



## Original Article

# Barriers to Early Discharge after Elective Percutaneous Coronary Intervention (BED PCI): A Single-Center Study



Francis D. Graziano<sup>b</sup>, Sandeep Banga<sup>a,c,\*</sup>, Denise K. Busman<sup>a,b</sup>,  
Purushothaman Muthusamy<sup>a</sup>, David H. Wohns<sup>a,b</sup>

<sup>a</sup>Frederik Meijer Heart & Vascular Institute, Grand Rapids, MI, USA

<sup>b</sup>Spectrum Health, Grand Rapids, MI, USA

<sup>c</sup>University of Illinois College of Medicine at Peoria, Peoria, IL, USA

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## ABSTRACT

**Objective:** To identify patient characteristics and procedural factors that may play a role in hindering same-day discharge (SDD) practices.

**Background:** Multiple studies have shown the safety and cost effectiveness of SDD following elective percutaneous coronary intervention (PCI), but factors that hinder SDD practices have not been thoroughly studied.

**Material and Methods:** A retrospective comparative analysis of elective PCI patients who had an overnight stay (OS) (n = 345) vs. SDD patients (n = 222) was conducted to identify significant differences between the two groups in baseline patient characteristics, procedural, and postprocedural factors.

**Results:** Comparing OS to SDD patients, OS patients had a lower prevalence of radial access (20.29% vs. 39.64%,  $P < 0.0001$ ); a higher incidence of suboptimal angiographic results (14.49% vs. 1.80%,  $P = 0.0027$ ); CRCL values lower than 60 mL/min (26.38% vs. 15.32%,  $P = 0.0019$ ); and greater femoral vascular site hemostasis with manual compression (69.09% vs. 36.57%,  $P = 0.0027$ ). OS patients received larger sheath sizes ( $P = 0.0209$ ), more bivalirudin (45.80% vs. 36.70%) and glycoprotein IIb/IIIa inhibitors (5.51% vs. 2.25%), but less heparin (51.30% vs. 53.21%). Chest pain (8.12% vs. 0.92%,  $P = 0.0042$ ) and vascular access site concerns (20.58% vs. 0%,  $P = 0.0027$ ) were more common among OS patients.

**Conclusions:** Pre-, peri-, and post-procedural factors play a role in SDD eligibility. Understanding factors that limit as well as those that facilitate SDD may enable institutions to establish or enhance a SDD program.

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## 1. Introduction

Recent advances in the approach to PCI including antithrombotic therapy, greater radial access and vascular closure devices have led to significant improvements in short- and long-term outcomes for percutaneous coronary intervention (PCI).<sup>1–4</sup> These advances have greatly increased our ability to perform elective coronary intervention and discharge patients within one day. Numerous retrospective and single-center studies have demonstrated that same-day discharge (SDD) following an elective PCI can be both efficacious and safe with rare complications.<sup>5–19</sup> In

addition to safety, studies also show that SDD practices for an uncomplicated PCI can have potential benefits including cost savings for the hospital, increased patient satisfaction, more open inpatient beds, and improved alignment between billing practices and payer expectations).<sup>20–21</sup> Although an overnight stay (OS) after elective PCI is still the standard approach for care in the majority of institutions, many are currently aiming to increase the frequency of their SDD practice.

Despite the effort to increase the frequency of SDDs, institutions are often deterred by the unpredictability of complications and the fear of adverse events. To increase the frequency of SDD, features that limit SDD discharge have not been well delineated. Patients discharged on the same day as their procedure may possess different baseline, procedural, and postprocedural characteristics when compared to those of patients who are admitted for an OS. Comparing these two groups of patients can help to identify characteristics and factors that are hindering SDD practices.

**Abbreviations:** PCI, Percutaneous coronary intervention; SDD, Same-day discharge; OS, Overnight stay; TR, Transradial; TF, Transfemoral.

\* Corresponding author. Present Address: Department of Cardiology, University of Illinois College of Medicine at Peoria, 530 NE Glen Oak Ave., Peoria, IL 61637, USA.

