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Outcome of Diabetic and Non-Diabetic Patients Undergoing Successful Percutaneous Coronary Intervention of Chronic Total Occlusion

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ABSTRACT

Introduction: Diabetes mellitus is associated with an increased risk of adverse clinical outcomes after percutaneous coronary intervention (PCI). The prognosis of patients with diabetes mellitus and chronic total occlusion (CTO) treated with PCI is poorly investigated. Current study evaluates outcome of successful PCI on CTO in patients with and without diabetes. **Methods**: One hundred and sixty three patients treated with successful PCI on CTO between January 2009 and March 2011 were prospectively identified from the PCI registry at the Madani Heart Center, Tabriz, Iran. Patients were followed for 15±3 months, were evaluated for the occurrence of major adverse cardiac events (MACE) comprising death, acute myocardial infarction, and need for repeat revascularization.**Results**: No differences were found in baseline clinical and procedural variables between patients with (n=34) and without diabetes (n=129), unless for hypertension (p=0.03). Hospitalization period after PCI in diabetics (3.26±0.61 days) and non-diabetics (2.86±0.52 days) was similar. In-hospital MACE occurred in 8 (23.5%) individuals of diabetics and 10 (7.8%) individuals of non-diabetics (p=0.02), among them revascularization was significantly higher in diabetics (20.6% vs. 7%, p=0.04). Follow-up events in diabetic and non-diabetic groups were 12 (35.3%) and 37 (28.5%), respectively (p was not significant). **Conclusion**: In patients undergoing successful PCI on CTO, diabetes is associated with higher in-hospital adverse events; however diabetes does not affect long term outcomes in these patients.

Introduction

Patients with diabetes experience a more generalized form of atherosclerosis than patients without diabetes. Diabetes mellitus (DM), 25% of all percutaneous coronary interventions (PCI),[1,2] is associated with an increased risk of adverse clinical outcomes after PCI.[3-5] They are at an increased risk for new coronary lesion and have more restenosis after the implantation of coronary stents. The risk of adverse outcomes with percutaneous coronary interventions is higher in diabetic than in non-diabetic patients.[6] Chronic total occlusion (CTO) of a coronary artery is present in almost one-third of patients with coronary artery disease (CAD).[7] PCI for CTO accounts for 10 –20% of all PCI procedures.[8] Successful intervention for a CTO has been reported to improve symptoms, lower rates of myocardial infarction (MI) and improve long-term survival when compared to unsuccessful attempted PCI.[9,10] The prognosis of patients with diabetes mellitus and chronic coronary total occlusion treated with percutaneous coronary intervention is poorly investigated. Current study evaluates outcome of successful PCI on CTO in patients with and without diabetes.

Materials and methods

Patients were identified using the PCI registry at the Madani Heart Center. Patients who underwent successful PCI of a CTO between January 2009 and March 2011 were included in this analysis. Information was prospectively recorded, including baseline demographics, clinical and procedural characteristics, and in-hospital outcomes. Patients were followed for one year and major adverse cardiac events in hospital and in one year follow-up were recorded. All procedures were followed in accordance with the Declaration of Helsinki. A CTO was defined as complete obstruction of the vessel with thrombolysis in myocardial infarction antegrade flow 0 with an estimated duration ≥1 month with or without visible collateral flow, whether antegrade or retrograde. Patients with acute MI within seven days before the procedure and those with CTO of a venous or arterial bypass conduit were excluded. Patients were included in all analyses only once, based on the earliest procedure recorded in the database, and those included in the CTO cohort were excluded if they underwent non-CTO PCI during the study period. Angiographic success was defined as successful balloon dilatation of the lesion, with or without stent placement, with less than 40% residual stenosis. Procedural success was defined as angiographic success with no in-hospital major adverse cardiac event (MACE), defined as death, MI with new Q-waves on electrocardiogram (ECG) or urgent target vessel revascularization (TVR) (including both repeat PCI and coronary artery bypass graft surgery [CABG]). New MI was defined as elevation of creatine kinase-MB to > 2 times the upper limit of normal with recurrent ischemic symptoms following PCI. Post-procedural ECGs were routinely assessed for new Q-waves; however, cardiac troponin, creatine kinase and creatine kinase-MB fraction were not routinely collected.

