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## Cardiovascular Revascularization Medicine



## Feasibility and safety of same-day discharge after complex percutaneous coronary intervention using forearm approach

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## ABSTRACT

**Objectives:** We sought to assess the feasibility and safety of same-day discharge (SDD) after complex percutaneous coronary intervention (PCI) using a forearm approach.

**Background:** SDD has been shown to be safe after elective, low-risk PCI. However, the feasibility and safety of SDD in more complex patients and lesions has received limited study.

**Methods:** We retrospectively reviewed 1190 elective PCIs that were performed between January 2013 and December 2015 at the Red Cross General Hospital.

**Results:** Of the 1190 PCIs, 166 (13.9%) were complex (bifurcations, vein and arterial grafts, unprotected left main, last remaining vessel, chronic total occlusions, or with utilization of rotational atherectomy or hemodynamic support). As compared with non-complex cases, complex cases were associated with older age, male gender, higher prevalence of diabetes mellitus and prior coronary artery bypass graft surgery, lower prevalence of smoking, higher utilization of femoral access and 7F guiding catheters, higher contrast utilization and fluoroscopy dose, longer fluoroscopy time, more stents per lesion, more frequent single vessel treatment and non-complete revascularization, and treatment with ticagrelor and bivalirudin. Among the patients who underwent complex PCI ( $n = 166$ ), twenty eight (16.9%) were discharged the same day. SDD after complex PCI was associated with younger age and more frequent use of forearm access. The 30-day incidence of major adverse cardiac events after complex PCI was 0% vs 3.6% ( $p = 0.59$ ) in patients with SDD vs. overnight hospitalization.

**Conclusions:** SDD is feasible and safe in selected patients undergoing elective complex PCI using the forearm approach.

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### 1. Introduction

Percutaneous coronary intervention (PCI) is performed in increasingly complex patients and lesions which often require use of advanced equipment and techniques [1,2], with excellent outcomes currently achieved in experienced centers [3,4]. Concurrently, there has been increased interest in same-day discharge (SDD) as an alternative to overnight hospitalization (OH), which is in part facilitated by the widespread adoption of the radial approach. Same day discharge after selected, elective PCI cases has been shown to be feasible and safe [5–8], reduce costs and logistic demands [9,10], and achieve high patient satisfaction [11]. However, SDD is still infrequently performed [6,8], and its utilization after complex elective PCI has received limited

study. We, therefore, sought to examine the feasibility of SDD and its safety compared with OH in a cohort of patients undergoing complex PCI using the forearm approach.

### 2. Materials and methods

#### 2.1. Patients

We examined the Red Cross General Hospital Catheterization Laboratory Registry to retrospectively identify all patients who underwent PCI between January 2013 until December 2015. Informed consent was obtained from all patients before the catheterization and the Ethics Committee of our Hospital approved the protocol of this study.

Patients with acute coronary syndrome (ST elevation myocardial infarction [STEMI], non-ST elevation myocardial infarction [NSTEMI] and unstable angina [UA]) were excluded from the analysis, since they traditionally are not considered as candidates for SDD.

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## 2.2. Definitions

Complex PCI was defined as PCI for bifurcations, vein and arterial grafts, unprotected left main, last remaining vessel, chronic total occlusions (CTO), or when rotational atherectomy or hemodynamic support was used. The decision about SDD or overnight stay was at the discretion of the operator and SDD was only performed if PCI was uneventful. Uneventful PCI was defined as a procedure performed without prolonged chest pain for the patient, without symptoms of heart failure, without prolonged flow limitation in the main or in a significant side branch, without need of inotropic support or defibrillation due to malignant arrhythmias. Patients with baseline serum creatinine more than 1.5 mg/dl were not considered as candidates for SDD. Major adverse cardiovascular events (MACE) were defined as the composite of death, myocardial infarction or target vessel revascularization. Major bleeding was defined as bleeding requiring intervention, prolonging hospitalization or requiring transfusion. Stent thrombosis was defined according to the Academic Research Consortium criteria [12]. Myocardial infarction at 30 days included periprocedural myocardial infarction and was defined according to the Third Universal Definition of myocardial infarction [13]. Contrast induced nephropathy (CIN) was defined as new renal failure or worsening of pre-existing renal failure requiring new hospitalization or prolonging of hospitalization after the procedure.

## 2.3. Technique

Procedures were performed using the radial, ulnar and femoral approach. For patients treated via forearm (radial or ulnar) approach, verapamil 5 mg and unfractionated heparin (50 IU/kg) were administered intrasheath, directly after sheath insertion. Procedures were performed with 6F and 7F guiding catheters according to the treating physician discretion. After procedure completion, a forearm closure device was applied with intention to perform patent hemostasis. For patients treated through the femoral approach, a 6 or 7F femoral sheath was introduced and arterial closure was performed either with an Angioseal femoral closure device (St Jude Medical, Minneapolis, Minnesota) or with manual compression.

