Effect of drug-eluting stents on 1-year risk of new-onset atrial fibrillation in patients with acute myocardial infarction treated with percutaneous coronary intervention

Fa-Chang Yu, MD, Ya-Hui Chang, MSc, I-Ming Chen, PhD, Hung-Yi Liu, MSc, Chao-Feng Lin, PhD, Li-Nien Chien, PhD*

Abstract
The use of a drug-eluting stent (DES) in patients with acute myocardial infarction (AMI) treated with percutaneous coronary intervention is conventional. However, the effect of DES on new-onset atrial fibrillation (AF) after AMI still remains unclear.

By using data from Taiwan’s National Health Insurance Research Database, a total of 17,741 patients with ST-elevation myocardial infarction (STEMI) and 17,631 patients with non-ST-elevation myocardial infarction (NSTEMI) treated with percutaneous coronary intervention were analyzed to investigate the risk of new-onset AF after index admission of AMI.

There were 26.5% (N = 4696) of patients with STEMI and 39.5% (N = 6967) of patients with NSTEMI who received DES implantation. Upon 1-year follow-up, we observed that DES placement was associated with a reduced 1-year risk of new-onset AF in the patients with NSTEMI (adjusted hazard ratio [aHR] = 0.74, 95% confidence interval [CI] = 0.59–0.93, P = .009) after adjustment for clinical relevant variables. This benefit was consistent with that in the patients with NSTEMI who were ≥75 years old, had a CHA2DS2-VASc score of ≥2, and did not receive intra-aortic balloon pump insertion (aHR = 0.72, 95% CI = 0.53–0.98, P = .039; aHR = 0.73, 95% CI = 0.586–0.92, P = .006; and aHR = 0.71, 95% CI = 0.56–0.90, P = .004; respectively). However, DES placement had a neutral effect on the risk of new-onset AF in the patients with STEMI.

Compared with the use of BMS, the use of DES might reduce the risk of new-onset AF in patients with NSTEMI.

Abbreviations: AF = atrial fibrillation, AFL = atrial flutter, aHR = adjusted hazard ratio, AMI = acute myocardial infarction, BMS = bare-metal stent, CI = confidence interval, DAPT = dual antiplatelet therapy, DES = drug-eluting stent, IABP = intra-aortic balloon pump, NHI = National Health Insurance, NHIRD = National Health Insurance Research Database, NSTEMI = non-ST-elevation myocardial infarction, OAC = oral anticoagulant, PCI = percutaneous coronary intervention, STEMI = ST-elevation myocardial infarction.

