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ORIGINAL ARTICLE

SAME-DAY DISCHARGE AFTER PERCUTANEOUS CORONARY INTERVENTION IN MIDDLE EASTERN PATIENTS. RESULTS FROM THE FIRST JORDANIAN PCI REGISTRY (JOPCR1)

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ABSTRACT

***Background and methods**: Long-term safety of same-day (SD) discharge from hospital after percutaneous coronary intervention (PCI) has not been studied in a Middle Eastern patient population. From January 1, 2013, through February 28, 2014, consecutive patients (N=2408) discharged from hospital after PCI were enrolled in this prospective, multicenter registry. There were 747 patients (31.0%) who had SD discharge and 1661 patients (69.0%) who had delayed discharge (DD), i.e., >24 hours after admission. Baseline clinical profiles, coronary angiographic features, details of the PCI procedures, and adverse cardiovascular events were compared in the two groups.*

***Results:** The mean age of the study population was 58.3+10.9 years. Patients in the SD discharge group had similar mean age, proportion of males and prevalence of multivessel coronary artery disease compared with patients in the DD group, but they were less likely to have ST-segment deviation, elevated levels of serum biomarkers, low left ventricular ejection fraction and heart failure than the DD group. At 30 days, 6 months and one year after discharge, the SD group did not have higher rate of adverse cardiovascular events of cardiac death, bleeding events, vascular access site complications or stent thrombosis compared with DD group.*

***Conclusions:** In this contemporary Middle Eastern PCI study, 31% of the patients were discharged <24 hours after admission. SD discharge was safe and was not associated with excess cardiovascular events compared with those who had delayed discharge.*

***Keywords:** percutaneous coronary intervention; same-day discharge; cardiovascular outcome; coronary artery disease.*

INTRODUCTION

Percutaneous coronary intervention (PCI) is one of the most commonly performed cardiovascular procedures in current medical practice, and an increasing number of patients undergo or being referred to this procedure for acute coronary syndrome (ACS) and stable coronary disease (1,2). Given the cost considerations of these procedures, the ongoing improvements in PCI procedural safety and advances in vascular access site closure and care, considerable attention is being given to the feasibility and adoption of the policy of discharging selected groups of patients 24 hours or less after admission, i.e., same day discharge (SD) (3,4) rather than delayed hospital discharge (DD) after >24 hours. The primary concern of an early or SD discharge is the potential occurrence of early abrupt coronary artery occlusion and vascular access site complications after discharge (5,6).

There is scarcity of data about the length of hospital stay and safety of same day discharge after PCI in the Middle East. Published local and regional ACS and PCI registries did not address these important issues (7-11). One study reported a mean length of hospital stay of about 6 days post PCI for ACS (11) and another reported a mean length of stay of 5.2 days for non-ST-segment elevation ACS (NSTEACS) and 6.2 days for ST-segment elevation myocardial infarction (STEMI) patients (12). None of the ACS or PCI registries reported the proportions of patients who had SD discharge, the clinical and angiographic features, or the incidence of adverse cardiovascular outcomes among these patients. Two small studies evaluated short-term outcome after SD discharge (13,14). A study of 124 patients who underwent elective or semielective PCI and were discharged within 10 hours of the procedure, reported no readmissions or complications within 24 hours after discharge (13). The other study involved 77 patients who had SD discharge after PCI for stable angina reported no

events in these patients at one month (14).

The recently completed first Jordanian PCI Registry evaluated the in-hospital, one month and one year outcome in patients who underwent PCI for ACS or stable coronary syndrome (15). We used data from this registry to determine the proportion of patients who had SD discharge, and to evaluate the baseline clinical and coronary angiographic features, PCI procedural details, and short- and long-term adverse cardiovascular events of these patients compared with the DD patients.

METHODS

The study population consisted of consecutive patients enrolled in the prospective, multicenter first Jordanian PCI registry (JoPCR1), who were discharged alive from hospital after successful PCI for ACS or stable coronary disease. Twelve tertiary care centers in Jordan participated in the registry from January 1, 2013 through February 28, 2014. Patients were divided into two groups; SD discharge patients and DD patients. SD discharge patients were those discharged from hospital ≤24 hours after PCI regardless of the time of the procedure. DD patients were those dent home >24 hours after the procedure.

