1 Struct
TUD							Simple Stenting Complex Stenting

**Figure 3.** The forest plots of MI, all-cause death, TLR, TVR, MV restenosis, SB restenosis, cardiac death, and MACEs in 6 months. Abbreviations: MACEs, major adverse cardiovascular events; MI, myocardial infarction; MV, main vessel; SB, side branch; TLR, target lesion revascularization; TVR, target vessel revascularization.

	Simple S	tenting	Comple	x Sten	ting	<b>Risk Ratio</b>	Risk Ratio
Study or Subgroup	Events	Total	Events	Total	Weight	M-H, Random, 95% C	CI M-H, Random, 95% CI
DKCRUSH-II2011	6	185	12	185	32.1%	0.50 [0.19, 1.30]	
Ferenc2008	6	101	6	101	24.5%	1.00 [0.33, 3.00]	
Hildick-Smith2016	8	103	14	97	43.5%	0.54 [0.24, 1.23]	-
Total (95% CI)		389		383	100.0%	0.61 [0.36, 1.05]	$\bullet$
Total events	20		32				
Heterogeneity: Tau <sup>2</sup> =	0.00; Chi <sup>2</sup> :	= 1.03, d	df = 2 (P =	= 0.60)	; l² = 0%		
Test for overall effect:	Z = 1.78 (P	<b>P</b> = 0.08)	)				
MACEs							
BBK2016	18	150	9	150	35.1%	2.00 [0.93, 4.31]	╷──┼┱─
DKCRUSH-II2011	24	185	8	185	34.6%	3.00 [1.38, 6.50]	<b>_∎</b> _
Ferenc2008	11	101	9	101	30.3%	1.22 [0.53, 2.82]	i — <b>≱</b> —
Total (95% CI)		436		436	100.0%	1.98 [1.20, 3.27]	$\bullet$
Total events	53		26				
Heterogeneity: Tau <sup>2</sup> =	0.03; Chi <sup>2</sup> :	= 2.40, c	df = 2 (P = 7)	= 0.30);	l <sup>2</sup> = 17%		
	∠ - 2.00 (P	- 0.007	)				
TLR							
DKCRUSH-II2011	27	185	12	185	92.3%	2.25 [1.18, 4.30]	
Hildick-Smith2016	3	103	1	97	7.7%	2.83 [0.30, 26.70]	<del>_</del>
Total (95% CI)		288	10	282	100.0%	2.29 [1.23, 4.27]	
Total events	30		13	0.05	12 00/		
Test for overall effect:	0.00; Chi2 = 7 = 2.61 (P	= 0.04, c = 0.000	ד = רו (P = א)	0.85);	$1^2 = 0\%$		
	2 - 2.01 (1	- 0.000	,)				
TVR							
BBK2016	4	150	3	150	56.5%	1.33 [0.30, 5.86]	
Ferenc2008	2	101	1	101	21.8%	2.00 [0.18, 21.71]	
Hildick-Smith2016	2	103	1	97	21.8%	1.88 [0.17, 20.44]	
Total (95% CI)		354		348	100.0%	1.57 [0.52, 4.77]	-
Total events	8		5				
Heterogeneity: Tau <sup>2</sup> =	0.00; Chi <sup>2</sup> =	= 0.11, c	lf = 2 (P =	0.95);	l² = 0%		
Test for overall effect:	Z = 0.79 (P	= 0.43)					
All-cause death							
DKCRUSH-112011	4	185	6	185	36.7%	0 67 10 19 2 321	<b>_</b>
Ferenc2008	- 1	101	2	101	10.1%	0.50 [0.05, 5.43]	
Hildick-Smith2016	5	103	10	97	53.2%	0.47 [0.17, 1.33]	- <b>-</b> +
					400 001		
Total (95% CI)	40	389	40	383	100.0%	0.54 [0.25, 1.15]	
I otal events	10 0 00: 05:2 -	- 0 10 -	18 If – 2 /D –	0.041	12 - 00/		
Test for overall effect:	0.00; Chi <sup>2</sup> =	= 0.18, 0 = 0.11)	IT = 2 (P =	0.91);	1- = 0%		
	2 - 1.00 (F	- 0.11)					
MI							
DKCRUSH-II2011	2	185	5	185	38.6%	0.40 [0.08, 2.04]	
Ferenc2008	3	101	3	101	41.1%	1.00 [0.21, 4.84]	<b>+</b>
Hildick-Smith2016	1	103	3	97	20.3%	0.31 [0.03, 2.97]	
Total (95% CI)		389		383	100 0%	0 56 [0 20 1 53]	
Total events	6	505	11	505		0.00 [0.20, 1.00]	-
Heterogeneity: Tau <sup>2</sup> =	0.00; Chi² =	= 0.94. d	f = 2 (P =	0.62):	l² = 0%		
Test for overall effect:	Z = 1.14 (P	= 0.25)			_ /0		0.01 0.1 1 10 100 Simple Stenting Complex Stenting
ST							

