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Percutanous revascularization of chronic total occlusion of diabetic patients at Iraqi center for heart diseases, a single center experience 2012

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Abstract

We aimed to evaluate the influence of DM on the results of PCI of patents with CTO and to compare that with the results in non-diabetic patients. Prospectively studied 150 consecutive cases of CTO with PCI at Iraqi center for heart diseases- Baghdad/Iraq for the period January–December 2012. Success of revascularization of chronic total occlusion by percutaneous coronary intervention was similar in both sexes (male 69.4%, female 72.4%). Intervention was successful in (40) out of (55) patients with diabetes mellitus (72.7%) which was identical to those without diabetes mellitus (66 patients out of 95 patients 69.47%). The success in diabetic and non- diabetic groups in the absence of other risk factors was (64.2%) and (62%) while in the presence of these risk factors it was (73.1%) and (71.2 %) respectively. In (11) out of the (15) patients with diabetes failed intervention was attributed to inability to pass the wire (73.3 %) compared to (23) out of the (29) non-diabetic patients (79.3%). While failure to pass the balloon was identical in both groups (13.3%) compared (13.7) and failure to pass a stent while it was not reported compared to (3.4%) in both diabetic and non-diabetic patients respectively. As far as failure of procedure, passing the wire into a false lumen occurred in one patient (6.6%) of diabetic group, while creation of perforation had occurred in one patient (6.6%) in diabetics. Successful revascularization has led to a prompt relieve of symptoms; angina and improved exercise tolerance as well as enhanced left ventricular function equally in both groups. Regarding CTO- PCI, there was no much difference between success in diabetic and non-diabetic.

Keywords: DM, PCI, CTO, HTN, HLP

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Introduction

A CTO was defined as a lesion exhibiting Thrombolysis in myocardial Infarction flow grade (0–1) of a native coronary artery.

Technical success was defined as the ability to cross the occluded segment with both a wire and balloon and successfully open the artery with a (<40%) residual stenosis in all views. Procedural success was defined as a technical success with no in-hospital major adverse cardiac event (MACE).

A CTO success was defined as a technical success. A MACE was defined as the occurrence of death, Q-wave MI or urgent revascularization. Urgent revascularization was classified by operators caring for patients and required repeat PCI of target vessel during the same admission or coronary artery bypass graft surgery (CABG) including bypass of the target vessel [1].

Dates highlight a striking survival advantage among patients with a successfully opened occluded artery versus those whose procedure was unsuccessful. Work supports the concept of a time- independent benefit of reperfusion. CTOs are a continuum of atherosclerotic progression leading to plaque rupture with thrombus formation. Over time, this thrombus tissue will be converted to fibrous tissue composed mainly of collagen and, in the later phase, calcium. The plaque that forms a CTO is also categorized as soft, hard, or mixed. Soft plaque is primarily composed of cholesterol-laden cells and foam cells that are generally more amenable to wire passage. The hard plaques are composed of dense, fibrous tissue with fibrocalcific regions that are more resistant to wire passage [2].

PCI of chronic total occlusion represents (10%- 20%) of all angioplasty procedures and poses a management, dilemma for the interventional cardiologist [3].

A CTO was defined as obstruction of a native coronary artery with no luminal continuity and thrombolytic in myocardial infarction (TIMI) flow grade 0 or 1. Technical success was defined as restoration of TIMI flow grade 2 or 3 with residual stenosis (<15 %) (in stented lesion) [3]. G

Recently, the presence of a CTO in a non-infarct- related artery (non-IRA) and not MVD alone was reported to be an independent predictor of mortality after STEMI. Given the greater extent of coronary artery disease in diabetic patients with STEMI, it was hypothesized that the prevalence of a CTO in a non-IRA would be higher in this high-risk subgroup. Moreover, the prognostic impact of a CTO in a non-IRA in diabetic patients with STEMI is currently unknown [4].

Two retrospective studies from the 1990 suggested that the prevalence of CTO in patients with coronary artery disease (CAD) on coronary angiograms ranged from (33% to 52 %) [5]. Adoption of techniques and technologies to improve procedural success may have an impact on prognosis [6]. Pre-selected variables for CTO- PCI were age, gender, diabetes mellitus, hypertension, and hypercholesterolemia, presence of multi vessel disease, impaired left ventricular function, prior AMI, prior PCI, and prior CABG, use of a glycoprotein IIb/IIIa inhibitor, target vessel, successful procedure, and use of a stent [7].