Patients were followed up for one year after the index hospitalization. The clinical, electrocardiographic, echocardiographic and coronary angiographic features in the SD discharge group were compared with those of DD group. The PCI indications, procedural details and complications, and cardiovascular adverse events during hospitalization, at 30 days, 6 months and one year were also compared in the two groups.

ACS was classified as STEMI or NSTEACS, which included non-ST-segment elevation MI and unstable angina. Stable coronary disease was defined by the presence of either chronic stable angina or silent ischemia.

PCI for STEMI was primary (PCI as reperfusion strategy with no thrombolysis), rescue (after failure of thrombolysis), or elective (after successful thrombolysis). PCI for NSTEACS was urgent (performed within 2 hours after admission for ongoing chest pain, hemodynamic instability, life-threatening ventricular arrhythmia or heart failure), early invasive (within 24 hours after admission), or invasive (within 24-72 hours after admission).

PCI procedures were performed according to current standard guidelines. All patients received dual oral antiplatelet therapy (aspirin and 300-600 mg clopidogrel or 180 mg ticagrelor loading dose, and a loading dose of unfractionated heparin (100 IU/kg body weight). The activated clotting time was maintained ≥300 seconds throughout or immediately at the conclusion of the PCI procedure. Hemostasis following PCI was achieved by manual compression or vascular closure devices. After PCI, patients were observed in the coronary care unit or telemetry care unit. Patients were ambulated 2-6 hours following sheath removal, according to the vascular access site and once the general condition of the patient permitted. Patients were given instructions about the vascular site care and were asked to call the hospital or return to the emergency department for any worrying symptom. They were also instructed to return to the outpatient clinic 3-7 days after hospital discharge.

The choice of vascular access site, size of sheath, type of stent, use of manual compression or vascular closure devices after sheath removal, and timing of hospital discharge were left to operator's discretion. The incidence rate of adverse cardiovascular events among the SD and DD groups included cardiac death, major bleeding events, vascular access complications, stent thrombosis, and hospital readmission for ACS, stroke, heart failure, and repeat PCI.

All deaths were considered cardiac unless a definite non-cardiac cause could be established. Major bleeding events were defined according to the CRUSADE study classification which included intracranial hemorrhage, retroperitoneal bleeding, hematocrit (Hct) drop ≥12% from baseline, any red blood cell (RBC) transfusion when baseline Hct was ≥28%, or any RBC transfusion when baseline was <28% with witnessed bleeding (16). Other bleeding events were considered as minor ones. Major vascular access complications included the need for surgical intervention for expanding hematomas not responding to manual compression, arterial thrombosis or dissection pseudoaneurysm, or arteriovenous fistula. Minor vascular access complications site included hematomas not associated with hemodynamic compromise and did not require blood transfusion or vascular surgical intervention. Definite and probable stent thrombosis events were defined according to the Academic Research Consortium (17). Data after 1, 6, and 12 months were collected during follow-up visits or through phone calls to the patient, household relative or primary care physician. The study was approved by the Institutional Review Board of each participating hospital and each patient signed an informed consent.

Data were described and analyzed using the IBM SPSS Statistics (version 20). Data were described using means, standard deviations, or percentages wherever appropriate. The differences in the demographic and clinical characteristics and cardiovascular events during hospitalization, and after one and 12 months of discharge between SD discharge and DD groups were tested using chi-square test. A p-value of less than 0.05 was considered statistically significant.

RESULTS

Of 2426 patients enrolled in the registry, 18 (0.7%) died during hospitalization and 2408 (99.3%) were discharged alive from hospital. Further analysis involves this latter group of patients sent home alive. Mean age of those patients was 58.3±10.9 years and 1914 (79.5%) were men. PCI was indicated for ACS in 77.1% and for stable coronary disease in 22.9%.