E-mail addresses: [drsbanga@uicomp.uic.edu](mailto:drsbanga@uicomp.uic.edu), [drsbanga@gmail.com](mailto:drsbanga@gmail.com) (S. Banga).

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Previous studies have compared SDD patients to OS patients after PCI procedures.<sup>7,8,11,15,19,22–26</sup> However, these studies tend to focus on major complications of PCI (death, myocardial infarction, stroke, etc.). The primary focus of our study was to identify conventional clinical factors and characteristics that play a role in a patient's ultimate inpatient admission. The common concerns that cause patient admission after PCI have not been studied in current SDD literature, especially in the United States. We sought to identify common factors that prevent patients from being discharged the same day following elective PCI by comparing OS and SDD patients in the context of a robust SDD program.

## 2. Material and methods

### 2.1. Study Sample

This single-center study was a retrospective assessment of collected data from 567 patients who underwent an elective PCI procedure at the Fred and Lena Meijer Heart Center, in Grand Rapids, Michigan, from January 2012 through December 2012. All patients presented to the facility as outpatients for either a planned or an ad hoc elective PCI. Of the 567 patients who underwent an elective PCI, 345 patients were admitted to the hospital. A total of 222 patients met the criteria of our institution's current SDD guidelines (Table 1) and were discharged on the same day as the

elective PCI. The study was approved by the organization's Institutional Review Board, which determined that informed consent was not required as the procedures adhered to the standard of care and only the length of post-procedure observation was subject to change. All patients' pre-, peri-, and post-procedural data and details were recorded in a large institutional review board-approved database. Information from the database was de-identified before use.

### Definitions

Definitions used for this study included the following:

1. Elective PCI: Any coronary revascularization performed on a stable patient presenting to the institution for a planned or an ad hoc PCI.
2. Suboptimal angiographic result: A residual stenosis of >40% after angioplasty, as estimated by visual assessment.
3. Vascular site access concerns: Any vascular site complications, such as bleeding that required transfusion, retroperitoneal hemorrhage, arteriovenous fistula, pseudoaneurysm, thrombosis, arterial dissection, minor bleeding, or hematomas.
4. Femoral closure device: Vascular closure devices to achieve hemostasis, such as Mynx (AccessClosure, Santa Clara, CA);

**Table 1**  
Same-Day Discharge Guidelines.

Preprocedure	Periprocedure	Postprocedure	Discharge criteria
Age ≤75 years	No occluded target vessel post-PCI in vessel with TIMI flow ≥1 prior to PCI	Stable blood pressure without ongoing treatment (e.g., vasopressors, nitroglycerin, etc.)	Stable vital signs; afebrile
BMI ≤40 (Kg/m <sup>2</sup> )	No dissection, side branch occlusion, angiographic thrombus and perforation	No access site complications: 1. Persistent bleeding 2. Hematoma ≥5 cm 3. Pseudoaneurysm 4. Limb ischemia 5. Retroperitoneal bleeding	No cardiac chest pain
EF ≥40%	Absent no-reflow or slow-flow phenomenon	No blood transfusion	Access site stable; no hematoma ≥5 cm
No allergy to aspirin/clopidogrel/contrast agents	Non-utilization of enoxaparin or GP IIb/IIIa inhibitors infusions	Anticipated discharge before 10 pm	No nausea, vomiting; taking oral fluids without difficulty
Hemoglobin ≥10 mg/dl	No triple vessel disease, unprotected left main PCI, or vein graft intervention		Voided once before discharge
Creatinine clearance ≥60 mL/min	≤3 stents used		Off from bed rest for ≥90 min
Platelets ≥100,000/μL	Procedure duration ≤3 h		Ambulated in unit without complication
INR ≤1.5 (if on warfarin)	GFR calculated contrast limit not exceeded		
No active COPD (wheezing or on home oxygen support)	No vasopressors, ventricular pacing, or over-sedation		
Acute MI >14 days (unless staged procedure)			
Adequacy of support			
Postdischarge <sup>a</sup> :			
Social or cognitive capacity			
Lives within 60 minutes from hospital			
Transportation availability			

BMI, body mass index; COPD, chronic obstructive pulmonary disease; EF, ejection fraction; GFR, glomerular filtration rate; GP, glycoprotein; INR, international normalized ratio; MI, myocardial infarction; PCI, percutaneous coronary intervention; TIMI, thrombolysis in myocardial infarction.

