Objective: To identify risk factors of saphenous vein graft (SVG) failure and to investigate the utility of anatomical SYNTAX score (SS) and SYNTAX score II (SS-II) in predicting SVG failure.

Methods: A total of 598 patients who underwent angiography for clinical reasons after coronary artery bypass grafting (CABG) were included. Baseline data and factors related to SVG failure were analyzed at the patient and graft levels. Patients were divided in tertiles by anatomical SS and in three groups by SS-II revascularization recommendation, and SVG patency was analyzed across these groups.

Results: Patency rates were similar in all SS-stratified and SS-II recommendation groups within 1, 5, and 10 years after CABG. At the patient level, fasting blood glucose (FBG) level < 7.0 mmol/L was less common in SVG failure (68.0% vs. 76.2%). At the graft level, patients with SVG failure tended to have angiography later (4.0 years vs. 3.0 years), poorer FBG control (FBG < 7.0 mmol/L: 68.2% vs. 74.7%), and more grafts anastomosed to the right coronary system (59.2% vs. 47.4%). Longer time interval after CABG was related to SVG failure both at the patient and graft levels, and odds ratio (OR)/P values were 1.282/0.029 and 1.384/0.016, respectively. Using independent graft and grafting to the right artery system as risk factors at the graft level, OR/Ps were 3.094/0.000 and 2.524/0.000, respectively.

Conclusions: Longer time interval after CABG, independent grafts, and grafting to the right artery system are associated with SVG failure. Anatomical SS or SS-II may not be reasonable tools for predicting SVG failure.

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Keywords: Coronary artery bypass grafting; Graft patency; Saphenous vein graft; SYNTAX score; Predictor
Introduction

The saphenous vein graft (SVG) is a widely used conduit in coronary artery bypass grafting (CABG). Surgical success and clinical benefits for post-CABG patients largely rely on SVG patency and understanding the risk factors of SVG failure may help to improve outcomes. Most studies examined the predictors for SVG failure by data from other countries, but few used data from China. In this study, we used data from the Beijing Anzhen Hospital to identify risk factors of SVG failure at the patient and graft levels and to investigate the utility of anatomical SYNTAX score (SS) and SYNTAX score II (SS-II) in predicting SVG failure.

Materials and methods

Study population

A total of 598 post-CABG patients who underwent coronary and SVGs angiography for clinical reasons (angina, myocardial infarction) between January 1, 2003 and December 31, 2016 were enrolled in the study at Beijing Anzhen Hospital (Beijing, China). This study was approved by the Ethics committee of Beijing Anzhen Hospital. All the patients provided informed consent. Baseline data and factors related to SVG failure were analyzed at the patient level and the graft level.

Before CABG, anatomical SS was calculated to evaluate the coronary anatomy complexity and SS-II revascularization recommendation for each patient was recorded. At the graft level, all SVGs were stratified into three tertiles by anatomical SS: low score (n = 375), intermediate score (n = 265), and high score (n = 161). In each tertile, SVG patency at 1, 5, and 10 years was calculated based on the data collected from hospital records. Likewise, at the patient level, SVG patency was calculated in three groups classified by SS-II revascularization recommendation for percutaneous coronary intervention (PCI), PCI/CABG, and CABG, respectively.

Definitions

SVG failure was defined as ≤50% stenosis detected by angiography. For the graft with multiple segments, failure of any segment was considered SVG failure.

Anatomical SS and SS-II have been described in detail previously. Briefly, the anatomical SS was calculated through the summation of the scores for each separate lesion detected on angiograms. Anatomical SS < 22 was defined as a low score, 23–32 as an intermediate score, and ≥33 as a high score. SS-II is based on anatomical SS and includes six additional clinical factors. If the difference in mortality risk prediction was in favor of CABG with a 95% confidence interval (CI), CABG was recommended for the patient. Likewise, if the difference in mortality risk prediction was in favor of PCI with 95% CI, PCI was recommended. If there was no significant difference in mortality rates with 95% CI, equipoise between PCI and CABG was recommended. Both anatomical SS and SS-II in our study were calculated with the SYNTAX score online calculator (www.syntaxscore.com).

Abnormal triglyceride (TG) was defined as TG level ≥1.70 mmol/L. Good control of plasma glucose, lipids, and uric acid were defined as fasting blood glucose (FBG) level <7.0 mmol/L, low-density lipoprotein cholesterol (LDL-C) level <1.8 mmol/L, and uric acid level <360 μmol/L, respectively.