There were 747 patients (31.0%) in the SD discharge group and 1661 (69.0%) in the DD group. The majority of these patients (N=648, 87%) had PCI between 7 am and 12 noon and were discharged from hospital between 7 pm and 11 pm. Of the DD group, 870 patients (52.4%) had >24- to 48-hour stay, 597 (35.9%) had >48- to 72-hour stay, and 194

(11.7%) had >72-hour stay. Mean length of hospital stay among patients who had PCI for ACS was 2.3±1.4 days and among those who had PCI for stable coronary disease patients was 2.0±1.0 days (p<0.001).

Femoral access was utilized in 2336 (97.0%) and radial in 72 (3.0%) of the patients. 6F sheaths were used in 2404 (99.8%) of patients, and hemostasis was secured after sheath removal by manual compression in 2387 (99.1%) and by vascular closure devices in 21 (0.9%).

The baseline clinical, electrocardiographic, and echocardiographic characteristics of the SD and DD groups are depicted in Table 1. There was no difference in the mean ages of both groups. Patients in the SD discharge group were more likely to have diabetes mellitus and previous PCI. They were less likely to have elevated blood levels of cardiac biomarkers, heart failure and low left ventricular ejection fraction compared with DD group. More patients in the SD discharge group than the DD group had PCI for NSTEACS or stable coronary disease than STEMI.

Of the 1856 patients who had PCI for ACS, 449 (24.2%) had SD discharge. Of the 396 patients had urgent PCI or early invasive PCI for NSTEACS, 135 (34.1%) had SD discharge, and of the 457 patients who had primary or rescue PCI for STEMI, 96 (21.0%) had SD discharge. There were 552 patients who had PCI for stable coronary disease, 208 (37.7%) of those had SD discharge.

Coronary angiographic features and PCI procedural details are shown in Table 2. The femoral artery access was utilized in the majority of patients in the two groups. Prevalence of multivessel coronary disease the SD discharge group was not different from that in the DD group, but patients in the SD discharge group were more likely to undergo multivessel PCI. Stents were used in 95.7% and 97.0% of the SD discharge and DD groups, respectively. PCI procedures were stent-based in 95.7% and 97.0% of the SD and DD groups, respectively (p=0.16). Although second generation drug eluting stents (DES) were used in the majority of patients in the two groups, these stents were used in a larger proportion of patients in the SD discharge group than the DD group. The use of vascular closure devices was not different between the two groups. More SD discharge patients received glycoprotein IIb/IIIa inhibitors during the index admission than the DD group.

Adverse cardiovascular events at 30 days, 6 months and one year after discharged are shown in Table 3. There were 10 cardiac deaths at 30 days, and 28 deaths at one year. Cardiac mortality rate in the SD discharge group was not significantly different compared with that in the DD group from hospital discharge to one year of follow up. Incidence rates of other cardiovascular events, including stent thrombosis, were not different in the two groups. Details of the bleeding and vascular access site complications (Table 4) indicate that the bleeding and vascular access site complications were uncommon. Of the 16 major bleeding events and vascular access site complications at one year, 9 occurred in the SD discharge group and 7 in the DD group with no significant increase in these events in the SD discharge group compared with the DD group.

DISCUSSION

The major findings in this contemporary Middle Eastern PCI registry are (1) 31% of patients were discharged from hospital ≤24 hours after the procedure, (2) these SD discharge patients were a heterogeneous group of high and low risk patients who had PCI for STEMI, NSTEACS and stable coronary disease, and (3) the SD discharge group did not have excess cardiovascular adverse events throughout the study.

The concept of SD discharge following PCI was driven by the need for patient satisfaction and cost containment, without compromising patient safety (18). In this modern interventional era, low and high risk PCI procedures have become safer due to ongoing advances in pharmacotherapy and coronary instrumentation, systematic use of DES, and vascular access care and closure devices (19,20). These advances paved the road for a steady decrease in the length of hospital stay. In this context, several studies have demonstrated that a shorter period of post-procedural observation is safe and not associated with excess risk of abrupt coronary occlusion or vascular access site complications (20). The rather conservative current practice guidelines set by the Society for Cardiovascular Angiography and Interventions statement and endorsed by the American College of Cardiology on SD (21,22) advocate observing patients overnight to monitor for abrupt coronary occlusion mainly due to acute stent thrombosis, access site complications, non–access site bleeding and management of comorbidities, such as arrhythmias and heart failure, renal insufficiency, delayed contrast reactions, diabetes, and hypertension (20,21).

