

Retrograde Procedural Planning, Skills Development, and How to Set Up a Base of Operations

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KEYWORDS

• Chronic total occlusion • Retrograde access • Angiography • Skills development

KEY POINTS

- Retrograde access has improved procedural success in the treatment of chronic total occlusions (CTOs), but it requires a thorough understanding of the principles involved and careful planning.
- Retrograde access may be preferable in situations of predictable antegrade complexity or in situations where retrograde access is technically easier.
- Training to become a skilled retrograde operator should include background reading, attendance at training conferences, and performing cases under the supervision of an experienced proctor.
- Angiographic assessment is the bedrock of procedure planning.

 Videos of Proximal anatomic ambiguity; Ostial occlusions; and A distal CTO cap at a major bifurcation accompany this article.

INTRODUCTION

Background and Historical Perspective

Chronic total occlusions (CTOs) represent a commonly occurring lesion subset, historically associated with lower procedural success rates of revascularization, both percutaneously and by coronary artery bypass grafting (CABG).¹ Several recent developments in techniques have been associated with improved procedural success when adopted on a local basis. Of these, access via donor collaterals to the CTO segment (retrograde access) was first described in 1990,² and when more widely adopted and refined has been associated with improvements in procedural success.³ Despite this, it is unclear how widely retrograde access has been adopted. Data from the EuroCTO registry suggest that the retrograde procedure is used in

approximately 15% of CTO procedures.⁴ Given that these data represent a subset of CTO specialists, it would seem likely that retrograde access represents only a small minority of the techniques currently used to treat CTOs.

It is probable that there are several factors influencing this failure of uptake, including: unfamiliarity with the technique; lack of an educational framework within which the technique is delivered; and lack of clarity as to when and how to apply the technique. Some of these issues are addressed further in this article.

Skills Development

Although this article describes a step-by-step approach to the retrograde procedure, it is not a substitute for hands-on training. It is important,

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Box 1**Abbreviations**

CC	– collateral channels
CTA	– computed angiography
Cx	– circumflex coronary artery
IVUS	– intravascular ultrasound
LAD	– left anterior descending coronary artery
LMS	– left main stem
PDA	– posterior descending artery
PLV	– posterior left ventricular branch of right coronary artery
RCA	– right coronary artery

however, to support the technical proficiency required for the retrograde procedure with a fundamental understanding of the underlying principles. It is the authors' belief that the training required to become a skilled retrograde operator is multifaceted and should include background reading, attendance at training conferences, and performing cases under the supervision of an experienced proctor. The intricacies of the procedure are such that it is not recommended for operators to attempt their first procedure unsupervised. Abbreviations used in this article are listed in **Box 1**.

Physiologic and Histopathologic Rationale

CTO lesions are made up of proximal and distal fibrous caps, which encase a softer core of organized thrombus and lipid. There has been some suggestion from pathologic data that the formation of the CTO cap is dependent on the pressures it is exposed to.⁵ The proximal CTO cap is typically exposed to higher pressures (diastolic = 60–80 mm Hg) and therefore tends to form a less benign or blunt cap (**Fig. 1**). The distal cap, however, is exposed to lower pressures and as a consequence may be softer, more tapered, and hence easier to

penetrate. Histopathologic comparisons of proximal and distal caps reveal the former to be thicker, with more dense collagen-rich fibrous tissue.⁶

PROCEDURE PLANNING: CASE SELECTION ***When Retrograde Access May be Preferable***

Retrograde access may be preferable in situations of predictable antegrade complexity or situations whereby retrograde access is technically easier. It is partly for this reason that the adoption of retrograde skills leads to improved procedural success. These situations are often not binary and represent a continuum wherein the threshold for retrograde access will be lower with greater experience.

Anatomic subsets of predictable antegrade complexity are shown in **Fig. 2**.

Proximal Anatomic Ambiguity

Proximal anatomic ambiguity is illustrated in **Video 1** (available online at <http://www.interventional.theclinics.com>). If the location/nature of the proximal cap cannot be defined, this significantly limits the ability to escalate penetration force. Although there are occasions when the proximal cap can be defined further with adjunctive imaging techniques (intravascular ultrasonography [IVUS] coronary computed tomographic angiography [CTA]), there are limitations to the applicability of these techniques. IVUS requires the presence of a side branch large enough to accommodate an IVUS catheter at, or very near, the proximal cap. CTA can help to define and localize the proximal cap, but in the absence of highly accurate coregistration this can be of limited applicability.

In these situations retrograde access may be preferable, either from a primary procedural success perspective or by the presence of a retrograde wire/microcatheter to help define the proximal cap (**Fig. 3**) and enable escalation of therapy.

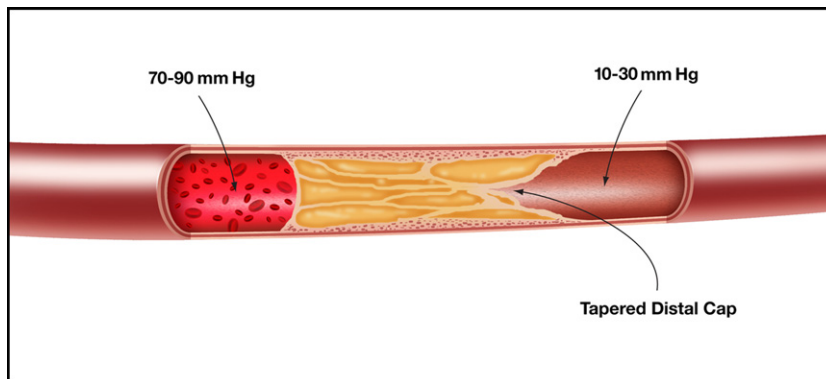


Fig. 1. Higher perfusion pressures lead to a harder, blunter, less "favourable" proximal cap of the CTO.

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