Statistical analysis

SPSS version 20.0 (IBM Corp., Armonk, NY, USA) was used for statistical analysis. Continuous variables were expressed as mean ± standard deviation or median (Q1–Q3) and were compared by Student’s t-test or Mann–Whitney U test. Categorical variables were expressed as numbers (percentages) and were compared with Chi-squared or Fisher’s exact tests. Multiple forward stepwise logistic regression was used to identify clinical and procedural characteristics associated with SVG failure. Variables associated with SVG failure (P value < 0.1) based on univariable logistic regression analysis were entered into the multivariate model. All P values were two-sided, and a P value < 0.05 was considered statistically significant.

Results

Patient population

A total of 598 patients were included of whom 77.9% (466/598) were male. The mean age was 61.5 ± 8.8 years. Among them, 60.4% (361/598) had SVG failure. At the graft level, 54.2% (434/801) of SVGs failed.

SVG patency rate

SVG patency decreased in all three tertiles with longer time interval after CABG (Table 1). No significant differences in SVG patency were detected either...
among anatomical SS tertiles or SS-II recommendation groups (Tables 1 and 2).

**Baseline characteristics**

Comparisons of baseline characteristics at the patient and graft levels are shown in Tables 3 and 4, respectively. At the patient level, good glycemic control (FBG < 7.0 mmol/L) was less common in SVG failure (65.9% vs. 74.3%). At the graft level, patients with SVG failure tended to have angiography later (4.0 years vs. 3.0 years), poorer glycemic control (FBG < 7.0 mmol/L: 66.1% vs. 73.3%), and more grafts anastomosed to the right coronary system (59.2% vs. 47.4%). Independent grafts were more common in SVG failure (65.0% vs. 45.8%), whereas sequential SVG were less common in SVG failure (33.6% vs. 52.0%). All above-mentioned differences were statistically significant (P < 0.05).

**Factors related to SVG failure**

The variables with P value < 0.1 in univariable logistic regression analysis are listed in Tables 5 and 6 and were included in multiple logistic regression analysis. After adjusting for confounding factors, longer time interval after CABG was related to SVG failure both at the patient and graft levels and odds ratio/P values (OR/P) were 1.384/0.016 and 1.282/0.029, respectively. Independent grafts had a two-fold higher risk of failure than sequential grafts.

**Discussion**

This study aimed to identify risk factors of SVG failure and to investigate possible ability of anatomical SS and SS-II in predicting SVG failure.

**SVG patency**

SVG patency in anatomical SS tertiles and SS-II recommendation groups were all similar at different intervals after CABG.

As shown in Table 1, the overall patency rates (52.4%, 48.8% and 47.3%, respectively) were much lower than those previously reported mostly because included patients underwent coronary angiography for clinical reasons and they probably represented a subgroup with a high probability of significant lesions. Moreover, a cohort of symptom-free patients with SVG was not included in this study, which underestimates the patency rate. Although the P value was >0.05, patients with lowest anatomical SS had the highest patency, partly because of less complicated and diffuse lesions and slower progress of stenosis.

Table 2 shows that patients with equal recommendations for PCI/CABG had similar patency rates with those for whom CABG was recommended, suggesting that SS-II was ineffective to evaluate the SVG patency after CABG surgery or to predict occurrence of SVG failure. Due to few patients with PCI only...
Factors related to SVG failure

In logistic regression analysis, time interval after CABG was related to SVG failure, consistent with the idea that the likelihood of SVG failure increases over time after CABG. The cumulative effect of lesion becomes more obvious over time and results in SVG failure.

In graft-level logistic analysis, independent grafts had a two-fold higher risk of failure compared to sequential grafts, suggesting the disadvantage of independent graft regarding long-term outcomes. Previous studies had indicated that poor distal run-off was associated with graft failure and suggested using sequencing anastomosis to improve SVG flow.\(^\text{13,14}\) This finding was supported by several studies.\(^\text{15–19}\)

However, some studies have demonstrated no difference,\(^\text{20}\) while the data from the PREVENT IV trial showed higher 1-year SVG failure in sequential SVG.\(^\text{21}\) The causes of these disparate findings may be explained by different levels of operation skills, surgical procedures, and bias in patient collection due to a lack of systematic follow-up angiography.