<sup>a</sup> A mandatory criterion for same-day discharge.

**Table 2**  
Procedural Data Collected for OS and SDD Patients.

Preprocedure	Periprocedure	Postprocedure
<ul style="list-style-type: none"> <li>• Age</li> <li>• Gender</li> <li>• Race</li> <li>• BMI</li> <li>• EF</li> <li>• CRCL</li> <li>• Hgb</li> <li>• Allergy to aspirin</li> <li>• Hypertension</li> <li>• Diabetes</li> <li>• COPD</li> <li>• Prior PCI</li> <li>• Prior CABG</li> <li>• Distance from nearest hospital</li> </ul>	<ul style="list-style-type: none"> <li>• Access (TF or TR)</li> <li>• Femoral closure device</li> <li>• Number of stents implanted</li> <li>• DES or BMS</li> <li>• Sheath size</li> <li>• Heparin use</li> <li>• Bivalirudin use</li> <li>• IIIa/IIb use</li> <li>• Site of the lesion</li> <li>• Amount of contrast dye used</li> <li>• Patent target vessel status post-PCI</li> <li>• Angiographic result status</li> <li>• Residual dissection occurrence</li> <li>• Major side branch occlusion caused by intervention</li> <li>• Angiographic thrombus</li> <li>• Intervention on vein graft</li> <li>• Procedure duration</li> </ul>	<ul style="list-style-type: none"> <li>• Vital sign stability</li> <li>• Cardiac pain status</li> <li>• Puncture site stability</li> <li>• Fluid tolerance</li> <li>• Bleeding/hematoma status at vascular site</li> <li>• Ambulation status</li> <li>• Vasopressor administration</li> <li>• Vasodilator administration</li> <li>• Post-procedure troponin</li> <li>• MACE</li> </ul>

BMI, body mass index; BMS, bare-metal stent; CABG, coronary artery bypass graft; COPD, chronic obstructive pulmonary disease; CRCL, creatinine clearance; DES, drug-eluting stent; EF, ejection fraction; Hgb, hemoglobin; OS, overnight stay; PCI, percutaneous coronary intervention; SDD, same-day discharge; TF, transfemoral; TR, transradial; MACE, major adverse cardiac event.

Angioseal (St. Jude Medical, Minnetonka, MN); or Perclose (Perclose, Redwood City, CA).

## 2.2. Pre-, Peri-, and Post-Procedural Patient Assessment

Pre-, peri-, and post-procedural clinical factors were assessed in both the OS and SDD patient groups (Table 2). Pre-procedure factors assessed included basic demographic information, lab values, medical comorbidities, and prior cardiac procedures. Peri-procedural factors assessed included access site (transfemoral [TF] or transradial [TR]), vascular closure device, number and type of stents, anticoagulation used, site of the lesion, and various measures that assessed the success of the procedure. Post-procedure factors evaluated included vascular site status, vital signs, chest pain, MACE, and administered vasodilators and vasopressors.

## 2.3. Statistical Analyses

Continuous variables were expressed as mean  $\pm$  standard deviation, and categorical variables were expressed as numbers and percentages. The clinical factors of SDD and OS patients were compared using Fischer's exact test or the Pearson chi-square test. Since our data were dichotomous in respect to a patient being OS or SDD, logistic regression was used to model type of discharge (i.e., OS or SDD). To test the validity of the logistic regression model, 1000 simulations of size 100 from the original sample were used. A probability value  $<0.05$  was considered significant. All statistical analyses were performed using SAS version 9.3 (SAS Institute, Cary, NC).