The proportion of SD discharge patients in this study (31%) was not different from those demonstrated by other investigators which ranged from 18% to 30% (23,24). Patients who undergo PCI have different levels of cardiovascular risk that is attributed to three factors. First, the indication for PCI, i.e., stable coronary disease vs. ACS. Second, the PCI procedure, i.e., elective or emergency, single- or multi-vessel. And third, presence of comorbid conditions and complications, i.e., heart failure, renal disease, advanced age. Low risk patients include those who had PCI for stable coronary disease, intermediate risk patients include those who had PCI for uncomplicated ACS, and those at high risk include those who had primary and rescue PCI for STEMI, or urgent PCI for NSTEACS. In this study, one in three patients who had PCI for stable coronary disease, one in three of those who had PCI for urgent or early invasive PCI for NSTEACS, and one in five of those who had primary or rescue PCI for STEMI were discharged from hospital ≤24 hours after the procedure.

The evolution from rather long hospital stay to SD discharge started with adopting this policy in low risk elective PCI for chronic stable angina (25,26). Further studies showed that low- and low-moderate risk PCI patients can

be safely discharged ≤24 hours after PCI (3,27). A debate that is still ongoing, however, is the optimal time of hospital discharge of patients who undergo PCI for STEMI (28). Longer hospital stay was initially advocated for these patients for monitoring of potentially life threatening ventricular tachyarrhythmias (29). The current practice that adopts a 5-7-day stay is largely empirical (22,30). A shorter stay of ≤72 hours (31) or ≤48 hours (32) also appears to be feasible and safe in selected STEMI patients. In this study, the cardiac mortality of primary PCI-treated STEMI patients was very low (0.7%) from hospital discharge to 30 days, which is consistent with previously reported data. This underscores the safety of SD discharging uncomplicated STEMI patients after primary PCI (29). SD discharge seems to be safe for patients admitted with STEMI who get timely primary PCI followed by a post procedural hemodynamic and electric stability observation period.

Length of hospital stay does not appear to be dependent on the vascular access used, femoral or radial (20,23). Most of patients in this study had femoral artery access PCI. Despite the advent of radial artery-based PCI, the femoral approach is still the favored technique worldwide (33). Despite their availability in the majority of the participating hospitals, vascular closure devices were used in a small number of patients in this study, most likely due to costs issue and the proven efficacy and safety of manual compression in these high-volume centers. Although controversy may still exist regarding the safety of closure devices, the available data show that these devices reduce the time to hemostasis and ambulation compared with manual compression (34). Randomized trials to confirm these recommendations are needed (35). The rate of using radial access has increased in the centers that participated in the registry since the completion of this registry. Further studies are needed to study whether this practice shift will increase the number of SD discharge patients.

Cost saving most probably does not have a major impact on the length of hospital stay after PCI in this part of the region. A significant proportion of the total hospital bill is related to the costs of the prescribed oral and parenteral medications, coronary angiography and PCI, and physicians' fees. The hospital charges for bed occupancy do not exceed 10% of the total bill. Hence, the SD discharge is mainly driven by patient's satisfaction and the need for a rapid hospital turnover especially in high volume university and public hospitals were the bed availability is a crucial issue.

Few limitations in our study warrant discussion. Selection bias, collection of non-randomized data, and missing or incomplete information is inherent to similar observational registries. Participation was voluntary and the enrolment of consecutive patients was encouraged, but this was not verified. Despite explicit patient discharge instructions, incidence of vascular access site complications could have been under-estimated. However, this might have resulted in underreporting of minor hematomas, rather than major complications that were unlikely to be overseen, such as major groin bleeding or expanding hematomas that necessitated hospital readmission. Furthermore, the registry protocol did not mandate a systematic evaluation of pseudoaneurysms or fistulae during outpatient visits. Despite these limitations, this study is the first in this region to prospectively evaluate the issue of SD discharge in a large cohort of patients who underwent PCI.