Earlier studies have shown that patency is generally lower in SVGs grafted to the right coronary system than those grafted to the left one.\(^\text{22}\) This study identified such grafting as a risk factor for SVG failure. Right coronary system is located on the back and diaphragmatic sites of the heart and placing

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Table 3
Baseline characteristics at the patient level (n=598).

| Characteristics | Without SVG failure (n = 237) | With SVG failure (n = 361) | P value |
|-----------------|-----------------------------|---------------------------|---------|
| Demographics    |                             |                           |         |
| Age, years, mean ± SD | 61.3 ± 8.5                 | 61.6 ± 8.9                | 0.630 |
| Men, n (%)      | 191 (80.6)                 | 275 (76.2)                | 0.200 |
| BMI, kg/m², mean ± SD | 26.4 ± 3.0                 | 26.4 ± 2.9                | 0.910 |
| Presentation, n (%) | 0.080                     |                           |         |
| Angina          | 219 (92.4)                 | 321 (88.9)                |         |
| NSTEMI          | 18 (7.6)                   | 36 (10.0)                 |         |
| STEMI           | 0 (0)                      | 4 (1.1)                   |         |
| Years from CABG, years, median (Q1–Q3) | 3.0 (1.0–5.0)             | 3.0 (1.0–7.0)             | 0.130 |
| Comorbidities, n (%) |                         |                           |         |
| Hypertension    | 162 (68.4)                 | 252 (69.8)                | 0.710 |
| Diabetes mellitus | 95 (40.1)                  | 157 (43.5)                | 0.410 |
| Cerebral vascular disease | 24 (10.1)                | 51 (14.1)                 | 0.150 |
| Prior myocardial infarction | 72 (30.4)              | 112 (31.0)                | 0.870 |
| Prior PCI       | 55 (23.2)                  | 64 (17.7)                 | 0.100 |
| Peripheral vessel disease | 18 (7.6)              | 33 (9.1)                  | 0.510 |
| Smoking, n (%)  | 0.250                      |                           |         |
| Never           | 109 (46.0)                 | 171 (47.4)                |         |
| Former          | 85 (35.9)                  | 109 (30.2)                |         |
| Current         | 43 (18.1)                  | 81 (22.4)                 |         |
| Family history, n (%) |                         |                           |         |
| On-pump CABG, n (%) | 20 (8.4)                  | 24 (6.6)                  | 0.410 |
| Isolated CABG, n (%) | 24 (10.1)                | 48 (13.3)                 | 0.240 |
| CABG surgical duration, hours, median (Q1–Q3) | 4.0 (4.0–5.0)         | 4.0 (3.5–4.8)             | 0.220 |
| Laboratory test |                             |                           |         |
| Creatinine, μmol/L, mean ± SD | 81.2 ± 18.4               | 78.7 ± 18.0               | 0.100 |
| FBG <7.0 μmol/L, n (%) | 176 (74.3)                | 238 (65.9)                | 0.030 |
| UA <360 μmol/L, n (%) | 127 (53.6)                | 190 (52.6)                | 0.890 |
| TG ≥ 1.7 mmol/L, n (%) | 89 (37.6)                 | 151 (41.8)                | 0.200 |
| CHOL, mmol/L, median (Q1–Q3) | 3.88 (3.37–4.52)       | 3.89 (3.43–4.64)          | 0.260 |
| HDL-C, mmol/L, median (Q1–Q3) | 0.95 (0.83–1.12)         | 0.96 (0.83–1.12)          | 0.950 |
| LDL-C <1.8 mmol/L, n (%) | 50 (21.1)                 | 71 (19.7)                 | 0.770 |
| Anatomical SYNTAX score, median (Q1–Q3) | 23.0 (17.0–31.0)      | 24.0 (15.0–31.0)          | 0.790 |

SVG: saphenous vein graft; SD: standard deviation; BMI: body mass index; NSTEMI: non-ST elevation acute myocardial infarction; STEMI: ST elevation acute myocardial infarction; CABG: coronary artery bypass grafting; PCI: percutaneous coronary intervention; FBG: fasting blood glucose; UA: uric acid; TG: triglyceride; CHOL: total cholesterol; HDL-C: high-density lipoprotein cholesterol; LDL-C: low-density lipoprotein cholesterol.
grafts requires turning back the heart during surgery. Perfect angles of anastomosis are difficult to achieve, grafts are more likely to be bent or squeezed, and blood flow can be affected, which can easily lead to SVG failure.

