SHORT TERM CLINICAL OUTCOME OF PERCUTANEOUS CORONARY INTERVENTION IN PATIENTS WITH CHRONIC TOTAL OCCLUSION OF CORONARY ARTERY

Thesis

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Dedication

To the soul of

My great father

Hosny ibrahim

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Abbreviations & Acronyms

ACT:	Activated clotting time
AMI:	Acute myocardial infarction
CABG:	Coronary artery bypass graft
CART:	Controlled Antegrade and Retrograde Subintimal Tracking
CCS:	Canadian Cardiology Society
CTO:	Chronic total occlusion
DM:	Diabetes Mellitus
ECG:	Electrocardiogram
EF:	Ejection fraction
IHD:	Ischemic heart disease
IVUS:	Intravascular ultrasound
LAD:	Long anterior descending artery
LV:	Left ventricle
LVEDV:	Left ventricular end-diastolic volume
LVESV:	Left ventricular end-systolic volume
MACE:	Major adverse cardiac events
MAHI:	Mid-America Heart Institute
MBG	Myocardial blush grade
MI:	Myocardial infarction
NHLBI:	National Heart, Lung & Blood Institute
OCR:	Optical coherence reflectometry
PCI:	Percutaneous coronary intervention
POBA:	Plain old balloon angioplasty
RCA:	Right coronary artery
SD:	Standard deviation
SICCO:	Stenting in Chronic Coronary Occlusion
STAR:	Subintimal tracking and reentry technique
TIMI:	Thrombolysis in myocardial infarction
TG	Triglycerides
TOSCA:	Total Occlusion Study of Canada
WMA:	Wall motion abnormality
WMSI:	Wall motion score index

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Introduction

Since the advent of angioplasty, management of a patient with a completely occluded artery has been relatively difficult. The initial descriptions of angioplasty of total occlusions where published in 1982. (1) Subsequently, there have been several studies dealing with primary success, safety, and technical factors.(2)

The advent of the stenting has reduced the incidence of restenosis which had been a major concern regarding long term outcomes with conventional "balloon-only" PTCA. PTCA in chronic total occlusion is associated with higher rate of angiographic restenosis, reocclusion than PTCA in subtotal stenosis (3)

With improvement of both operator skill, and catheter technology, particularly with the development of steerable guide wire system, angioplasty has now been applied to a significant number of patients with totally occluded arteries successfully (4).

Within the cardiology community there continues to be confusion regarding the indications for percutaneous coronary interventions (PCI) in patients with chronic total occlusion (CTO) and scepticism with regard to the ultimate impact revascularisation has on patient outcomes.

It is not surprising, therefore, that most interventional cardiologists try to avoid these potentially long procedures that can be costly and expose the operator to higher radiation doses. (5,6) and, with success rates remained unchanged in the last years, perceived as insufficient to justify the effort involved.

The procedural complexity of CTO angioplasty and the lack of familiarity with new equipment and techniques often prompts half-hearted and prematurely aborted attempts at PCI, leading to physician and patient frustration.

A recent analysis from a NHLBI database even showed a decrease of attempted PCIs in CTOs from 9.4 to 5.7% between 1997 to 2004. (7) Consequently, patients with single vessel disease and chronically occluded vessels are often managed medically regardless of the severity of symptoms and extent of ischemia, and those with multivessel disease with a CTO are referred for bypass graft surgery even if the other lesions are ideal suited for PCI. (8_ 11)

As a reaction to this prevailing attitude, experienced European interventionists have recently established the EuroCTO Club, modelled on similar initiatives in Japan and the USA, whereby members share their experience both within the group and with the interventional and general cardiology communities at large. The aim of the EuroCTO Club is to promote clinical excellence through training and quality control as well as fostering research and technical development in the field of CTO recanalisation. (12)

AIM OF THE WORK

The aim of this study is to assess the short term clinical outcome of percutaneous coronary intervention in patients with chronic total occlusion of coronary arteries in.Ain shams university and Gamal abd Elnaser health insurance hospital.

Chronic total occlusion

Definition of CTO:

Any definition of coronary CTO must consider the degree of lumen narrowing, antegrade blood flow grade & age of the occlusion.

True total occlusion:

Characterized by significant atherosclerotic vessel narrowing with lumen compromise that results in either complete interruption of antegrade blood flow as assessed by coronary arteriography (Thrombolysis in Myocardial Infarction [TIMI] grade 0 flow).

Functional total occlusion:

Characterized by minimal contrast penetration though the lesion without distal vessel opacification (TIMI grade 1 flow).

In the absence of serial angiograms, the duration of coronary occlusion is difficult to specify with certainty and instead must be estimated from available clinical information related to the timing of the event that caused the occlusion, e.g. acute MI or sudden change in angina pattern with ECG changes consistent with the location of the occlusion.

However, in many patients the age of the CTO cannot be determined with confidence.

Furthermore, the temporal criterion used to define a CTO has varied widely in prior reports, typically ranging from>2 weeks (13,14) to >3 months (15), which in part explains inter study differences in lesion characteristics and procedural success.

OCCLUSION DURATION:

Since the time of occlusion is not always known, we suggest 3 levels of certainty:

a) Certain (angiographically confirmed): the minority of cases where a previous angiogram (for instance before a previous CABG operation, or after an acute myocardial infarction) has confirmed the presence of TIMI 0 flow for > 3 months prior to the planned procedure.

b) Likely (clinically confirmed): objective evidence of an acute myocardial infarction in the territory of the occluded artery without other possible culprit arteries > 3 months before the current angiogram.

c) Possible (undetermined): a CTO with TIMI 0 flow and angiographic anatomy suggestive of long-standing occlusion (collateral development, no contrast staining) with stable anginal symptoms unchanged in the last 3 months or evidence of silent ischaemia; in case of recent acute ischaemic episodes (acute myocardial infarction or unstable angina or worsening effort angina), a culprit artery other than the occluded vessel should be present. (12)

In general, a total occlusion of duration >3 months may be considered "chronic."

Pathophsioloy:

The initial acute event leading to the development of a CTO is a ruptured atherosclerotic plaque with bidirectional thrombus formation (16).

Early stages of CTO development:

Thrombus and inflammation:

Our knowledge of thrombus organization is almost exclusively limited to veins. This process resembles the pattern of wound healing .(17) Initially, the freshly formed thrombus contains platelets and erythrocytes within a fibrin mesh, which is followed by invasion of acute inflammatory cells. (18) Neutrophils predominate at first but are later replaced with mononuclear cells. (19,20)

Extracellular matrix:

Collagen is the major structural component of the extracellular matrix (ECM) (21) With predominance of types I and III (and minor amounts of IV, V, and VI) in the fibrous stroma of atherosclerotic plaques. (22)

Neovascularization and Angiogenesis:

Presence of microvessels within the CTO may facilitate angioplasty success.(23) There are three types of microvessels formation in arteries with advanced atherosclerotic lesions;

The *first* pattern occurs in the vasa vasorum, which is the fine network of microvessels in the adventitia and outer media.

These vessels proliferate in atherosclerosis and in response to vascular injury such as angioplasty and stenting (24,25,26)

Second, revascularization can develop within occlusive atherosclerotic intimal plaques, predominantly in response to chronic infl ammation. (27)

The localization of plaque vessels in so-called "hot spots" in the shoulders of atheromas may predispose these plaques to rupture and acute coronary events .(28,29)

The *third* type is the pattern of intraluminal microvessels formation (known as "recanalization") that occurs as part of the organization phase in CTO in which thrombus is replaced by fibrous tissue. These microvessels generally range in size from 100 to 200 μm, but can be as large as 500 μm .(30)