Keywords: acute myocardial infarction, atrial fibrillation, drug-eluting stent

1. Introduction
Atrial fibrillation (AF) is a common arrhythmia that occurs during acute myocardial infarction (AMI), with the incidence reported to vary between 6% and 21%.[1] Among all types of AF in the setting of AMI, new-onset AF carries an excess risk of short- and long-term adverse outcomes.[2–4] Patients admitted for AMI who develop new-onset AF have an approximately 30% increased risk of a composite cardiovascular outcome (all-cause mortality, reinfarction, or ischemic stroke) within 90 days after discharge.[4] Additionally, patients with new-onset AF occurring...
coronary intervention (PCI) for patients with AMI yields lower
following AMI.
importance of prevention of the occurrence of new-onset AF
pared with patients without AF. These data indicate the
compared with the use of bare-metal stents (BMS).\[9,10\] Despite
of cardiac death, reinfarction, and target vessel revascularization
AMI treated invasively with PCI is associated with reduced rates
strated that the use of drug-eluting stents (DES) in patients with
stent types which was dif
investigate the association between the risk of new-onset AF and
Taiwan. This mentioned situation provided an opportunity to
use is fully covered by National Health Insurance (NHI) in
Taiwan; had died at the index AMI admission; had preexisting
AF or atrial flutter (AFL); had a record of AF or AFL at index
AMI hospitalization; and had received chronic vitamin K antagonist or non-vitamin K
antagonist oral anticoagulants that may negatively influence the
tolerance of dual antiplatelet therapy (DAFT) and preclude the
physicians’ choice of DES were also excluded.\[12\] In addition,
patients who had received prior PCI before the index AMI
admission and who did not receive PCI or stent implantation
during the index AMI admission were excluded. Patients
diagnosed as having 2 different subtypes of AMI, STEMI, and
NSTEMI, were identi
dated from
2.2. Study cohort
Within the retrospective cohort, we included patients who had
received a primary diagnosis of AMI (ICD-9-CM code 410)
based on the discharge claim between 2007 and 2013. The date of
admission for AMI was considered the index of AMI. We
excluded patients who were <20 years old; were not residents of
Taiwan; had died at the index AMI admission; had preexisting
AF or atrial flutter (AFL); had a record of AF or AFL at index
AMI admission; and had received coronary artery bypass
grafting, ventricular assist device support, extracorporeal
membrane oxygenation, or heart transplantation during the
study period. Patients who had medical conditions requiring
anticoagulant treatment (eg, deep vein thrombosis, pulmonary
thromboembolism, any type of AF or AFL, and valvular
replacement surgery with mechanical or bioprothetic valves) and
received chronic vitamin K antagonist or non-vitamin K
antagonist oral anticoagulants that may negatively influence the
tolerance of dual antiplatelet therapy (DAFT) and preclude the
physicians’ choice of DES were also excluded.\[12\] In addition,
patients who had received prior PCI before the index AMI
admission and who did not receive PCI or stent implantation
during the index AMI admission were excluded. Patients
diagnosed as having 2 different subtypes of AMI, STEMI, and
NSTEMI, were identified. Figure 1 presents the patient selection
process. Patients who had received any DES and BMS
implantation during PCI at their index AMI hospitalization
constituted the DES and BMS groups, respectively.

2.3. Main outcome measures
The principal outcome in the present study was the new-onset AF
requiring new prescriptions of vitamin K antagonist or non-
vitamin K antagonist oral anticoagulants that can be defined from
diagnostic claim of ICD-9-CM code of 427.31 and drug claims.
The patients were followed up for 1 year, and the data of those
who died or did not have the events of interest during the study
periods were treated as censored cases.

2.4. Statistical analysis
Continuous variables are presented as mean±standard deviation,
and categorical variables are expressed as percentages.
Comparisons between the baseline characteristics in the DES and
BMS groups were performed using the chi-squared test for
categorical variables and Student t test for continuous variables.
The Kaplan–Meier method was used to report the cumulative
incidence of events over time, and log-rank tests were applied to
evaluate differences between the 2 groups. A multivariable Cox
proportional hazard regression model was used to compare the
risk of new-onset AF between DES groups and BMS groups after
adjustment for clinical relevant variables, comorbidities, and
prescribed medications. Clinical relevant variables included age,
year of AMI admission, complex PCI procedures (ie, PCI for ≥2
vessels), and the use of intra-aortic balloon pump (IABP)
counterpulsation during PCI. Patients’ comorbidities included
diabetes mellitus, hypertension, hyperlipidemia, cerebrovascular
disease, chronic kidney disease, congestive heart failure, chronic
obstructive pulmonary disease or asthma, dementia, Parkinson
disease, osteoarthritis, rheumatoid arthritis or rheumatism, and
CHA2DS2–VASc scores (the sum of risk factors for congestive
heart failure, hypertension, age ≥75 years, diabetes mellitus,
stroke, vascular disease, age of 65 to 74 years, and sex category of
women).\[13,14\] Prescribed medications included angiotensin-
converting enzyme inhibitors/angiotensin II receptor blockers,
beta-blockers, nitrate, antiplatelets, statins, proton pump
inhibitors, nonsteroidal anti-inflammatory drugs, and steroids.
A subgroup analysis of patients who were ≥75 years old, had a
CHA2DS2–VASc score ≥2, and had received treatment with or
without IABP insertion during AMI admission was also
performed. Due to enrichment of data from the NHIRD, no
data were missing during adjustment for differences in baseline
characteristics. The ICD-9-CM codes for disease diagnosis and
the anatomical therapeutic chemical codes for medication are listed in Supplementary Table A, http://links.lww.com/MD/E733. All analyses were performed using SAS/STAT 9.4 software (SAS Institute Inc., Cary, NC) and STATA 14 software (Stata Corp LP, College Station, TX). P < .05 was considered significant.