## 3. Results

Exploratory analyses of OS and SDD patients showed that there were relatively no differences between the groups with respect to age, body mass index, and ejection fraction (Table 3). Males accounted for a majority of the OS (71.01%) and SDD (71.62%) groups. White patients also accounted for a majority of the OS (94.49%) and SDD (96.85%) groups, which is expected given the demographics of our referral region. There were no significant differences between OS and SDD patients with respect to prior PCI history, prior CABG history, hypertension, diabetes, or COPD

conditions. However, smoking status and creatinine clearance (CRCL) levels differed significantly between the OS and SDD patients. Patients with a CRCL value below 60 mL/min were more likely to be admitted, whereas patients with a CRCL value greater than 60 mL/min were more likely to be discharged the same day. While most patients in the OS and SDD groups were nonsmokers, there were a higher proportion of SDD patients who were current smokers (23.87%) than OS patients who were current smokers (10.72%).

Four periprocedural factors varied significantly between the OS and SDD groups. These included access site, femoral hemostasis method, anticoagulant, and sheath size (Table 4). Although most patients in both the OS and SDD groups underwent a PCI with femoral access, those patients who did undergo radial access were more likely to be discharged the same day (39.64%) than stay overnight (20.29%). Femoral closure devices were used significantly more often in SDD patients (63.43%) than OS patients (30.09%). Peri-procedural drug administration varied between the OS and SDD groups. SDD patients received heparin more frequently (53.21%) than OS patients (51.30%); OS patients received bivalirudin more frequently (45.80%) than SDD patients (36.70%). In addition, SDD patients were more likely to have smaller sheath sizes.

Three post-procedural factors were also found to be significantly different (Table 4). Suboptimal angiographic results were significantly higher in the OS group (14.49%) than the SDD group (1.80%). OS patients also reported significantly greater frequency of cardiac chest pain after the procedure (8.12%) compared to the SDD patients (0.92%). Furthermore, there were significantly more vascular site access concerns in the OS group (20.58%) than the SDD group (0%).

The logistic regression model analysis revealed that there were four statistically significant predictors for length of stay (Table 5). These predictors included CRCL ( $P$  value  $<0.0001$ ), femoral hemostasis method ( $P$  value  $<0.0001$ ), number of stents implanted ( $P$  value = 0.0042), and suboptimal angiographic result ( $P$  value = 0.0001). Holding all other variables constant, patients were 3.4 times more likely to go home on the same day if their CRCL value was higher than 60 mL/min than patients whose CRCL value was less than 60 mL/min. Similarly, patients were 2.2 times more likely to be discharged the same day if fewer than two stents were placed, and 4.9 times more likely to have SDD if a femoral closure device was used vs. manual compression. Lastly, holding all other

**Table 3**  
Baseline Characteristics of OS and SDD Patients.

Variable	OS n = 345	SDD n = 222	P Value
Age	68.52 ± 11.50	65.10 ± 10.21	
BMI	31.06 ± 6.50	31.64 ± 7.77	
EF	53.6 ± 11.30	55.77 ± 10.94	
Hgb	13.2 ± 1.72	14.08 ± 1.52	
Gender			NS
Male	245/345 = 71.01%	159/222 = 71.62%	
Female	100/345 = 28.99%	63/222 = 28.38%	
Race			NS
White	326/345 = 94.49%	215/222 = 96.85%	
Black	8/345 = 2.32%	4/222 = 1.80%	
Asian	9/345 = 2.61%	2/222 = 0.90%	
Other	2/345 = 0.58%	1/222 = 0.45%	
CRCL			0.0019
0–60 mL/min	91/345 = 26.38%	34/222 = 15.32%	
≥60 mL/min	254/345 = 73.62%	188/222 = 84.68%	
Prior PCI			NS
No	174/345 = 50.43%	108/222 = 48.65%	
Yes	171/345 = 49.57%	114/222 = 51.35%	
Prior CABG			NS
No	272/345 = 78.84%	186/222 = 83.78%	
Yes	73/345 = 21.16%	36/222 = 16.22%	
Medical Comorbidities			NS
No	18/345 = 5.22%	8/222 = 3.60%	
Yes	327/345 = 94.78%	214/222 = 96.40%	
Hypertension			NS
No	43/345 = 12.46%	25/222 = 11.26%	
Yes	302/345 = 87.54%	197/222 = 88.74%	
Diabetes			NS
No	209/345 = 60.58%	143/222 = 64.41%	
Yes	136/345 = 39.42%	79/222 = 35.59%	
Current Smoker			<0.0001
No	308/345 = 89.28%	169/222 = 76.13%	
Yes	37/345 = 10.72%	53/222 = 23.87%	
COPD			NS
No	309/345 = 89.57%	202/222 = 90.99%	
Yes	36/345 = 10.43%	20/222 = 9.01%	