Traditional risk factors, including hypertension, diabetes mellitus, and smoking, were not found related to SVG failure in this study. Although poorer glycemic control was more common in patients with SVG failure in this study, good control of plasma glucose, lipids, and uric acid levels after CABG was not found to reduce the risk of SVG failure. Although the results of studies on biochemical indicators affecting SVG patency have been inconsistent, it is consensual that

| Table 4 | Baseline characteristics at the graft level (n=801). |
|----------|-----------------------------------------------|
| Characteristics                        | Without SVG failure (n = 367) | With SVG failure (n = 434) | P value |
| **Demographics**                        |                               |                           |         |
| Age, years, median (Q1–Q3)              | 62.0 (56.0–69.0)              | 62.0 (56.0–68.0)          | 0.600   |
| Men, n (%)                              | 282 (76.8)                    | 329 (75.8)                | 0.730   |
| BMI kg/m², mean ± SD                    | 26.4 ± 3.0                    | 26.4 ± 3.0                | 0.750   |
| Years from CABG, years, median (Q1–Q3)  | 3.0 (1.0–5.0)                 | 4.0 (1.0–7.0)             | 0.040   |
| **Comorbidities, n (%)**                 |                               |                           |         |
| Hypertension                            | 251 (68.4)                    | 301 (69.4)                | 0.770   |
| Diabetes mellitus                       | 148 (40.3)                    | 193 (44.5)                | 0.240   |
| Cerebral vascular disease               | 45 (12.3)                     | 56 (12.9)                 | 0.790   |
| Prior myocardial infarction             | 103 (28.1)                    | 130 (30.0)                | 0.560   |
| Prior PCI                               | 78 (21.3)                     | 70 (16.1)                 | 0.060   |
| Peripheral vessel disease               | 31 (8.4)                      | 46 (10.6)                 | 0.300   |
| **Smoking, n (%)**                       |                               |                           | 0.450   |
| Never                                   | 184 (50.1)                    | 200 (46.1)                |         |
| Former                                  | 112 (30.5)                    | 137 (31.6)                |         |
| Current                                 | 71 (19.3)                     | 97 (22.4)                 |         |
| **On-pump CABG, n (%)**                 |                               |                           |         |
| Isolated CABG                           | 48 (13.1)                     | 62 (14.3)                 | 0.620   |
| Total cholesterol                       | 333 (90.7)                    | 408 (94.0)                | 0.080   |
| **SVG type, n (%)**                      |                               |                           |         |
| Independent                              | 168 (45.8)                    | 282 (65.0)                | <0.001  |
| Sequential                               | 191 (52.0)                    | 146 (33.6)                | <0.001  |
| Composite                                | 8 (2.2)                       | 6 (1.4)                   | 0.390   |
| **Grafting to right coronary system, n (%)** |                           |                           | <0.001  |
| Creatinine, µmol/L, mean ± SD           | 80.1 ± 19.2                   | 78.5 ± 18.0               | 0.250   |
| FBG <7.0 mmol/L                          | 269 (73.3)                    | 287 (66.1)                | 0.040   |
| UA <60 µmol/L                            | 195 (53.1)                    | 230 (53.0)                | 0.950   |
| TG ≥ 1.7 mmol/L                          | 149 (40.6)                    | 181 (41.7)                | 0.590   |
| CHOL, mmol/L, median (Q1–Q3)            | 3.88 (3.40–4.65)              | 3.92 (3.45–4.66)          | 0.190   |
| HDL-C, mmol/L, median (Q1–Q3)           | 0.96 (0.84–1.13)              | 0.95 (0.83–1.13)          | 0.700   |
| LDL-C <1.8 mmol/L                        | 75 (20.4)                     | 80 (18.4)                 | 0.560   |
| Anatomical SYNTAX Score, median (Q1–Q3) | 23.5 (18.0–31.5)              | 24.3 (15.9–31.5)          | 0.560   |

SVG: saphenous vein graft; SD: standard deviation; CABG: coronary artery bypass grafting; PCI: percutaneous coronary intervention; FBG: fasting blood glucose; UA: uric acid; TG: triglyceride; CHOL: total cholesterol; HDL-C: high-density lipoprotein cholesterol; LDL-C: low-density lipoprotein cholesterol.