Figure 4. The forest plots of all-cause death, TLR, TVR, MI, ST, and MACEs in 1 year. Abbreviations: MACEs, major adverse cardiovascular events; MI, myocardial infarction; ST, stent thrombosis; TLR, target lesion revascularization; TVR, target vessel revascularization.

	Simple St	enting	Comple	x Sten	ting	Risk Ratio	Risk Ratio
Study or Subgroup	Events	Total	Events	Total	Weight	M-H, Random, 95% C	M-H, Random, 95% Cl
BBC ONE2010	7	245	14	238	10.5%	0.49 [0.20, 1.18]	
DKCRUSH-II2017	24	183	30	183	33.9%	0.80 [0.49, 1.31]	
Nordic2013	34	202	51	202	55.5%	0.67 [0.45, 0.98]	
		620		622	100.0%	0 60 [0 51 0 02]	
Total (95% CI)	05	030	05	023	100.0%	0.09 [0.51, 0.92]	•
l otal events	00	0.07	95	0.00	12 - 00/		
Test for overall effect:	0.00; Chi <sup>2</sup> =	= 0.97, 0 = 0.01)	ui = 2 (P = \	= 0.62);	1- = 0%		
	2 - 2.50 (F	- 0.01)	,				
MACEs							
DKCRUSH-II2017	30	183	16	183	48.9%	1.88 [1.06, 3.32]	- <b>-</b> -
Nordic2013	23	202	31	202	51.1%	0.74 [0.45, 1.23]	
Fotal (95% CI)	50	385		385	100.0%	1.17 [0.47, 2.90]	
otal events	53	- <b>- - -</b>	47	0.00	12 000/		
leterogeneity:   au <sup>2</sup> =	0.35; Chi <sup>2</sup> =	= 5.71, 0	df = 1 (P =	= 0.02);	I <sup>2</sup> = 82%		
est for overall effect:	Z = 0.33 (P	= 0.74)	)				
ΓLR							
OKCRUSH-II2017	35	183	23	183	49.2%	1.52 [0.94, 2.47]	<b>↓■</b> -
Nordic2013	28	202	37	202	50.8%	0.76 [0.48. 1.19]	
				_ / _			L
Total (95% CI)		385		385	100.0%	1.07 [0.54, 2.12]	<b>•</b>
Total events	63		60				
Heterogeneity: Tau <sup>2</sup> = Fest for overall effect:	0.19; Chi² = Z = 0.19 (P	= 4.28, o = 0.85)	df = 1 (P = )	= 0.04);	l² = 77%		
ΓVR		,					
0KCRUSH-II2017	7	183	14	238	36.7%	0.65 [0.27, 1.58]	
Nordic2013	12	202	22	202	63.3%	0.55 [0.28, 1.07]	
otal (95% CI)		385		440	100 0%	0 58 [0 34 1 00]	•
Total events	19	000	36	440	100.070	0.00 [0.04, 1.00]	•
Heterogeneity: Tau <sup>2</sup> =	0.00: Chi <sup>2</sup> =	= 0.10. c	f = 1 (P =	0.76):	$ ^2 = 0\%$		
Test for overall effect:	Z = 1.97 (P	= 0.05)		,,			
All-cause death	·	,					
Sector a						and the first second	
KCRUSH-II2017	6	183	4	183	39.8%	1.50 [0.43, 5.23]	
Vordic2013	6	202	9	202	60.2%	0.67 [0.24, 1.84]	
Cotal (95% CI)		395		395	100.0%	1002 04 01 00 0	<b></b>
	10	200	10	300	100.0%	0.92 [0.42, 2.02]	T
laterogeneity: Tau <sup>2</sup> -	ו∠ ח חחי ⊂hi² –	. 0 0 2	13 \f=1/D-	0 331.	l <sup>2</sup> = 0%		
est for overall effect.	Z = 0.21 (P)	= () 84)	(F =	0.02),	0 %		
		0.04)					