BMI, body mass index; CABG, coronary artery bypass graft; COPD, chronic obstructive pulmonary disease; CRCL, creatinine clearance; EF, ejection fraction; Hgb, hemoglobin; OS, overnight stay; PCI, percutaneous coronary intervention; SDD, same-day discharge.

variables constant, patients were 17.9 times more likely to stay overnight in the hospital if their angiographic results were deemed suboptimal.

#### 4. Discussion

This single-center retrospective study evaluated overnight stay patients compared to same-day discharge patients in order to identify patient baseline, procedural, and post-procedural factors that may cause admission following an elective PCI procedure. The principal findings of our analyses were the following:

1. Pre-procedure characteristics that were significant between the OS and SDD group included CRCL levels and smoking status.
2. Peri-procedural factors that were significantly different included access site, femoral vascular site hemostasis method, anticoagulation, and sheath size.

3. Post-procedural factors differentiating OS vs SDD included suboptimal angiographic result, cardiac chest pain, and vascular site access concerns.
4. Logistic regression analysis found CRCL, femoral vascular site closure method, number of stents, and suboptimal angiographic results as significant predictors of length of stay.

Collectively, these results indicate common baseline characteristics and procedural factors that may play a role in the physician's decision to admit or discharge a patient on the same day as an elective PCI procedure.

This study was designed to review our institution's current SDD criteria and identify factors to increase our utilization of SDD practices. Our institution implemented an SDD program in December 2008; since then SDD practice frequency has gradually increased with no compromise in patient safety. A previous study at our institution found no major adverse cardiac events or major bleeding at 7 days post-PCI in 200 consecutive SDD patients following elective PCI.<sup>5</sup> Consequently, significant factors identified in this study reflect current clinical practices in a United States institution with experience in conducting safe SDD practices. This is important because most of the studies that compare OS to SDD patients after PCI procedures have been conducted in Canada, Europe, and Asia.

A randomized study by Bertrand et al.,<sup>27</sup> found that peri-procedural factors, such as suboptimal angiographic results, played a role in determining whether a patient could be discharged on the same day as their PCI. Our study supports this finding and expands the list to include pre- and post-procedural factors that may play a role in the decision to admit or discharge a patient after an elective PCI. To our knowledge this is the first study to observe differences in each of the three temporal categories (pre-, peri-, and post-procedural factors). It is important to recognize that not only does the procedural outcome play a role in admission, but so do baseline and post-procedural factors. Of even more importance, by identifying factors that may play a role in prompting admission, these factors may be addressed and minimized to increase the frequency of SDD practices.

Finding ways to increase SDD frequency in the United States is important for a number of reasons. SDD practices are associated with increased patient satisfaction, more open inpatient beds, and lower costs for the hospital. A study by Resnic<sup>28</sup> suggested that widespread adoption of same-day discharge in the United States could result in direct savings of more than \$600 million for hospitals per year. Furthermore, Medicare has shifted reimbursement criteria for inpatient status following PCI. Medicare no longer considers elective PCI an inpatient procedure, and reimbursement for elective PCI has shifted from Diagnosis-Related Group reimbursement to Ambulatory Payment Classification reimbursement. Moreover, inappropriate admissions after PCI are now potential targets for Medicare Recovery Audit Contractor audits.