3. Results

3.1. Baseline characteristics

Among the patients admitted for AMI treated invasively by PCI with stent placement, 50.2% had STEMI and 33.0% had received DES placement. The rate of receiving DES placement was lower in the patients with STEMI than that in those with NSTEMI (26.5% vs 39.5%) (Table 1). In both STEMI and NSTEMI cohorts, the patients who had received DES placement were younger and had lower IABP use, fewer prior cerebrovascular disease events, more complex PCI procedures, and more prescriptions of angiotensin-converting enzyme inhibitors/angiotensin II receptor blockers, beta-blockers, nitrates, and statins compared with patients who had received BMS placement (Table 1).

3.2. Use of DES and risk of new-onset AF in patients with STEMI

The cumulative incidence rate of new-onset AF in DES group was similar to that of the BMS group during the 1-year follow-up (Fig. 2A). Additionally, the incidence rates (per 100 person-year) of new-onset AF were also similar between the DES group (1.52, 95% confidence interval [CI] = 1.20–1.92) and BMS groups (1.64, 95% CI = 1.43–1.88) (Table 2). Any DES placement in patients with STEMI did not show a reduced risk of new-onset AF after adjustment for all variables compared with BMS placement (adjusted hazard ratio [aHR] = 1.00, 95% CI = 0.76–1.32, P = .989) (Table 2).

3.3. Use of DES and risk of new-onset AF in patients with NSTEMI

The cumulative incidence rate of new-onset AF in the DES group was lower than that in the BMS group (Fig. 2B). Additionally, the incidence rates (per 100 person-year) of new-onset AF were lower in the DES group (1.79, 95% CI = 1.49–2.14) than that in the BMS group (2.55, 95% CI = 2.26–2.89) (Table 2). After adjusting for all variables, we found that any DES use in
patients with NSTEMI was associated with a reduced risk of new-onset AF (aHR = 0.74, 95% CI = 0.59–0.93, P = 0.009) compared with BMS use (Table 2).

### 3.4. Subgroup analysis for patients who were ≥75 years of age, had a CHA2DS2-VASc score of ≥2, and who received treatment with or without IABP insertion

Of the NSTEMI patients aged ≥75 years, the incidence rates of new-onset AF were lower in the DES group than in the BMS group, with an aHR of 0.72 (95% CI = 0.53–0.98, P = 0.039).

Additionally, the use of DES was associated with a reduced risk of new-onset AF (aHR = 0.73, 95% CI = 0.58–0.92, P = 0.06) in the patients with NSTEMI who had a CHA2DS2-VASc score of ≥2 (Table 3). However, the use of DES did not show a reduced risk of new-onset AF in the patients with STEMI who were ≥75 years old or had a CHA2DS2-VASc score of ≥2 (Table 3).

In both patients with STEMI and NSTEMI who received IABP insertion during PCI, any DES use did not show a reduced risk of new-onset AF. Among the patients with NSTEMI who did not receive IABP insertion during PCI, DES placement was associated with a reduced risk of new-onset AF, with an aHR of 0.71 (95% CI = 0.56–0.90, P = 0.004) (Table 3).