Coronary chronic total occlusions CTOs are commonly encountered complex lesions identified in (15%) of all patients referred for coronary angiography [8]. The ideal patient is one who has persistent angina with suitable lesion anatomy consisting of a tapered occlusion, angulation (<45°), a single lesion, and lesion length (<15 mm). The appropriately selected patient can now look forward to increased successful recanalization and safety during treatment of CTOs using the Safe-Cross System, which is unique in its ability to assess the intraluminal tissue in real time [9].

There is a benefit of cardiac magnetic resonance (CMR), a safe, noninvasive technology, for the follow-up and assessment of the efficacy of a complex PCI procedure like CTO [10].

Patient and methods

A (150) cases of CTO who had undergone PCI at Iraqi center for heart diseases regarding the base line characteristics. The patients classified according to arterial and then segmental involvement. Verified the causes of failure and number of attempts of PCI in both diabetic and non-diabetic groups. Investigated the success of CTO-PCI in both diabetic and non-diabetic patients when diabetes was the only risk factor and also the success in the presence of other risk factors for ischemic heart diseases in both groups. Both groups divided according to age groups, sex with relation to success and failure.

Statistical analysis

Chi-square test was used to analyze the statistical association between the various selected variables. Statistical significance was accepted for ($P \leq 0.05$) (significant). and ($P > 0.05$) (insignificant).

Results

Regarding the base line characteristics, the results of this study demonstrated in table 1.

	All CTO-PCI patients studied	CTO-PCI success	CTO-PCI failure	P value
Male	121(81%)	84 (69.4%)	37 (30.5%)	0.7 N/S
Female	29(19%)	21 (72.4%)	8(27.5%)	
Diabetic patients	55(36.6%)	40 (72.7%)	15(27.2%)	0.6 N/S
Non-diabetic patients	95(63.3%)	66(69.4%)	29 (30.5%)	
HTN	72(48%)	52 (72.2%)	20 (27, 7%)	0.5 N/S
Hyperlipidemia	55(36.6%)	42 (76.36%)	13 (23.63%)	0.1 N/S
Smoking	48(32%)	37 (77%)	11 (22.9%)	0.1 N/S
Obesity	47(31.3%)	36 (76%)	11 (23.4%)	0.2 N/S
Prior MI	46(30.6%)	27(58.7%)	19(41.3%)	0.04 S
Prior CABG	7(4.6%)	5(71.4%)	2(28.5%)	0.9 N/S
Prior PCI	20(13.3%)	17(85%)	3(15%)	0.1 N/S
Multi-vessel disease	84(56%)	68(80.9%)	16(19%)	0.2 N/S

Table 1.
Base line characteristics

	Diabetic patients*			Non-diabetic patients**		
Age grope	Total	Success	Failure	Total	Success	Failure
30-39 year	-	-	-	5(5.2%)	5 (100%)	
40-49 year	11(20%)	6(54.54%)	5(45.45%)	23(24.2%)	21 (91.3%)	2 (8.69%)
50-59 year	24(43.6%)	18(75%)	6(25%)	27(28.4%)	16 (59.2%)	11 (40.7%)
60-69 year	15(27.2%)	11(73.33%)	4 (26.66%)	35(36.8%)	21 (60%)	14 (40%)
70-80 year	5(9.09%)	5(100%)	-	5(5.2%)	3 (60%)	2 (40%)

*P>0.05 **P<0.05

Table 2.
Success and failure of PCI according to age groups.

LCX	9(6%)	8(88.8%)	1(11.1%)	0.3 N/S
RCA	67(44.6%)	43(64.1%)	24(35.8%)	0.1 N/S
OM	8(5.3%)	6 (75 %)	2(25%)	0.7 N/S
Diagonal	1(0.6%)	1(100%)	—	0.9 N/S
PLV	1(0.6%)	1(100%)	—	0.9 N/S
PDA	—	—	—	
Ramus	2(1.3%)	2(100%)	—	0.9 N/S

Table 3.
Success and failure of PCI according to arterial involvement.

