

Chronic total coronary occlusion recanalization: Current techniques and new devices

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Percutaneous coronary intervention (PCI) of total chronic coronary occlusion (CTO) still remains a major challenge. The prevalence of a CTO has been reported to be up to 30% among patients with a clinical indication for coronary angiography. Progress has been made with further advanced interventional techniques and continuously sophisticated interventional tools. Nevertheless the number of interventions carried out to recanalize a CTO is less than 10% of all procedures. Benefits of a successful CTO recanalization include relief of angina pectoris and ischemia-related dyspnea, substantial improvement in left ventricular function and, avoidance of surgery treatment. A vast variety of new CTO PCI techniques and materials has been introduced into clinical practise and pushed success rates of reopening a CTO up to around 90% in experienced hands. Particular the introduction of the retrograde technique was a milestone. New developed microcatheters and special polymer coated wires allow to recanalize via small collaterals and vessels. Other tools such as intravascular ultrasound (IVUS) and multislice computertomography (MSCT) help to identify the anatomy and the characteristic of the lesions. Any invasive cardiac center should adopt CTO PCI procedures as standard therapy.

Objective: This review wants to assess and describe the latest development in CTO recanalization strategies.

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Keywords: Latest development, Chronic total occlusion, Coronary artery disease, Technical innovation, Recanalization strategies

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Disclosure: Authors have nothing to disclose with regard to commercial support.

Received 28 June 2016; revised 5 August 2016; accepted 12 August 2016.

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Peer review under responsibility of King Saud University.
URL: www.ksu.edu.sa
<http://dx.doi.org/10.1016/j.jsha.2016.08.003>



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Introduction

Chronic total coronary occlusion (CTO) is defined as an occlusion lasting longer than 3 months following thrombolysis in myocardial infarction flow grade 0 within the occluded segment [1]. The prevalence of a CTO has been reported to be up to 30% among patients with a clinical indication for coronary angiography [2]. Despite this high prevalence, the number of interventions carried out to recanalize a CTO is <10% of all procedures [3].

The main reasons for this mismatch are significant technical challenges, a huge shortage of sophisticated and specialized interventionalists, the considerable time resources needed for the revascularization procedures, and a comparatively low level of reimbursement [4].

An additional barrier is an overestimated increased risk of CTO-percutaneous coronary intervention (PCI) with suspected severe complications as well as the fear of overirradiation. Thus, according to a large U.S. database analysis, attempts at performing a CTO-PCI are decreasing (from 9.4% to 5.7% between 1997 and 2004) although much progress has been made with further advanced interventional techniques and sophisticated interventional tools [3].

In patients with chronically occluded coronary arteries who are symptomatic with angina pectoris and/or display exercise-related myocardial ischemia, coronary artery bypass grafting (CABG) is still considered the routine method of treatment [5–7]. This strategy has to be questioned because CTO intervention is a much less invasive and equally effective procedure with a significantly low rate of relevant major adverse cardiac events in hospital [8]. The success rates of CTO recanalization increased up to 90% in experienced hands in recent years. The time has therefore come to implement CTO in all coronary laboratories as an alternative to CABG.

This review will assess and describe the latest development in CTO recanalization strategies and try to outline new materials and methods.

Abbreviations

CABG	coronary artery bypass graft
CART	controlled antegrade and retrograde tracking
CTO	chronic total occlusion
IVUS	intravascular ultrasound
J-CTO	japanese CTO score
MACE	Major Adverse Cardiac Events
MI	myocardial infarction
MSCT	multislice computertomography
OTW	over-the-wire
PCI	percutaneous coronary intervention
TIMI	thrombolysis in myocardial infarction

Benefits

Relief of angina pectoris and ischemia-related dyspnea, substantial improvement in left ventricular function, and avoidance of major surgery, such as CABG, are the main benefits of CTO recanalization [9–11]. The Total Occlusion Angioplasty Study-Società Italiana di Cardiologia Invasiva (TOAST-GISE) trial proved that successful CTO-PCI was associated with 86% freedom from angina pectoris compared with 70% in the control group.

Regional wall motion and wall thickening of the myocardium improved significantly within 6 months of CTO-PCI (68% vs. 55%) [12]. Meanwhile, there is also evidence that complete CTO revascularization increases the survival of patients with at least one CTO significantly [13].

Multivessel coronary artery disease is associated with an increased risk of mortality in the control of acute myocardial infarction and the majority of this risk is attributable to the presence of a CTO [14]. Through several studies it has been possible to show that successful percutaneous revascularization of a CTO leads to a significantly improved survival rate and a reduction in major adverse cardiac and cerebrovascular events at 5 years compared with unsuccessful CTO-PCI; furthermore, prospective study registries have indicated a large impact of a successful intervention, compared with an unsuccessful intervention, of a CTO on total mortality [15,16].

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