### 4. Discussion

The current study revealed that the use of DES was associated with a reduced 1-year risk of new-onset AF in the patients with NSTEMI treated invasively with PCI. These benefits were also observed in the patients with NSTEMI who were ≥75 years old, had a CHA2DS2-VASc score of ≥2, and did not receive IABP insertion during PCI. However, the use of DES did not show a reduced risk of new-onset AF in the patients with STEMI treated with PCI.
STEMI DES 4597 70 1.52 (1.20–1.92) 
NSTEMI DES 6718 120 1.79 (1.49–2.01)

ST-elevation myocardial infarction. A retrospective study that analyzed 652 patients with AMI and cardiogenic shock enrolled in the Intra-aortic Balloon Pump in Cardiogenic Shock II trial revealed that the 1-year risk of mortality and reinfarction of patients treated with DES was similar to those of patients treated with BMS. However, we did not observe that DES use was associated with a reduced risk of new-onset AF in patients with IABP insertion compared with BMS placement. This might be due to the relatively small numbers of patients with IABP insertion and hence, a statistically significant difference was not observed. This finding of the present study must be confirmed using an appropriately powered randomized clinical trial.

The current guidelines recommend that DAPT should be given for at least 12 months in patients with AMI regardless of DES or BMS implantation. The administration of triple therapy, including DAPT and an oral anticoagulant (OAC), is usually required for patients who develop new-onset AF following AMI to prevent the occurrence of ischemic stroke. However, triple therapy results in a 2- to 3-fold increase in bleeding complications compared with OAC therapy alone. A possible clinical implication of the present study is that DES placement be considered in patients with NSTEMI to reduce not only the risk of new-onset AF but also the requirement of OAC therapy and the occurrence of potential drug-related bleeding complications.

Any disturbance of atrial architecture potentially increases the susceptibility to AF. Atrial ischemia from coronary artery disease tends to increase the atrial pressure, cause atrial dilation, and result in structural and electrophysiological abnormalities, which promote abnormal impulse generation and propagation. A reduced risk of new-onset AF and target vessel revascularization associated with DES use might lead to decreased recurrent atrial ischemia, limited atrial remodeling, and a reduced risk of AF formation. In the Swedish Coronary Angiography and Angioplasty Registry, PCI with DES placement was associated with a lower risk of stent thrombosis compared to that with BMS placement. Additionally, the superiority of DES over BMS for a lower risk of stent thrombosis became obvious in early months during the follow-up period in the Swedish Coronary Angiography and Angioplasty Registry data, which might also explain our findings. In the current study, patients with STEMI were observed to have a reduced risk of new-onset AF associated with DES use in the patients with NSTEMI treated invasively with PCI. The aforementioned results are consistent with those of the patients with NSTEMI who were ≥75 years old and had a CHA2DS2-VASc score of ≥2, as seen in previous studies.

Table 2

| Study cohort | Stent type | Person-yr | No. of AF | Incidence (95% CI) | Adjusted HR (95% CI) | P-value |
|--------------|-----------|-----------|-----------|--------------------|----------------------|---------|
| STEMI        | DES       | 4597      | 70        | 1.52 (1.20–1.92)   | 1.00 (0.76–1.32)     | .989    |
|              | BMS       | 12,574    | 206       | 1.84 (1.43–2.38)   | 1.00 (Ref.)          |         |
| NSTEMI       | DES       | 6718      | 120       | 1.79 (1.49–2.14)   | 0.74 (0.59–0.93)     | .009    |
|              | BMS       | 9909      | 253       | 2.55 (2.26–2.89)   | 1.00 (Ref.)          |         |

AF = atrial fibrillation, BMS = bare-metal stent, CI = confidence interval, DES = drug-eluting stent, HR = hazard ratio, No. = number, NSTEMI = non-ST-elevation myocardial infarction, STEMI = ST-elevation myocardial infarction.

*Adjusted HR was estimated by multivariable Cox proportional hazard regression with adjustment for clinical relevant variables, comorbidities, and prescribed medications that were listed in Table 1.
mostly younger and had fewer comorbidities compared with patients with NSTEMI, as observed in previous studies.\textsuperscript{4,13} The favorable baseline characteristics of patients with STEMI themselves lead to a lowered risk of AF regardless of stent types.