Conclusions. In this contemporary Middle Eastern PCI registry, SD discharges was found to be safe and associated with very low rate of adverse cardiovascular events compared with DD patients. These reassuring results might help change the current practice of routine extended hospital stay after PCI for all patients. SD discharge can be considered for selected group of patients who undergo PCI for stable coronary disease or ACS.

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Table 1: Baseline features in the same-day and delayed discharge groups.

Features	SD discharge (747 patients) N (%)	DD (1661 patients) N (%)	p-value
Age (years) mean ± standard deviation	59.0±10.2	58.0±11.2	0.04
Men	608 (81.4)	1306 (78.6)	0.13
Hypertension	456 (61.0)	1043 (62.8)	0.43
Diabetes mellitus	426 (57.0)	860 (51.8)	0.02
Dyslipidemia	382 (51.1)	795 (47.9)	0.16
Cigarette smoking	280 (37.5)	771 (46.4)	<0.001
BMI ($kg/m^{2)}$ mean± standard deviation	27.9±4.5	28.0±4.5	0.61
Chronic renal impairment	14 (1.9)	28 (1.7)	0.86
Previous myocardial infarction	77 (10.4)	185 (11.1)	0.61
Previous PCI	218 (29.2)	365 (22.0)	<0.001
ST-segment deviation	262 (35.1)	902 (54.3)	<0.001
Elevated levels of cardiac biomarkers	194 (26.0)	764 (46.0)	<0.001
LVEF<45%	50 (6.7)	241 (14.5)	<0.001
Heart failure	37 (5.0)	222 (13.4)	<0.001

BMI: Body mass index, DD: delayed discharge, LVEF: left ventricular ejection fraction, PCI: percutaneous coronary intervention, SD: same day discharge.

Table 2: Coronary angiographic features, PCI procedural details and in-hospital complications in the SD discharge and DD groups.

Features	SD discharge (747 patients) N (%)	DD (1661 patients) N (%)	p-value
Indications for PCI:			
- STEMI	154 (20.6)	569 (34.4)	<0.001
- NSTEACS	385 (51.1)	748 (45.0)	0.006
- Chronic coronary disease			
CAD:			
- One vessel CAD	425 (56.9)	986 (59.4)	0.27
- Multivessel CAD	322 (43.1)	675 (40.6)	0.27
PCI:			
- One vessel PCI	513 (68.7)	986 (59.4)	<0.001
- Multivessel PCI	234 (31.3)	675 (40.6)	0.03
Vascular access:			
- Femoral artery	732 (98.0)	1604 (96.6)	0.08
- Radial artery	15 (2.0)	57 (3.4)	0.08
Types of stents:			
- Second generation DES	684 (91.6)	1395 (84.0)	<0.001
- BMS	17 (2.3)	205 (12.3)	<0.001
- BVS	13 (1.8)	11 (0.7)	0.03
Periprocedural medications:			
- Aspirin	738 (98.8)	1647 (99.2)	0.62
-Second oral antiplatelet agent	743 (99.5)	1658 (99.8)	0.39
- Thrombolysis	8 (1.1)	71 (4.3)	<0.001
- GPI	61 (8.2)	263 (15.8)	<0.001
- Beta blockers	514 (68.8)	1291 (77.7)	<0.001
- RASB	370 (49.5)	1008 (60.7)	<0.001
- Statins	700 (93.7)	1569 (94.5)	0.49
In-hospital complications:			
- Ventricular tachyarrhythmia	1 (0.13)	15 (0.9)	0.06
- Heart failure	24 (3.21)	159 (9.6)	<0.001
- Cardiogenic shock	0 (0)	7 (0.4)	0.19
- Acute renal failure	0 (0)	7 (0.4)	0.19
- Ventilatory support	0 (0)	9 (0.5)	0.12
- Stent thrombosis	0 (0)	7 (0.4)	0.19
- Major bleeding events	1 (0.13)	19 (1.1)	0.03
- Minor bleeding events	13 (1.74)	51 (3.3)	0.02

BMS: bare metal stents, BVS: bioresorbable vascular scaffolds, DD: delayed discharge; DES: drug-eluting stents; GPI: glycoprotein IIb/IIIa inhibitors, RASB: renin angiotensin system blockers, SD: same day discharge, CAD: coronary artery disease, PCI: percutaneous coronary intervention, STEMI: ST-segment myocardial infarction, NSTEACS: non-ST-segment acute coronary syndrome.