Unfractionated heparin (100 IU/kg) or bivalirudin (0.75 mg/kg bolus dose and 1.75 mg/kg/h infusion) was administered during the procedure. Glycoprotein IIb/IIIa inhibitors were used only as a bailout strategy. All patients were loaded with aspirin 325 mg, if not already receiving. Loading with clopidogrel (600 mg), ticagrelor (180 mg) or prasugrel (60 mg) was performed if the patients were not already receiving a P2Y12 inhibitor. All patients received dual antiplatelet treatment at discharge with aspirin 100 mg and clopidogrel 75 mg daily, ticagrelor 90 mg twice daily or prasugrel 10 mg daily at the discretion of the operator.

Coronary stents (bare metal stents and drug eluting stents) were implanted in most patients, although some patients underwent balloon angioplasty with normal and drug eluting balloons. For patients undergoing bifurcation PCI, provisional stenting strategy was preferred. However, if stenting of the side branch was decided, this was performed using the Culotte or mini crush technique. Kissing balloon technique was intended to be performed at the end of all bifurcation PCI procedures.

For patients undergoing PCI for CTO's, double arterial puncture was performed, by bilateral radial, bilateral femoral or radial and femoral puncture. In cases of radial and femoral puncture, the patient was enrolled in the femoral group. Pre-discharge transthoracic ultrasound evaluation was performed in order to exclude pericardial effusion after both successful and failed procedures. Procedures in vein grafts were performed without the use of distal protection devices, due to limited availability. Rotational atherectomy procedures were performed in cases of extensively calcified lesions with a 1.25 mm burr as an initial approach and increase of burr size was performed afterward only according to the operating physician. Hemodynamic support in our

institution was performed with transfemoral insertion of intraaortic balloon pump (IABP) in the catheterization laboratory and before the PCI.

## 2.4. Follow-up

Follow-up was performed by telephone 30 days after the procedure. The following endpoints were recorded: death, major bleeding, stroke, new myocardial infarction, definite and probable stent thrombosis, target vessel revascularization and contrast induced nephropathy.

## 2.5. Statistical analysis

Continuous parameters are reported as mean  $\pm$  standard deviation and compared using one-way ANOVA and categorical variables as percentages and compared using the chi-square test or the Fisher's exact test, as appropriate. All statistical analyses were performed using SPSS 20.0 (IBM, Armonk, New York) and Prism 6.0 (GraphPad Software, La Jolla, California). A *p* value less than 0.05 was considered statistically significant.

## 3. Results

### 3.1. Baseline and procedural characteristics: complex vs. non-complex procedures

During the study period 2916 PCI procedures were performed in 2568 patients. Of these, 1726 procedures (59.1%) performed in patients with acute coronary syndromes (1191 in NSTEMI/UA patients and 535 in STEMI patients) were excluded from the analysis. From the remaining 1190 PCIs, 1024 (86.1%) were non-complex and 166 (13.9%) were complex: 17 were bifurcation PCIs, 22 were vein graft PCIs, 2 were arterial graft PCIs, 78 were CTO PCIs, 30 were unprotected left main PCIs, 12 were PCIs with use of rotational atherectomy, 3 were procedures with IABP hemodynamic support and 2 PCIs were performed in the last remaining vessel.

Demographic and procedural characteristics of non-complex and complex procedures are presented in Table 1. As compared with non-complex cases, complex cases were associated with older age, male gender, higher prevalence of diabetes mellitus and prior CABG and lower prevalence of smoking. During the procedure, femoral access and use of 7F guiding catheters were more common in complex PCIs. Complex PCIs were also associated with more stents per lesion, larger contrast volume consumption, higher radiation exposure, single vessel treatment, incomplete revascularization and treatment with ticagrelor and bivalirudin.

### 3.2. Baseline and procedural characteristics of complex procedures: SDD vs. OH

Twenty-eight of these complex patients were discharged the same day (16.9%): 6 underwent bifurcation PCI, 3 underwent PCI in a saphenous vein graft, 1 underwent PCI in a left internal mammary arterial graft, 10 patients underwent unprotected left main PCI, 6 patients underwent CTO PCI and 2 patients underwent rotational atherectomy. None of the complex PCI patients who underwent IABP assisted PCI or PCI at patient's only patent vessel were discharged on the same day. Demographic and procedural characteristics of SDD and OH complex procedures are presented in Table 2. Compared with OH complex cases, complex cases with SDD were more likely to be performed in younger patients, were all done using the forearm approach and required less contrast volume and lower radiation exposure. A visual diagram that demonstrates the patient's selection clearly is presented in Table 3.

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