Statistical analysis

The overall cohort of patients with successful PCI was divided into diabetic and non-diabetic subgroups. Baseline characteristics were then compared between groups using the Student's t-test for continuous variables and chi-squared or the Fisher exact test for discrete variables. Data are listed as mean±standard deviation for continuous variables and as percentages for discrete variables. A level of $p < 0.05$ was considered significant. All calculations were done with SPSS (Version 16) for Windows.

Results

Thirty Baseline Characteristics

One hundred and sixty three patients undergoing successful PCI of CTO were studied. There were no significant differences between groups with respect to baseline characteristics, medical history and risk factors, or prior cardiovascular disease unless hypertension (Table 1). Table 2 shows the procedural characteristics according to diabetic and non-diabetic groups. Most of the procedural characteristics of the two groups were similar.

Table 1. Clinical characteristics of patients who underwent PCI

	Diabetic (n=34)	Non-diabetic (n=129)	P value
Age, years, mean (SD)	58.11 (10.94)	58.23 (11.13)	NS
Male, No. (%)	22 (64.7%)	104 (80.6%)	NS
Smoking current, No. (%)	7 (20.6%)	47 (36.4%)	NS
Poor left ventricular ejection fraction, (<30%) No. (%)	2 (8%)	5 (4.3%)	NS
Familial history of coronary disease	3 (8.8%)	21 (16.4%)	NS
Co-morbidities, No. (%)			
Hyperlipidemia	13 (38.2%)	38 (29.5%)	NS
Hypertension	20 (58.8%)	49 (38%)	0.03
Renal insufficiency	1 (2.9%)	1 (0.8%)	NS
Cardiovascular history, No. (%)			
Myocardial infarction	15 (44.1%)	53 (41.1%)	NS
Percutaneous coronary intervention	17 (50%)	43 (33.3%)	NS
Coronary bypass surgery	4 (11.8%)	9 (7%)	NS
Cerebrovascular disease & arrest	0	1 (0.8%)	NS
Peripheral vascular disease	7 (20.6%)	29 (22.5%)	NS

Table 2. Procedural Characteristics According to Diabetic and Non-Diabetic Groups

	Diabetic (n=34)	Non-diabetic (n=129)	P value
Target vessel of intervention, No. (%)			NS
Left anterior descending	19 (55.9%)	79 (61.2%)	
Circumflex	6 (17.6%)	20 (15.5%)	
Right coronary artery	9 (23.1%)	30 (23.3%)	
Number of diseased vessels, No. (%)			NS
1	19 (55.9%)	83 (65.4%)	
2	13 (38.2%)	27 (21.3%)	
3	2 (5.9%)	17 (13.4%)	

In-hospital and 12-months follow-up complications

All patients were evaluated after a follow-up of 12 months. In-hospital and 12-months follow-up events are described in Table 3.

CTO procedure in diabetics was associated with a significantly higher rate of in-hospital MACE (23.5% vs. 7.8%, p=0.02), especially revascularization (20.6% vs. 7%, p=0.04). However, twelve months follow-up events in two groups were similar. Hospitalization period after PCI in diabetics (3.26±0.61 days) and non-diabetics (2.86±0.52 days) was similar.

Table 3. In-hospital and 12-months follow-up events in patients with successful CTO

	Diabetic (n=34)	Non-diabetic (n=129)	P value
In-hospital MACE, N (%)	8 (23.5%)	10 (7.8%)	0.02
Cardiac death	1 (2.9%)	0	NS
Myocardial infarction	1 (2.9%)	1 (0.8%)	NS
Revascularization	7 (20.6%)	9 (7%)	0.04
Target lesion	4 (11.8%)	7 (5.4%)	
Other vessel	3 (8.8%)	2 (1.6%)	
bleeding	1 (2.9%)	1 (0.8%)	NS
MACE in 12 months	12 (35.3%)	37 (28.7%)	NS
Cardiac death	0	2 (1.6%)	NS
Non-cardiac death	0	3 (2.3%)	NS
Myocardial infarction	3 (8.8%)	9 (7%)	NS
Revascularization	11 (32.4%)	30 (23.3%)	NS