Table 3: Adverse cardiovascular events 30 days, six months and one year after discharge from hospital in the SD discharge and DD groups.

Events	SD discharge N (%)	DD N (%)	p-value
Events from hospital discharge to 30 days	N=635	N=1608	
- Cardiac mortality	1 (0.16)	9 (0.56)	0.35
- Stent thrombosis	4 (0.63)	20 (1.24)	0.30
- Readmission for:			
- ACS	11 (1.73)	35 (2.18)	0.61
- Stroke	2 (0.31)	4 (0.25)	0.84
- Heart failure	2 (0.31)	11 (0.69)	0.45
- Repeat PCI	5 (0.79)	25 (1.55)	0.23
Events from hospital discharge to 6 months	N=610	N=1587	
- Cardiac mortality	3 (0.49)	17 (1.06)	0.31
- Stent thrombosis	6 (0.96)	29 (1.81)	0.21
- Readmission for:			
- ACS	25 (4.03)	68 (4.26)	0.90
- Stroke	2 (0.31)	6 (0.38)	0.88
- Heart failure	2 (0.31)	20 (1.26)	0.08
- Repeat PCI	14 (2.27)	41 (2.55)	0.81
Events from hospital discharge to one year	N=582	N=1556	
- Cardiac mortality	4 (0.66)	24 (1.51)	0.18
- Stent thrombosis	7 (1.13)	31 (1.94)	0.27
- Readmission for:			
- ACS	35 (5.75)	92 (5.80)	0.95
- Stroke	2 (0.31)	10 (0.64)	0.56
- Heart failure	3 (0.48)	26 (1.56)	0.09
- Repeat PCI	17 (2.79)	56 (3.51)	0.49

ACS: acute coronary syndrome, DD: delayed discharge, PCI: percutaneous coronary intervention, SD: same day discharge.

Table 4: Bleeding events and vascular access site complications in the SD discharge and DD groups.

Events	SDD N (%)	EHS N (%)	p-value
Events from hospital discharge to 30 days	N=635	N=1608	
Non-vascular access site bleeding events:			
- Major bleedings #	2 (0.31)	2 (0.21)	0.68
- Minor bleedings #	0 (0)	7 (0.44)	0.54
Vascular access site complications:			
- Major complications	0 (0)	0 (0)	-
- Minor hematomas	1 (0.16)	2 (0.12)	0.94
Events from hospital discharge to 6 months:	N=610	N=1587	
Non-vascular access site bleeding events:			
- Major bleeding events #	3 (0.47)	2 (0.12)	0.29
- Minor bleeding events #	1 (0.16)	8 (0.50)	0.45
Vascular access site complications:			
- Major complications	0 (0)	0 (0)	-
- Minor hematomas	0 (0)	2 (0.12)	0.96
Events from hospital discharge to one year:	N=582	N=1556	
Non-vascular access site bleeding events:			
- Major bleeding events #	4 (0.64)	3 (0.18)	0.20
- Minor bleeding events #	1 (0.16)	10 (0.63)	0.31
Vascular access site complication:			
- Major complications	0 (0)	0 (0)	-
- Minor hematomas	0 (0)	2 (0.12)	0.99

All of these events were gastrointestinal or genitourinary tract bleeding events

List of abbreviations

ACS	acute coronary syndrome
CRUSADE study	Can Rapid risk stratification of Unstable angina patients Suppress ADverse outcomes with Early implementation of the ACC/AHA guidelines Study
DD	delayed discharge
DES	drug eluting stents
JoPCR1	first Jordanian percutaneous coronary intervention registry
NSTEACS	non-ST-segment elevation ACS
PCI	percutaneous coronary intervention
RBC	red blood cells
SD	same day discharge
STEMI	ST-segment elevation myocardial infarction

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