The price of each DES paid by patients in Taiwan was approximately USD $2,300 in the year of 2007 whereas the cost of BMS was fully covered by NHI. This mentioned gap in medical cost may introduce a bias in patients undergone either DES or BMS stent implantation, resulting in a difference in the real-world data, which can reflect the actual application of DES in the present study. Besides, the patients with a high bleeding risk were more likely to receive BMS because of undetermined compliance of DAPT. We acknowledged that the socioeconomic status and bleeding risks would influence the choice of DES in the present study, as also seen in other research\textsuperscript{23}; however, they might not be associated with the risk of AF. To estimate the association between the DES use and AF, this study used multiple regression methods to adjust potential confounding factors listed in Table 1. There were still some unobserved confounders that might bias the study results. Despite these limitations, our results presented a real-world data analysis bias should be non-differential between 2 exposure groups that was more likely to result in underestimating the effect of DES on the risk of AF. Finally, to clearly compare the effect of DES on the risk of new-onset AF, we only included the patients who were eligible for the current study, resulting in 60\% of the initial population being excluded in the final analysis. Thus, the potential selection bias might exist. Moreover, the results cannot be generalized to all the patients with AMI. Future prospective, randomized trials are warranted to confirm our findings.

5. Conclusions

In this population-based cohort study, the use of DES, compared with the use of BMS, is associated with a decreased risk of new-onset AF in the patients with NSTEMI treated with PCI at 1-year follow-up; these results are consistent with those for patients with a high risk to develop AF. Overall, our findings suggest that DES

---

### Table 3

Subgroup analysis: 1-yr incidence (per 100 person-yr) and the risk of new-onset AF in patients with AMI who were \(\geq 75\) yr of age, had a CHA\textsubscript{2}-DS\textsubscript{2}-VASc score of \(\geq 2\), and had received PCI with and without IABP insertion at the index of AMI admission.

| Study cohort | Stent type | Person-year | No. of AF | Incidence (95\% CI) | Adjusted HR (95\% CI) | P-value |
|--------------|------------|-------------|-----------|---------------------|-----------------------|---------|
| Age \(\geq 75\) yr | DES | 651 | 37 | 5.68 (4.12–7.84) | 1.22 (0.82–1.79) | .325 |
| | BMS | 2139 | 98 | 4.58 (3.76–5.58) | 1.00 (Ref.) |        |
| | NSTEMI | DES | 1442 | 62 | 4.30 (3.35–5.52) | 0.72 (0.53–0.98) | .039 |
| | BMS | 2447 | 143 | 5.84 (4.96–6.89) | 1.00 (Ref.) |        |
| CHA\textsubscript{2}-DS\textsubscript{2}-VASc \(\geq 2\) | STEMI | DES | 3624 | 66 | 1.82 (1.43–2.32) | 1.01 (0.76–1.35) | .929 |
| | BMS | 9927 | 191 | 1.92 (1.67–2.22) | 1.00 (Ref.) |        |
| | NSTEMI | DES | 5668 | 116 | 2.05 (1.71–2.46) | 0.73 (0.58–0.92) | .006 |
| | BMS | 8368 | 250 | 2.99 (2.64–3.38) | 1.00 (Ref.) |        |
| With IABP | STEMI | DES | 266 | 6 | 2.26 (1.01–5.02) | 0.80 (0.31–2.02) | .630 |
| | BMS | 1015 | 32 | 3.15 (2.23–4.46) | 1.00 (Ref.) |        |
| | NSTEMI | DES | 215 | 13 | 6.05 (3.52–10.4) | 1.27 (0.59–2.76) | .542 |
| | BMS | 482 | 22 | 4.56 (3.00–6.93) | 1.00 (Ref.) |        |
| Without IABP | STEMI | DES | 4331 | 64 | 1.48 (1.16–1.89) | 1.03 (0.77–1.38) | .841 |
| | BMS | 11,558 | 174 | 1.51 (1.30–1.75) | 1.00 (Ref.) |        |
| | NSTEMI | DES | 6503 | 107 | 1.65 (1.36–1.99) | 0.71 (0.56–0.90) | .004 |
| | BMS | 9427 | 231 | 2.45 (2.15–2.79) | 1.00 (Ref.) |        |