Discussion

In this study, we compared clinical and one year follow-up outcome in successful PCI on CTO in diabetics and non diabetic patients. In-hospital MACE was significantly higher in diabetics. Unlike our study, in another study, MACE in diabetics was lower than non-diabetics (6.3% vs. 15.6%).[11]

Werner and coworkers reported that in diabetic patients treated with bare metal stent (BMS), the target vessel failure rate was almost double that in non-diabetic patients (64.3% vs. 35.3%). In contrast, there was no influence of diabetes mellitus on target vessel failure rate in the drug-eluting stent (DES) group (6.3% vs. 9.4%).[12]

In the current study, among in-hospital events, revascularization was significantly higher in diabetics. Revascularization rates in people with and without diabetes were 12% and 9% in the Cardiac Care Network of Ontario study at two years[13]; the higher results were seen in our study, 32.4% and 23.3%, respectively. Data from Hoye et al,[14] which were mainly from the BMS data, showed that successful revascularization confers a better outcome irrespective of the presence of DM, whereas Lee et al[12] showed that the presence of DM still affects the patient's outcome irrespective of complete and successful revascularization of the CTO. An additional interesting finding in Lee et al study was that DM was not a significant predictor of ischemia-related MACE in contrast to the case of total MACE.

It is well recognized from large-scale studies that mortality is higher following PCI procedures in those with diabetes when compared with those without diabetes mellitus.[15,16] Also, increased in-hospital mortality after PCI among patients with DM, regardless of the urgency of PCI was previously demonstrated.[17]

In a recent study, survival was significantly lower in those patients with diabetes mellitus. Within the diabetic population, 5-year survival was 84.9% in those with a successful recanalization against 79.1% following unsuccessful recanalization, suggesting that most of the benefit in terms of survival following successful recanalization is in the non-diabetic group.[14]

Results of current study showed that in-hospital mortality rate, although not significant, was higher in diabetic patients; on contrary, mortality in one year follow-up was higher in non-diabetics, mentioning role of other factors in long time survival. However, DM remains a risk factor for poor outcomes. During 9.6±2.0 months of follow-up after stenting of long (> 50 mm) CTOs, DM correlated with the need for repeat PCI.[18]

Recent reports describing results of drug-eluting stent use in CTO demonstrate further improvements in outcomes.

In one study, the one-year survival free of MACE was 96.4% among 56 patients (eight with DM) with CTO treated with sirolimus-eluting stents vs. 82.8% ($p<0.05$) among 28 patients (two with DM) with CTO treated with bare metal stenting.[19] MACE rate in diabetic patients was 10.5% during follow-up in Pei *et al*. study: 3 deaths, 1 myocardial infarction and 11 repeated target lesion revascularization with PCI.[20]

Likewise, Safley and coworkers in the analysis of DM patients with CTO according to angiographic success of PCI, found no significant differences in either in-hospital (success 1.6% vs. failure 2.4%) or 1-year mortality (success 22.2% vs. failure 26.8%). This study suggested that PCI of CTO is safe in patients with DM. However, there is not a measurable improvement in survival in this DM-CTO population.[21]

In the current study, twelve months follow-up events in diabetic and non diabetic groups were 35.3% and 28.5%, respectively. These results were higher than reported follow-up MACE in other studies. Also, De Felice et al., observed that there were 27% and 21% events in diabetic and non-diabetic groups in follow-up period, respectively.[22] The reason for this higher MACE rate in the two mentioned study would be because of multiple risk factors existence in diabetic patients.

Conclusion

Diabetes in patients undergoing successful PCI on CTO is associated with higher in-hospital adverse events; however diabetes does not affect long term outcomes in these patients.

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Conflict of interests: No conflict of interest to be declared.

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