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Original Research Article

Prognostic Value of Successful Percutaneous Coronary Intervention in Patients with Chronic Total Coronary Occlusion

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Abstract

Chronic Total Occlusion (CTO) of coronary arteries remains one of the most challenging lesion subsets in interventional cardiology even with the development of medical devices and operator experiences. Successful revascularization results in clinical improvement, symptom relief and enhanced left ventricular function and reduces the need for Coronary Artery Bypass Grafting (CABG) surgery. This study sought to assess prognostic value and clinical outcome of successful percutaneous coronary intervention in patients with chronic total coronary occlusion. In this study, clinical and coronary angiography data of (60) patients with CTO between January 2012 and September 2015 where (30) patients underwent successful Percutaneous Coronary Intervention (PCI) with drug-eluting stent and the other (30) received medical treatment only. Patients must have evidence of viable myocardium. All patients underwent clinical and laboratory evaluation. Follow up for six months after the procedure for major adverse cardiac events and clinical outcome. The successful PCI group included 22 males (73.30%) and 8 females (26.7%). The conservative group included 23 males (76.7%) and 7 females (23.3%), no significant difference was found between both groups; P = 0.766. The mean age of the successful PCI group was 51.87± 6.63 years and that of conservative group was 50.93±5.60 years, no significant difference was found between both groups; P = 0.558. After six months angina CCS class, NYHA class and left ventricular function significantly improved in the successful PCI group compared to the conservative group. Successful revascularization of CTO leads to clinical improvement, symptom relief and enhanced left ventricular function.

Keywords: Coronary angiography data, Chronic total occlusion, Percutaneous coronary intervention, Prognostic value

INTRODUCTION

Chronic total occlusion (CTO) can be found in the third of patients referred for diagnostic invasive coronary angiography (Werner et al., 2009). Percutaneous coronary interventions (PCIs) of chronic total occlusions (CTOs) can provide significant clinical benefits (Garcia et al., 2013). Another important potential benefit of CTO PCI is left ventricular (LV) function improvement (Hoebers et al., 2015).

It may be preferable to use ante-grade crossing techniques for CTO recanalization, as retrograde crossing techniques have been associated with higher risk for periprocedural myocardial infarction and procedural

Table 1. Baseline characteristics.

	All Cases (n=60)	Successful PCI group (n = 30)	Conservative group (n=30)	Statistical test
Age (years)				
Min	43	43	43	
Max	72	72	65	P = 0.558
Mean	51.40	51.87	50.93	
SD	6.10	6.63	5.60	
Sex				
Male	45 (75%)	22 (73.3.0%)	23 (76.7%)	X2 = 0.089
Female	15 (25%)	8 (26.7%)	7 (23.3%)	P = 0.766

P* is significant if < 0.05

Table 2. Baseline comparison between both groups as regards risk factors

Risk factors	All Cases (n=60)	Successful PCI group (n = 30)	Conservative group (n=30)	Statistical test
DM				P = 0.598
Yes	24 (40%)	13 (43.3%)	11 (36.3%)	
No	36 (60%)	17 (56.7%)	19 (63.7%)	
Hypertension				P = 0.573
Yes	18 (30%)	10 (33.3%)	8 (26.7%)	
No	42 (70%)	20 (66.7%)	22 (73.3%)	
Hypercholesterolemia				P = 0.604
Yes	32 (46.7%)	15 (50%)	17 (56.7%)	
No	28 (53.3%)	15 (50%)	13 (43.3%)	
Smoking				P = 0.793
Yes	25 (41.7%)	13 (43.3%)	12 (40%)	
No	35 (58.3%)	17 (56.7%)	18 (60%)	
History of MI				P = 0.058
Yes	21(35%)	14 (46.7%)	7 (23.3%)	
No	39(65%)	16 (53.3%)	23 (76.7%)	
Family history				P = 0.028*
Yes	13 (21.7%)	10 (33.3%)	3 (10%)	
No	47 (78.3%)	20 (66.7%)	27 (90%)	

P* is significant if < 0.05

complications (Lo et al.,2014; El Sabbagh et al., 2014). However, retrograde techniques may often be needed for recanalizing complex CTOs and preserving bifurcations (Kotsia et al., 2014; Christopoulos et al., 2015). Although the success of CTO PCI has been steadily increasing over time (Patel et al., 2013; Michael et al., 2013), it remains heavily dependent on operator experience (Brilakis et al., 2015; Michael et al., 2015).