Jardiac death							
	-		_		<b>0-</b> /		
KCRUSH-II2017	6	183	7	183	35.4%	0.86 [0.29, 2.50]	
lordic2013	9	202	16	202	64.6%	0.56 [0.25, 1.24]	<b>—</b> ]
otal (95% CI)		385		385	100 0%	0 65 10 35 1 241	
otal events	15	505	23	505	100.070	0.00 [0.00, 1.24]	•
eterogeneity: Tau <sup>2</sup> -	0 001 Chi2 -	038 -	23 ff = 1 (P -	0 541.	l² = ∩%		
est for overall effect.	Z = 1.31 (P)	= () 191		0.04),	0 /0		
		0.10)					
MI							
KCRUSH-112017	5	183	5	183	49.6%	1 00 10 29 3 401	<b>_</b>
Nordic2013	7	202	4	202	-0.0%	1.75 [0.52, 5.40]	- <b>T</b>
	'	202	4	202	JJ. <del>4</del> /0	1.10 [0.02, 0.09]	-
fotal (95% CI)		385		385	100.0%	1.33 [0.56, 3.14]	
Total (95% CI)	12	385	9	385	100.0%	1.33 [0.56, 3.14]	+
<b>Total (95% CI)</b> Total events leterogeneity: Tau <sup>2</sup> =	12 0.00; Chi² =	<b>385</b> : 0.41, c	9 lf = 1 (P =	<b>385</b> 0.52):	<b>100.0%</b> I <sup>2</sup> = 0%	1.33 [0.56, 3.14]	
otal (95% CI) otal events leterogeneity: Tau <sup>2</sup> = est for overall effect: :	12 0.00; Chi² = Z = 0.64 (P	<b>385</b> = 0.41, c = 0.52)	9 df = 1 (P =	<b>385</b> 0.52);	<b>100.0%</b>   <sup>2</sup> = 0%	1.33 [0.56, 3.14]	

Figure 5. The forest plots of all-cause death, TLR, TVR, cardiac death, MI, ST, and MACEs in 5 years. Abbreviations: MACEs, major adverse cardiovascular events; MI, myocardial infarction; ST, stent thrombosis; TLR, target lesion revascularization; TVR, target vessel revascularization. Shukun Sun contributed to data curation. Shujian Wei and Bailu Wang contributed to conception, design of this study and revised the article. All authors read and approved the publication of the article.

# Research Involving Human Participants and/or Animals

The present study is a meta-analysis of published articles, and neither a human nor animal study that should be approved by the appropriate ethics committee and performed in accordance with the ethical standards laid down in the 1964 Declaration of Helsinki and its later amendments.

#### **Informed Consent**

The present study is a meta-analysis of published articles, and there are no persons who gave their informed consent prior to their inclusion in the study.

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#### **Data Availability**

The data that support the findings of this study are available from the corresponding author upon reasonable request.

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