In 2011, ACC/SCAI released guidelines for SDD following PCI.<sup>29</sup> This was a positive step for creating standardized guidelines for use in the United States. However, the ACC/SCAI guidelines are based predominantly on expert consensus and studies conducted outside the United States with different practice patterns. As a result, many United States institutions may be hesitant to adopt these guidelines. Our findings can help to develop SDD practice guidelines that reflect real-world obstacles in the United States. For instance, our study showed that femoral vascular closure devices were associated with increased SDD frequency. Therefore, standardized guidelines for SDD after PCI could recommend the use of femoral closure devices for discharging a patient on the same day as the PCI procedure. Similarly, when evaluating a patient for possible same-day discharge, these criteria could be taken into consideration as an aid in decision-making.

**Table 4**  
Statistical Analysis of Procedural Characteristics Between OS and SDD Patients.

Variable	OS n = 345	SDD n = 222	P Value	Adjusted P Value <sup>a,b</sup>
Access Site			<b>&lt;0.0001</b>	<b>&lt;0.0001</b>
Femoral	268 (77.68%)	134 (60.34%)		
Radial	70 (20.29%)	88 (39.64%)		
Both	7(2.03%)	0 (0%)		
Contrast Dye Used			<b>0.0089</b>	0.1424
Less than 200	206(59.71%)	160 (72.07%)		
200–300	106 (30.72%)	50 (22.52%)		
300+	33 (9.57%)	12 (5.41%)		
Stents			<b>0.0056</b>	.0952
0–1	223 (64.64%)	168 (75.68%)		
2+	122 (35.36%)	54 (24.32%)		
Intervention Location			0.9328	1
Vein graft or multivessel	60(17.39%)	38 (17.12%)		
All other sites	285(82.61%)	184(82.88%)		
Femoral Closure Device			<b>0.0001</b>	<b>0.0027</b>
Manual compression	190/275 (69.09%)	49/134 (36.57%)		
Closure devices	85/275(30.09%)	85/134 (63.43%)		
Anticoagulant			<b>0.0006</b>	<b>0.0120</b>
Bivalirudin	158 (45.80%)	80 (36.70%)		
Heparin	177 (51.30%)	116 (53.21%)		
Heparin and bivalirudin	10 (2.90%)	22 (10.09%)		
Drug-Eluting Stent			0.22	1
No	61(17.68%)	30 (13.51%)		
Yes	284 (82.32%)	191 (86.04%)		
Missing	0 (0%)	1 (0.45%)		
Bare-Metal Stent			0.0222	0.333
No	293 (84.93%)	203 (91.44%)		
Yes	52(14.47%)	19 (8.56%)		
Sheath Size			<b>0.0011</b>	<b>0.0209</b>
5	0	8 (3.60%)		
6	258 (83.50%)	177 (79.73%)		
7	51 (15.07%)	37 (16.67%)		
Suboptimal Angio Result			<b>0.0001</b>	<b>0.0027</b>
No	295/345 (85.51%)	218/222 (98.20%)		
Yes	50/345 (14.49%)	4/222(1.80%)		
Cardiac Chest Pain			<b>0.0002</b>	<b>0.0042</b>
No	317/345 (91.88%)	220/222 (99.10%)		
Yes	28/345 (8.12%)	2/222 (0.92%)		
Vascular Site Access Concerns			<b>0.0001</b>	<b>0.0027</b>
No	274/345 (79.42%)	220/220 (100%)		
Yes	71/345 (20.58%)	0/220 (0%)		
IIb/IIIa			0.0602	0.8428
No	326/345 (94.49%)	217/222 (97.75%)		
Yes	19/345 (5.51%)	5/222 (2.25%)		

OS, overnight stay; SDD, same-day discharge.