Artery	Total number	Ostial	proximal	Mid	distal	success	failure
LAD	62 (41.3%)	4 (6.4%)	10 (16.1%)	44 (70.9%)	4 (6.4%)	45 (72.5%)	17 (27.4%)
LCX	9(6%)	—	1 (11.1%)	5 (55.5%)	3 (33.3%)	8 (88.8%)	1 (11.1%)
RCA	67(44.6%)	—	16 (23.8%)	37 (55.2%)	14 (20.8%)	43 (64.1%)	24 (35.8%)
OM	8(5.3%)	1 (12.5%)	4 (50%)	3 (37.5%)	—	6 (75%)	2 (25%)
Diagonal	1(0.6%)	—	1 (100%)	—	—	1 (100%)	-
PLV	1(0.6%)	1 (100%)	—	—	—	1 (100%)	-
PDA	—	—	—	—	—	-	-
Ramus	2(1.3%)	1 (50%)	1 (50%)	—	—	2 (100)	

P>0.05

Table 4.
Success and failure of PCI according to segmental involvement.

	Number	Success	Failure	Failure to pass a wire	Failure to pass a balloon	Failure to pass a stent	Passing wire in a false lumen	Creation of perforation	Single failed attempt	Multiple failed attempts
Diabetic patients	55(36.6%)	40(72.7%)	15(27.2%)	11(73.3%)	2(13.3%)	-	1(6.6%)	1(6.6%)	13(86.6%)	2(13.3%)
Non-diabetics	95(63.3%)	66(69.4%)	29(30.5%)	23(79.3%)	4(13.7%)	1(3.4%)	-	1(3.4%)	26(89.6%)	3(10.3%)

Table 5.
Causes of PCI failure

	Total	Success	Failure
Number of diabetic patients, DM as only risk factors	14(9.3%)	9 (64.2%)	5 (35.7%)
Number of diabetic patients, DM + other risk factors	41(27.3%)	30 (73.1%)	11 (26.8%)
Number of non-diabetic patients with no other risk factors	29(19.3%)	18 (62%)	11 (37.9%)
Number of non-diabetic patients with (+ve) other risk factors	66(44%)	47 (71.2%)	19 (28.7%)

P>0.05

Table 6.
Success and failure of PCI in diabetic and non-diabetic patients according to risk factor.

Type of patients	Sex	Total	Success	Failure
Diabetics	Male	43(78.1%)	30 (69.7%)	13 (30.2%)
	Female	12(21.8%)	9 (75%)	3 (25%)
Non-diabetics	Male	78(82.1%)	54 (69.2%)	24 (30.76%)
	Female	17(17.8%)	12 (70.5%)	5 (29.4%)

P>0.05

Table 7.
Success and failure of PCI according to sex.

Discussion

Regarding baseline characteristics, a (150) CTO-PCI patient according to gender, diabetic status, hypertension, smoking, obesity, prior PCI, prior CABG, prior MI and MVD. There was a similar study which used the same parameters [3], while in another study [7] the pre-selected variables were age, gender, diabetes mellitus, hypertension, hypercholesterolemia, MVD, impaired left ventricular function, prior AMI, prior PCI. Prior CABG, use of a glycoprotein IIb/III an inhibitor, target vessel, successful procedure and use of a stent and our results are nearly comparable. While in another study 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 re-vascularization 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.

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 [11]. Regarding the arterial involvement my results were a little bit similar to another study [6] which showed that CTO-PCI was performed on the left anterior descending coronary artery LAD in 232 (35.1%), left circumflex coronary artery in 112 (16.9%), and right coronary artery in 298 (45.1%) patients.