The aim of this study is to assess prognostic value and clinical outcome of successful percutaneous coronary intervention in patients with chronic total occlusion.

METHODS

This study included 60 patients who have chronic total occlusions proved to be the main lesions. 30 patients underwent successful percutaneous coronary intervention with drug-eluting stent underwent PCI between January 2012 and September 2015 and the remaining 30 patients served as the conservative group which received medical treatment only.

There was no significant difference found between both groups in baseline clinical characteristics (Table 1) or any risk factors except family history (Table 2).

Patients must have evidence of viable myocardium either by significant angina with single totally occluded vessel and normal wall motion, normal myocardial wall motion of the region supplied by the totally occluded artery, presence of collaterals supplying the totally occluded vessel with normal wall motion or documenting viable myocardium by thallium study or Dobutamine echocardiography. All patients underwent clinical and laboratory evaluation.

Table 3. Comparison between both group as regards the angina CCS class before and 6 months after PCI

CCS angina class		successful PCI group (n = 30)	Conservative group (n = 30)	X^2-test
Before	I	3 (10%)	5 (26.7%)	P = 0.448
PCI	II	18 (60%)	15 (50%)	P = 0.436
	III	9 (30%)	10 (33.3%)	P = 0.781
	IV	0 (0.0%)	0 (0.0%)	P = 1.00
After	No chest pain	20 (66.7%)	0 (0.0%)	P = 0.0001*
PCI	I	7 (23.3%)	11 (36.6%)	P = 0.26
	II	3 (10 %)	15 (50%)	P = 0.001*
	III	0 (0.0%)	4 (13.3%)	P = 0.038*
	IV	0 (0.0%)	0 (0.0%)	P = 1.00

P* is significant if < 0.05

Table 4. Comparison between both group as regards NYHA class before and 6 months after PCI

NYHA class		successful PCI group (n = 30)	Conservative group (n = 30)	X^2-test
Before	Class I	9 (30%)	7 (23.3%)	P = 0.559
	Class II	18 (60%)	20 (66.7%)	P = 0.592
	Class III	3 (10%)	3 (10%)	P = 1.0
	Class IV	0 (0.0%)	0 (0.0%)	P = 1.0
After	No dyspnoea			
		17 (56.7%)	0 (0.0%)	P = 0.0001*
	Class I	10 (33.3%)	1 (3.3%)	P = 0.0001*
	Class II	3 (10%)	17 (56.7%)	P = 0.003*
	Class III	0 (0.0%)	12 (40%)	P = 0.001*
	Class IV	0 (0.0%)	0 (0.0%)	P = 1.00

P* is significant if < 0.05

Follow up immediately and six months after the procedure for major adverse cardiac events and clinical outcome.

RESULTS

Before PCI

There was no significant difference between both groups as regards the percentage of patients with no chest pain, CCS angina class I, II, III or IV. There was no significant difference between both groups as regards the percentage of patients with no dyspnoea, NYHA class I, II, III or IV.

Wall motion score index and ejection fraction showed no significant difference between both groups (P value = 0.200 and 0.197 respectively).

After 6 months

Angina CCS class and NYHA class significantly improved in the successful PCI group compared to the conservative group. The percentage of patients with no chest pain was significantly higher in the successful PCI group (66.7%) compared to the conservative group where no patient was without chest pain (0%); P = 0.0001. The percentage of patients with class II and III were significantly higher in conservative group (50%) and (13.3%) respectively compared to the successful PCI group where these 3 (10 %) and 0 (0%); P = 0.001and P = 0.038 respectively (Table 3).

The percentage of patients with no dyspnoea was significantly higher in the successful PCI group (56.7%) compared to the conservative group where no patients where free of dyspnoea (0%); P = 0.0001. NYHA class II and III were significantly higher in conservative group than successful PCI group; P = 0.003 and P = 0.001, respectively. NYHA class III and IV disappeared in successful PCI group (Table 4).