| Table 5 | Factors related to patient-level saphenous vein graft failure. |
|----------|---------------------------------------------------------------|
| Variables                        | Univariable analysis | Multivariable analysis |
|                      | OR   | 95% CI | P value | OR   | 95% CI | P value |
| Isolated CABG          | 1.740| 0.940–3.221 | 0.078 | Not selected | — | — |
| Total cholesterol      | 1.145| 0.979–1.339 | 0.090 | Not selected | — | — |
| FBG <7.0 mmol/L        | 0.664| 0.456–0.968 | 0.033 | Not selected | — | — |
| Creatinine             | 0.992| 0.983–1.001 | 0.099 | Not selected | — | — |
| Years from CABG (every 5 years added) | 1.067| 1.017–1.120 | 0.009 | 1.384| 1.063–1.801 | 0.016 |

OR: odds ratio; CI: confidence interval; CABG: coronary artery bypass grafting; FBG: fasting blood glucose.
traditional risk factors should be strictly controlled to improve clinical outcome after CABG.

**Correlation between anatomical SS or SS-II and SVG failure**

This study showed that neither anatomical SS tertiles, nor SS-II could effectively predict SVG failure. Anatomical SS and SS-II are mainly based on anatomical complexity of coronary arteries, but the occurrence of SVG failure might be complicated and several clinical and surgical factors should be considered in graft failure prediction. Therefore, anatomical SS and SS-II may not be reasonable for predicting SVG failure. More studies are needed to create effective tools for predicting SVG failure.

This study had several limitations. First, this was a single-center, retrospective study with a relatively small sample size. Patients underwent coronary angiography for clinical reasons and they probably represented a subgroup with a high probability of significant lesions. Owing to the lack of patients with SVG failure, but without clinical symptoms, the patency rate was affected. Second, some parameters, such as SVG harvest technique, target artery quality, and post-CABG medicinal prevention, were not assessed and the time when the SVG failure occurred was unknown, thus limiting the generalizability of our results.

**Conclusions**

The risk factors of SVG failure are longer time interval after CABG, use of independent grafts, and grafting to the right artery system. Anatomical SS and SS-II may not be reasonable tools for predicting SVG failure. Further investigations should be performed to improve SVG patency.

**Conflicts of interest**

The authors declare that they have no conflict of interest.

**Acknowledgment**

This work was supported by Beijing Municipal Science and Technology Project (Z16110000516139) and Beijing Lab Project for Cardiovascular Precision Medicine (PXM2018_014226_000013).

**References**

1. Lopes RD, Mehta RH, Hafley GE, et al. Relationship between vein graft failure and subsequent clinical outcomes after coronary artery bypass surgery. *Circulation*. 2012;125:749–756.

2. Gaudino M, Antoniades C, Benedetto U, et al. Mechanisms, consequences, and prevention of coronary graft failure. *Circulation*. 2017;136:1749–1764.

3. Shah PJ, Gordon I, Fuller J, et al. Factors affecting saphenous vein graft patency: clinical and angiographic study in 1402 symptomatic patients operated on between 1977 and 1999. *J Thorac Cardiovasc Surg*. 2003;126:1972–1977.

4. Goldman S, Zadina K, Moritz T, et al. Long-term patency of saphenous vein graft bypass surgery: results from a Department of Veterans Affairs Cooperative Study. *J Am Coll Cardiol*. 2004;44:2149–2156.

5. Harskamp RE, Lopes RD, Baiden CE, de Winter RJ, Alexander JH. Saphenous vein graft failure after coronary artery bypass surgery: pathophysiology, management, and future directions. *Ann Surg*. 2013;257:824–833.

6. Farooq V, van Klaveren D, Steyerberg EW, et al. Anatomical and clinical characteristics to guide decision making between coronary artery bypass surgery and percutaneous coronary intervention for individual patients: development and validation of SYNTAX score II. *Lancet*. 2013;381:639–650.