<sup>a</sup> P values were adjusted for multiple comparisons using the Bonferroni-Holm method.<sup>b</sup> Bold P values indicate variables used for the logistic regression model.**Table 5**  
Logistic Regression Model Odds Ratio Estimates for Significant Predictors of Length of Stay.

Effect	Point Estimate	95% Wald Confidence Limits	
CRCL (>60 ml/min vs. 0–60 ml/min)	3.436	1.853	6.375
Stents (0–1 vs. 2+)	0.454	0.265	0.779
Suboptimal Angiographic result (Suboptimal vs. acceptable)	0.056	0.013	0.243
Femoral Vascular Site Closure (manual closure vs. femoral closure device)	4.883	3.018	7.903

CRCL = creatinine clearance.



## 5. Limitations

Due to the retrospective nature of the study, we were not able to collect certain types of data. For instance, social support was difficult to accurately assess retrospectively. Second, these data represent associations between patient groups and clinical factors, which is useful for assessing the data. However, the factors identified do not necessarily give the direct reason for patient admission or SDD. Finally, this was a relatively small sample; a larger multicenter study is needed to increase the validity and the generalizability of our findings.

## 6. Conclusions

Pre-, peri-, and post-procedural factors may play a role in the decision to admit or discharge a patient on the same day as their elective PCI. Understanding factors that hinder SDD practices may enable institutions to establish or enhance an SDD program. Changes in practice patterns may result in an increased likelihood of SDD practices, with the associated benefits of reduced costs.