Wall motion score index and ejection fraction showed statistically significant difference between both groups (P value = 0.0001and 0.0001 respectively) as they improved significantly in the successful PCI group and decline significantly in the conservative group (Table 5).

Table 5. Comparison between both groups as regards echocardiography before and 6 months after PCI

	Wall motion score index		Ejection fraction (%)	
	Before PCI	**After 6 months**	**Before PCI**	**After 6 months**
Successful PCI group				
Mean	1.37	1.195	53.17	58.4
SD	0.099	0.100	2.949	3.20
Conservative group				
Mean	1.33	1.41	53.5	52.06
SD	0.100	0.112	3.857	3.768
T	1.296	4.094	-0.925	7.01
P	0.200	0. 0001	0.197	0.0001

P* is significant if < 0.05

DISCUSSION

Coronary chronic total occlusions (CTOs) represent a frequent lesions subset observed in everyday catheterization laboratory practice. Previously considered to be an indication for surgical myocardial revascularization, the development of equipment and techniques and a wise patient's selection remains the key issue able to insure the best clinical outcome of CTO PCI.

According to Baseline clinical characteristics there were no significant difference in the baseline clinical characteristics except in family history of ischemic heart disease,10 patients (33.3%) in the successful PCI group and 3 patients (10%) in the conservative group had family history of IHD; P = 0.028.

The technical success of the procedure was defined as restoration of TIMI flow grade II or III and myocardial blush grade II or III with a residual stenosis of ≤ 20% assessed by qualitative coronary angiography. Procedural success was defined as technical success without in-hospital MACE.

In our study, the ante-grade approach was the strategy applied to open CTO in all cases and all stents implanted were Drug-eluting stents.

Follow up

Mace

MACE incidence within the 6 months was significantly lower in the successful PCI group than the conservative group; 3.3% versus 26.7% respectively P value = 0.0001.

Similarly, Christakopoulos et al meta-analysis of the long-term outcomes of successful CTO PCI. A total of 25 studies, published from 1990 to 2014, with 28,486 patients were included. During a weighted mean follow-up of 3.11 years, successful CTO PCIs are associated with a lower risk of death, stroke, and coronary artery bypass grafting and less recurrent angina pectoris (Christakopoulos et al., 2015).

Joyal et al. encompassed 7,288 patients observed over a weighted average follow-up of 6 years. Successful attempts appear to be associated with an improvement in mortality and with a reduction need for CABG (Joyal et al., 2010).

Clinical Symptoms

Angina Pectoris (CSS class) and dyspnoea NYHA class
In the present study, all patients prior to PCI experienced angina and dyspnoea.

In the successful PCI group, symptoms improved significantly in all patients.

Similarly, Ivanhoe et al (Ivanhoe et al., 1992) and Prasad el al (Prasad et al., 2007) reported improvement in symptoms and quality of life post-PCI to CTO.

Echocardiography Left ventricular function

We assessed the impact of revascularization of CTO on the left ventricular function by assessing the ejection fraction and wall motion score index (WMSI) 6 months after PCI in the successful PCI and conservative groups.

In the successful PCI group, there was significant impact on the LVF. The mean wall motion score index and mean ejection fraction improved from 1.37±0.099 and 53.17±2.949 prior to PCI to 1.195±0.1 and 58.4±3.20 respectively 6 months after PCI.

In the conservative group, there was decline in LVF. The mean wall motion score index and mean ejection fraction worsen from 1.33±0.1 and 53.5±3.857 to 1.41±0.112 and 52.06±3.768 respectively 6 months after medical treatment.

Several studies have shown LV function improvement following successful CTO PCI, but the power of each individual study to detect a difference was low due to small sample size. To overcome this limitation Hoebers et al. performed an elegant systematic review and meta-analysis of 34 studies (including 2,243 patients) on the impact of CTO PCI on LV function [left ventricular ejection fraction (LVEF) and left ventricular end-diastolic volume

(LV-EDV)] and on long-term mortality (3) he could concluded that his meta-analysis revealed that successful recanalization of a CTO resulted in an overall improvement of 4.44% absolute LVEF points, reduced adverse remodelling and an improvement of survival (OR: 0.52).

Also another recently published study on the myocardial function assessment pre and post CTO PCI by using Doppler tissue echocardiography, where the authors found an improvement of both diastolic and systolic indices post PCI to CTO territories after 3 months follow up (El Shafey et al., 2015).