AF = atrial fibrillation, AMI = acute myocardial infarction, BMS = bare-metal stent, CHA\textsubscript{2}-DS\textsubscript{2}-VASc = congestive heart failure, hypertension, age \(\geq 75\) yr, diabetes, stroke, vascular disease, age of 65 to 74 years, and female sex, CI = confidence interval, DES = drug-eluting stent, HR = hazard ratio, IABP = intra-aortic balloon pump, No. = number, NSTEMI = non-ST-elevation myocardial infarction, STEMI = ST-elevation myocardial infarction.

* Adjusted HR was estimated by multivariable Cox proportional hazard regression with adjustment for clinical relevant variables, comorbidities, and prescribed medications that were listed in Table 1.
placement significantly hinders new-onset AF following NSTEMI, whereas the use of DES in the patients with STEMI results in a neutral effect compared with BMS placement.

Author contributions

Conceptualization: Fa-Chang Yu.  
Data curation: Fa-Chang Yu, Hung-Yi Liu, Chao-Feng Lin, Li-Nien Chien.  
Formal analysis: Hung-Yi Liu, Chao-Feng Lin, Li-Nien Chien.  
Methodology: Fa-Chang Yu, Chao-Feng Lin, Li-Nien Chien.  
Resources: I-Ming Chen.  
Validation: Ya-Hui Chang, Hung-Yi Liu.  
Visualization: Ya-Hui Chang, I-Ming Chen.  
Writing – original draft: Fa-Chang Yu, Chao-Feng Lin, Li-Nien Chien.  
Writing – review & editing: Fa-Chang Yu, Ya-Hui Chang, I-Ming Chen, Hung-Yi Liu, Chao-Feng Lin, Li-Nien Chien.