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## References

- [1] Singh M, Rihal CS, Gersh BJ, et al. Twenty-five-year trends in in-hospital and long-term outcome after percutaneous coronary intervention: a single-institution experience. *Circulation*. 2007;115:28 35–41.
- [2] EPICLOG Investigators. Platelet glycoprotein IIb/IIIa receptor blockade and low-dose heparin during percutaneous coronary intervention. *N Engl J Med*. 1997;336:1689–1697.
- [3] Wilentz J, Mishkel G, McDermott D, et al. Outpatient coronary stenting: femoral approach with vascular sealing. *Herz*. 1999;24:624–633.
- [4] Carere R, Webb J, Buller C, et al. Suture closure of femoral arterial puncture sites post coronary angioplasty followed by same day discharge. *Am Heart J*. 2000;139:52–58.
- [5] Muthusamy P, Busman DK, Davis A, et al. Assessment of clinical outcomes related to early discharge after elective percutaneous coronary intervention —COED PCI. *Catheter Cardiovasc Interv*. 2013;81:6–13.
- [6] Kiemeneij F, Laarman GJ, Slagboom T, et al. Outpatient coronary stent implantation. *J Am Coll Cardiol*. 1997;29:323–327.
- [7] Koch KT, Piek JJ, Prins MH, et al. Triage of patients for short term observation after elective coronary angioplasty. *Heart*. 2000;83:557–563.
- [8] Slagboom T, Kiemeneij F, Laarman GJ, et al. Actual outpatient PTCA: results of the OUTCLAS pilot study. *Catheter Cardiovasc Interv*. 2001;53:204–208.
- [9] Gilchrist IC, Nickolaus MJ, Momplaisir T. Same-day transradial outpatient stenting with a 6-hr course of glycoprotein IIb/IIIa receptor blockade: A feasibility study. *Catheter Cardiovasc Interv*. 2002;56:10–13.
- [10] Ormiston JA, Shaw BL, Panther MJ, et al. Percutaneous coronary intervention with bivalirudin anticoagulation, immediate sheath removal, and early ambulation: a feasibility study with implications for day-stay procedure. *Catheter Cardiovasc Interv*. 2002;55:289–293.
- [11] Dalby M, Davies J, Rakhit R, et al. Feasibility and safety of day-case transfemoral coronary stenting. *Catheter Cardiovasc Interv*. 2003;60:18–24.
- [12] Banning AP, Ormerod OJM, Channon K, et al. Same day discharge following elective percutaneous coronary intervention in patients with stable angina. *Heart*. 2003;89:665–666.
- [13] Ziakas AA, Klinke BP, Mildenerberger CR, et al. Safety of same-day discharge radial percutaneous coronary intervention: a retrospective study. *Am Heart J*. 2003;146:699–704.
- [14] Porto I, Blackman DJ, Nicolson D, et al. What is the incidence of myocardial necrosis in elective patients discharged on the same day following percutaneous coronary intervention? *Heart*. 2004;90:1489–1490.
- [15] Slagboom T, Kiemeneij F, Laarman GJ, et al. Outpatient coronary angioplasty: feasible and safe. *Catheter Cardio Interv*. 2005;64:421–427.
- [16] Lasevitch R, Melchior R, Gomes V, et al. Early discharge using five french guiding catheter for transfemoral coronary stenting: a feasibility and safety study (EDU 5Fr study). *Am J Cardiol*. 2005;96:766–768.
- [17] Kumar S, Anantharaman R, Das P, et al. Radial approach to day case intervention in coronary artery lesions (RADICAL): a single centre safety and feasibility study. *Heart*. 2004;90:1340–1341.
- [18] Wiper A, Kumar S, MacDonald J, et al. Day case trans- radial coronary angioplasty: A four-year single-center experience. *Catheter Cardiovasc Interv*. 2006;68:549–553.
- [19] Heyde GS, Koch KT, de Winter RJ, et al. Randomized trial comparing same-day discharge with overnight hospital stay after percutaneous coronary intervention: results of the Elective PCI in Outpatient Study (EPOS). *Circulation*. 2007;115:2299–2306.
- [20] Rinfrat S, Kennedy WA, Lachaine J, et al. Economic impact of same-day home discharge after uncomplicated transradial percutaneous coronary intervention and bolus-only abciximab regimen. *Cardiovasc Interv*. 2010;3:1011–1019.
- [21] Gilchrist IC, Rhodes DA, Zimmerman HE. A single center experience with same-day transradial-PCI patients: a contrast with published guidelines. *Catheter Cardiovasc Interv*. 2012;79:583–587.
- [22] Abdelaal E, Rao SV, Gilchrist IC, et al. Same-day discharge compared with overnight hospitalization after uncomplicated percutaneous coronary intervention. *Cardiovasc Interv*. 2016;6:99–112.
- [23] Yee KM, Lazzam C, Richards J, et al. Same-day discharge after coronary stenting: a feasibility study using a hemostatic femoral puncture closure device. *J Interv Cardiol*. 2004;17:315–320.
- [24] Bertrand OF, De Larochelière R, Rodés-Cabau J, et al. Early discharge after transradial stenting of coronary arteries study investigators: a randomized study comparing same-day discharge and abciximab bolus only to overnight hospitalization and abciximab bolus and infusion after transradial coronary stent implantation. *Circulation*. 2006;114:2636–2643.
- [25] Khater M, Zureikat H, Alqasem A, et al. Contemporary outpatient percutaneous: feasible and safe. *Coron Artery Dis*. 2007;18:565–569.
- [26] Chung WJ, Fang HY, Tsai TH, et al. Transradial approach percutaneous coronary interventions in an out-patient clinic. *Int Heart J*. 2010;51:371–376.
- [27] Bertrand OF, Rodés-Cabau J, Larose E, et al. Early and late outcomes in patients excluded from same-day home discharge after transradial stenting and maximal antiplatelet therapy. *Catheter and Cardiovasc Interv*. 2008;72:619–625.
- [28] Resnic FS. The case for outpatient coronary intervention: balancing charges and discharges. *Circulation*. 2007;115:2248–2250.
- [29] Chambers CE, Dehmer GJ, Cox DA, et al. Society for cardiovascular angiography and interventions: defining the length of stay following percutaneous coronary intervention: an expert consensus document from the Society of Cardiovascular Angiography and Interventions. *Catheter Cardiovasc Interv*. 2009;73:847–858.