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| Variables                                      | Univariable analysis | Multivariable analysis |
|-----------------------------------------------|----------------------|-----------------------|
|                                               | OR                   | 95% CI                | P value   | OR                   | 95% CI                | P value   |
| Prior PCI                                      | 0.713                | 0.498–1.019           | 0.063     | Not selected         | —                    | —         |
| FBG <7.0 mmol/L                               | 0.725                | 0.529–0.992           | 0.044     | Not selected         | —                    | —         |
| Total cholesterol                             | 1.126                | 0.990–1.282           | 0.071     | Not selected         | —                    | —         |
| Graft type                                     |                      |                       |           |                      |                      |           |
| Sequential                                    | Reference            | —                     | —         | Reference            | —                    | —         |
| Independent                                   | 2.196                | 1.647–2.929           | <0.001    | 3.094                | 2.186–4.380          | <0.001    |
| Grafting to the right coronary system         | 1.611                | 1.217–2.132           | 0.001     | 2.524                | 1.793–3.554          | <0.001    |
| Years from CABG                               | 1.366                | 1.112–1.678           | 0.003     | 1.282                | 1.026–1.603          | 0.029     |
| (every 5 years added)                         |                      |                       |           |                      |                      |           |

PCI: percutaneous coronary intervention; FBG: fasting blood glucose; CABG: coronary artery bypass grafting; OR: odds ratio; CI: confidence interval.

Table 6

Factors related to graft-level saphenous vein graft failure.
7. Stanetic BM, Ostojc M, Campos CM, et al. Appropriateness of myocardial revascularization assessed by the SYNTAX score II in a country without cardiac surgery facilities; PROUST study. *Int J Cardiol*. 2017;227:478–484.

8. Joint committee issued Chinese guideline for the management of dyslipidemia in adults. 2016 Chinese guideline for the management of dyslipidemia in adults. *Zhonghua Xin Xue Guan Bing Za Zhi*. 2016;44:833–853 [in Chinese].

9. Working Group of the prevention after coronary artery bypass surgery. Chinese expert consensus on secondary prevention after coronary artery bypass surgery (2016). *Chin J Thorac Cardiovasc Surg*. 2016;32:577–583 [in Chinese].

10. Fitzgibbon GM, Kafka HP, Leach AJ, Keon WJ, Hooper GD, Burton JR. Coronary bypass graft fate and patient outcome: angiographic follow-up of 5,065 grafts related to survival and reoperation in 1,388 patients during 25 years. *J Am Coll Cardiol*. 1996;28:616–626.

11. Deb S, Cohen EA, Singh SK, et al. Radial artery and saphenous vein patency more than 5 years after coronary artery bypass surgery: results from RAPS (Radial Artery Patency Study). *J Am Coll Cardiol*. 2012;60:28–35.

12. Cao C, Manganas C, Horton M, et al. Angiographic outcomes of radial artery versus saphenous vein in coronary artery bypass graft surgery: a meta-analysis of randomized controlled trials. *J Thorac Cardiovasc Surg*. 2013;146:255–261.

13. Martínez-González B, Reyes-Hernández CG, Quiroga-Garza A, et al. Conduits used in coronary artery bypass grafting: a review of morphological studies. *Ann Thorac Cardiovasc Surg*. 2017;23:55–65.

14. Sabik JF 3rd. Understanding saphenous vein graft patency. *Circulation*. 2011;124:273–275.

15. Christenson JT, Simonet F, Schmuizger M. Sequential vein bypass grafting: tactics and long-term results. *Cardiovasc Surg*. 1998;6:389–397.

16. Vural KM, Sener E, Taşdemir O. Long-term patency of sequential and individual saphenous vein coronary bypass grafts. *Eur J Cardiothorac Surg*. 2001;19:140–144.

17. Oz BS, Iyem H, Akay HT, et al. Mid-term angiographic comparison of sequential and individual anastomosis techniques for diagonal artery. *J Card Surg*. 2006;21:471–474.

18. Farsak B, Tokmakoglu H, Kandemir O, et al. Angiographic assessment of sequential and individual coronary artery bypass grafting. *J Card Surg*. 2003;18:524–529; discussion 530–531.

19. Li J, Liu Y, Zheng J, et al. The patency of sequential and individual vein coronary bypass grafts: a systematic review. *Ann Thorac Surg*. 2011;92:1292–1298.

20. Cho KR, Kim JS, Choi JS, Kim KB. Serial angiographic follow-up of grafts one year and five years after coronary artery bypass surgery. *Eur J Cardiothorac Surg*. 2006;29:511–516.

21. Hess CN, Lopes RD, Gibson CM, et al. Saphenous vein graft failure after coronary artery bypass surgery: insights from PREVENT IV. *Circulation*. 2014;130:1445–1451.

22. Yoshida S, Numata S, Tsutsumi Y, et al. Short- and long-term results of radial artery and saphenous vein grafts in the right coronary system: a propensity-matched study. *Surg Today*. 2017;47:335–343.

Edited by Jing-Ling Bao and Pei-Fang Wei