CONCLUSION

Successful revascularization of CTO leads to clinical improvement, symptom relief and enhanced left ventricular function.

REFERENCES

Brilakis ES, Banerjee S, Karmpaliotis D, et al. (2015). Procedural outcomes of chronic total occlusion percutaneous coronary intervention: a report from the NCDR (National Cardiovascular Data Registry). JACC Cardiovasc Interv; 8:245-53.

Christakopoulos GE, Christopoulos G, Carlino M, et al. (2015). Meta-analysis of clinical outcomes of patients who underwent percutaneous coronary interventions for chronic total occlusions. Am J Cardiol; 115:1367-75.

Christopoulos G, Wyman RM, Alaswad K, et al. (2015). Clinical Utility of the Japan-Chronic Total Occlusion Score in Coronary Chronic Total Occlusion Interventions: Results from a Multicenter Registry. Circ Cardiovasc Interv;8.

El Sabbagh A, Patel VG, Jeroudi OM, et al. (2014). Angiographic success and procedural complications in patients undergoing retrograde percutaneous coronary chronic total occlusion interventions: a weighted meta-analysis of 3,482 patients from 26 studies. Int J Cardiol; 174:243-8.

El Shafey WH, Montaser SS, Badran HM, Gabr MK, Shokry KA, Galassi AR (2015). Assessment of left ventricular function before and after a percutanous coronary intervention to chronic total coronary occlusion: Doppler tissue imaging study. Menoufia Med J; 28:400-5.

Garcia S, Abdullah S, Banerjee S, et al. (2013). Chronic total occlusions: patient selection and overview of advanced techniques. Curr Cardiol Rep; 15:334.

Hoebers LP, Claessen BE, Elias J, et al. (2015). Meta-analysis on the impact of percutaneous coronary intervention of chronic total occlusions on left ventricular function and clinical outcome. Int J Cardiol; 187:90-6.

Ivanhoe R J, Weintraub WS, Douglas JS Jr, et al. Percutaneous transluminal coronary angioplasty of chronic total occlusions. Primary success, restenosis, and long-term clinical follow-up. Circulation 1992; 85:106-

Joyal D, Afilalo J, Rinfret S (2010). Effectiveness of recanalization of chronic total occlusions: a systematic review and meta-analysis. Am Heart J; 160:179-87.

Kotsia A, Christopoulos G, Brilakis ES (2014). Use of the retrograde approach for preserving the distal bifurcation after antegrade crossing of a right coronary artery chronic total occlusion. J Invasive Cardiol; 26: E48-9.

Lo N, Michael TT, Moin D, et al. (2014). Periprocedural myocardial injury in chronic total occlusion percutaneous interventions: a systematic cardiac biomarker evaluation study. JACC Cardiovasc Interv; 7:47-54.

Michael TT, Karmpaliotis D, Brilakis ES, et al. (2013). Procedural outcomes of revascularization of chronic total occlusion of native coronary arteries (from a multicenter United States registry). Am J Cardiol; 112:488-92.

Michael TT, Karmpaliotis D, Brilakis ES, et al. (2015). Temporal trends of fluoroscopy time and contrast utilization in coronary chronic total occlusion revascularization: insights from a multicenter United States registry. Catheter Cardiovasc Interv; 85:393-9.

Patel VG, Brayton KM, Tamayo A, et al. (2013). Angiographic success and procedural complications in patients undergoing percutaneous coronary chronic total occlusion interventions: a weighted meta-analysis of 18,061 patients from 65 studies. JACC Cardiovasc Interv; 6:128-36.

Prasad A, Rihal CS, Lennon RJ, Wiste HJ, Singh M, Holmes DR (2007). Trends in outcomes after percutaneous coronary intervention for chronc total occlusions. A 25-year experience from the Mayo Clinic. J Am Coll Cardiol.; 49:1611-8.

Werner GS, Gitt AK, ZeymerU, Juenger C, Towae F, Wienbergen H, Senges J (2009). Chronic total occlusions in patients with stable angina pectoris: impact on the therapy and outcome in present day clinical practice. Clin Res Cardio.;98:453-41.