Patients in the successful group were more likely to have undergone LAD intervention, whereas those in the unsuccessful group were more likely to have undergone intervention to the right coronary artery. In another study the following results had been established; 57 patients with chronic total occlusions underwent PCI out of them (31.58%) are female and (68.42%) are male. There was no per-procedural or in hospital complications. (49.1%) patients had MVD (33.33%) left anterior descending artery lesion, (29.82%) right coronary lesion, (24.56%) circumflex lesion and (12.28%) obtuse marginal lesion. Predilation was done in all cases using various size balloons. Various wires were used and in most cases more than one wire were used. Cypher, taxus and driver stents were used for stenting. (75.4%) are successful while (24.6%) were unsuccessful [3]. I also verified the segmental involvement of CTO lesions in our (150) patients (table 4), and I compared my findings with what had been accounted in another study [5] whereas it was stated that the distribution of solitary CTOs showed (47%) were in the right coronary artery (RCA). Whereas only (20%) had a solitary CTO in the left anterior descending artery and (16%) in the left circumflex branch. Chronic occlusion in (>1) coronary artery were observed in (17%). The CTO location was in the proximal or middle portion of the coronary arteries in (78%) of cases distribution of proximal or mid vessel occlusion per vessel: left anterior descending artery (84%); left circumflex branch (63%) and our results were nearly comparable.

Out of our (150) cases studied, there were (55) patients having DM and success of PCI trial was reported in 40 (72.7%) of cases. While the non-diabetic cases were (95) and the success of CTO- PCI was reported in (66) patients (69.4%), and in comparison with our results one study [5] showed that the success rate (70%) and is consistent with that of many previous registries [3], although more recent studies from CTO specialized centers have reported success rates (>80%) and all these results were a little bit comparable to my findings.

According to our study, out of the 15 (27.2%) failed attempts the causes of failure were as follow: 11 cases (73.3%) were due to failure to pass a wire, 2 cases (13.3%) were due to failure to pass a balloon, 1 case (6.6%) was due to a passage in a false lumen and 1 (6.6%) case was due to a creation of a perforation. While in the non-diabetic 29 (30.5%). failed attempts the causes of failure were as follow: 23 (79.3%) cases were due to a failure to pass a wire, 4 cases (13.7%) were due to a failure to pass a balloon, 1 case (3.4%) was due to a failure to pass a stent and in 1 case (3.4%) was due to creation of a perforation while as a comparison it was reported in one study (3) that technical and procedural success was obtained in (75.4%) of patients. Among failed procedures, inability to cross the lesion with a guide wire, inability to cross with a balloon and inability to dilate were the reasons of failure in (57.14%), (28.57%) and (12.28%) respectively. In our diabetic failed 15 attempts, 13 (86.6%) cases were reported as a single failed attempt and in 2(13.3%) of the cases there was more than a single failed attempt. While regarding the 29 failed attempts in non-diabetic patients we reported 26 (89.6%) as a single and in 3 (10.3%) the matter was due to multiple attempts. All our 150 cases of CTO-PCI were initially symptomatic whereas it was stated in one study that the true prevalence of CTO in the general population is unknown as a certain proportion of patients with CTO are asymptomatic or minimally symptomatic [5]. It was added in the same study that only (11%) to (15%) undergoing

PCI for CTO were asymptomatic. The same percentage was also reported in another study [9]. According to our study, the beneficial effect of successful recanalization of CTO on overall survival free of major adverse events was clearly apparent to be irrespective of diabetic status and this was confirmed in a similar study [7]. In my study there was no much difference in the success rates in both diabetic and non-diabetic patients, this was confirmed also in other two studies [12, 13] which accounted that diabetic and non-diabetic patients have similar rates of initial angioplasty success but diabetic patients have higher restenosis rates after percutaneous transluminal coronary angioplasty (PTCA) and worse long term outcomes. All our patients with successful CTO-PCI got remarkable improvement and this was witnessed by follow up in the outpatient clinic through enhanced left ventricular function, reduction of angina and improved exercise tolerance and our results were similar with what had been stated in another study [7] which accounted that the benefits of CTO percutaneous coronary intervention (PCI) include symptom relief, improved left ventricular function, and potentially a survival advantage associated with success when compared with failed CTO-PCI. In addition, successful PCI of CTO is associated with improved quality of life and reduced ischemia [7].

The data concluded that the CTO-PCI results, there was no much difference between success in diabetic and non-diabetic patients, so also the presence of other risk factors has no an impact on the same results at the time of intervention. In both groups and in all patients the disease was symptomatic and those with successful attempts got many benefits from PCI so CTO-PCI should be done in all patients with prognostically significant ischemia or heart failure with significant viability.

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Competing interests

The author declares that there is no conflict of interest.

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