References

[1] Schmitt J, Duray G, Gersh BJ, et al. Atrial fibrillation in acute myocardial infarction: a systematic review of the incidence, clinical features and prognostic implications. Eur Heart J 2009;30:1038–45.  
[2] Jabre P, Jouven X, Adnet F, et al. Atrial fibrillation and death after myocardial infarction: a community study. Circulation 2011;123:2094–100.  
[3] Jabre P, Roger VL, Murad MH, et al. Mortality associated with atrial fibrillation in patients with myocardial infarction: a systematic review and meta-analysis. Circulation 2011;123:1587–93.  
[4] Batra G, Svensblad B, Held C, et al. All types of atrial fibrillation in the setting of myocardial infarction are associated with impaired outcome. Heart 2016;102:926–33.  
[5] Steg PG, James SK, Atar D, et al. Task force on the management of ST-segment elevation myocardial infarction of the European Society of Cardiology (ESC), ESC Guidelines for the management of acute myocardial infarction in patients presenting with ST-segment elevation. Eur Heart J 2012;33:2569–619.  
[6] Roffi M, Patrono C, Collet JP, et al. 2015 ESC Guidelines for the management of acute coronary syndromes in patients presenting without persistent ST-segment elevation: Task Force for the Management of Acute Coronary Syndromes in Patients Presenting without Persistent ST-Segment Elevation of the European Society of Cardiology (ESC). Eur Heart J 2016;37:267–315.  
[7] O’Gara PT, Kushner FG, Ascheim DD, et al. 2013 ACCF/AHA guideline for the management of ST-elevation myocardial infarction: a report of the American College of Cardiology Foundation/American Heart Association Task Force on Practice Guidelines. Circulation 2013;127:e362–425.  
[8] Amsterdam EA, Wenger NK, Brindis RG, et al. 2014 AHA/ACC guideline for the management of patients with non-ST-elevation acute coronary syndromes: a report of the American College of Cardiology/American Heart Association Task Force on Practice Guidelines. Circulation 2014;130:e344–426.  
[9] Råber L, Kellbaek H, Taniwaki M, et al. Biolimus-eluting stents with biodegradable polymer versus bare-metal stents in acute myocardial infarction: two-year clinical results of the COMFORTABLE AMI trial. Circ Cardiovasc Interv 2014;7:355–64.  
[10] Sabaté M, Brugaletta S, Cequier A, et al. Clinical outcomes in patients with ST-segment elevation myocardial infarction treated with everolimus-eluting stents versus bare-metal stents (EXAMINATION): 5-year results of a randomised trial. Lancet 2016;387:357–66.  
[11] National Health Insurance: Review Legislations of Medical Institutes, update 2013/04/09. Available at: http://www.nhi.gov.tw/English/webdata/webdata.aspx?menu=11&menu_id=295&webdata_id=2440 [access date June 05, 2016].  
[12] Dadekian G, Kaplan AV, Chang CH, et al. Atrial fibrillation and stent selection (bare metal vs drug eluting) (from Medicare claims). Am J Cardiol 2017;120:1557–61.  
[13] Lip GY, Nieuwaart R, Pisters R, et al. Refining clinical risk stratification for predicting stroke and thromboembolism in atrial fibrillation using a novel risk factor-based approach: the Euro Heart Survey on atrial fibrillation. Chest 2010;137:263–72.  
[14] Saliba W, Gronich N, Barnett-Ginoss O, et al. Usefulness of CHADS2 and CHA2DS2-VASc scores in the prediction of new-onset atrial fibrillation: a population-based study. Am J Med 2016;129:843–9.  
[15] Steg PG, Goldberg RJ, Gore JM, et al. Baseline characteristics, management practices, and in-hospital outcomes of patients hospitalized with acute coronary syndromes in the Global Registry of Acute Coronary Events (GRACE). Am J Cardiol 2002;90:358–63.  
[16] Thiele H, Zeymer U, Neumann FJ, et al. Intra-aortic balloon counterpulsation in acute myocardial infarction complicated by cardiogenic shock (IAP-SHOCK II): final 12-month results of a randomised, open-label trial. Lancet 2013;382:1638–45.  
[17] Ledwoch J, Fuernau G, Desch S, et al. Drug-eluting stents versus bare-metal stents in acute myocardial infarction with cardiogenic shock. Heart 2017;103:1177–84.  
[18] Levine GN, Bates ER, Bittl JA, et al. 2016 ACC/AHA guideline focused update on duration of dual antiplatelet therapy in patients with coronary artery disease: a report of the American College of Cardiology/American Heart Association Task Force on Clinical Practice Guidelines. Circulation 2016;134:e123–135.  
[19] Windecker S, Koll P, Alfonso F, et al. 2014 ESC/EACTS guidelines on myocardial revascularization: the Task Force on Myocardial Revascularization of the European Society of Cardiology (ESC) and the European Association for Cardio-Thoracic Surgery (EACTS) developed with the special contribution of the European Association of Percutaneous Cardiovascular Interventions (EAPCI). Eur Heart J 2014;35:2541–619.  
[20] January CT, Wann LS, Alpert JS, et al. 2014 AHA/ACC/HRS guideline for the management of patients with atrial fibrillation: a report of the American College of Cardiology/American Heart Association Task Force on Practice Guidelines. Circulation 2014;130:e199–267.  
[21] Kirchhof P, Benussi S, Kotecha D, et al. 2016 ESC guidelines for the management of atrial fibrillation developed in collaboration with EACTS. Eur Heart J 2016;37:2893–962.  
[22] Sarno G, Lagerqvist B, Frobert O, et al. Lower risk of stent thrombosis and restenosis with unrestricted use of ‘new-generation’ drug-eluting stents: a report from the nationwide Swedish Coronary Angiography and Angioplasty Registry (SCAAR). Eur Heart J 2012;33:606–13.  
[23] Burgers LT, Mckellan EA, Hoeter IE, et al. Treatment variation in stent choice in patients with stable or unstable coronary artery disease. Neth Heart J 2016;24:110–9.