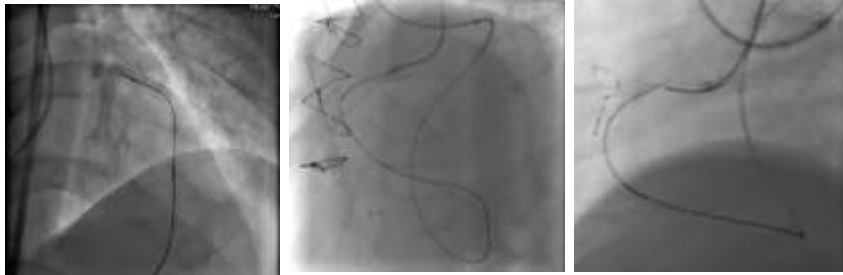


Preprocedural Planning

Ahmed M. ElGuindy, MD, MRCP(UK), FACC



Setting the scene

- Avoid ad-hoc PCI
- Allocate sufficient time
- Good hydration
- Prep alternative access site(s)
- Urinary catheter (optional but helpful)
- Adequate sedation and analgesia
- Revise indication for intervention



Indication/appropriateness

Recommendations for the treatment of specific lesion subsets

Recommendations	Class ^a	Level ^b	Ref ^c
DES should be considered for PCI of ostial lesions.	IIa	B	769-772
For PCI of bifurcation lesions, stent implantation in the main vessel only, followed by provisional balloon angioplasty with or without stenting of the side branch, should be the preferred treatment.	IIa	A	725-731
Percutaneous recanalization of CTOs should be considered in patients with expected ischaemia reduction in a corresponding myocardial territory and/or angina relief.	IIa	B	740-743, 745
Retrograde recanalization of CTOs may be considered after a failed antegrade approach or as the primary approach in selected patients.	IIIb	C	

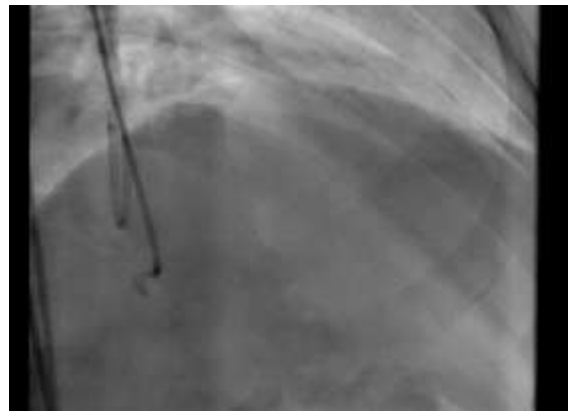
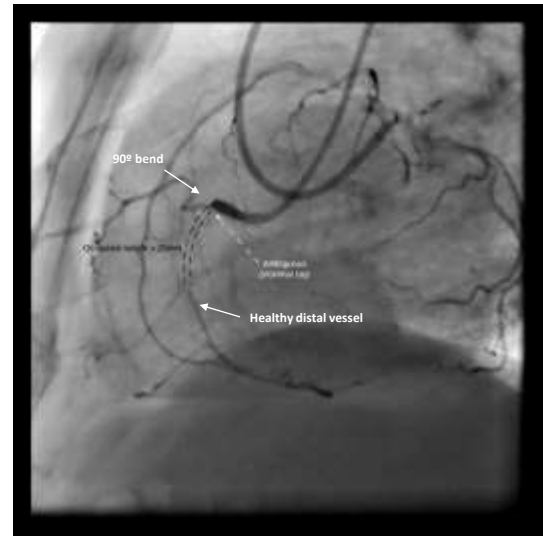
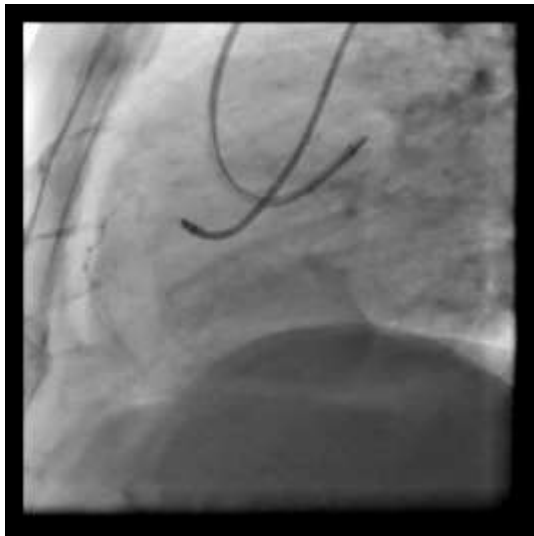


Image acquisition

- Dual injection
- Low magnification
- No panning
- Donor vessel first
- Angulation

Evaluation of the lesion

- Spend 15-20 minutes studying the angiogram – preferably with the whole team.
- Determine 4 key features (to guide strategy):
 - Proximal cap: clear vs. ambiguous
 - Lesion length: <20mm vs. >20mm
 - Quality of distal target vessel: healthy vs. diseased
 - Collaterals: interventional vs. non-interventional and septal vs. epicardial
- Determine complexity (chances of success)
- Determine access options
- Identify challenges and risks



Determining complexity: J-CTO Score

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Predicting Successful Guidewire Crossing Through Chronic Total Occlusion of Native Coronary Lesions Within 30 Minutes

The J-CTO (Multicenter CTO Registry in Japan) Score as a Difficulty Grading and Time Assessment Tool

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Osaka, Kyoto, Hiroshima, Yokohama, Tsukuba, Miyazaki, Kumamoto, Okazaki, Sapporo, and Kanazaki, Japan, and Redwood City, California

Objective: This study sought to establish a model for grading lesion difficulty in interventional chronic total occlusion (CTO) systems.

Background: Owing to uncertainty of success of the procedure and difficulties in selecting suitable cases for treatment, performance of interventional CTO remains infrequent.

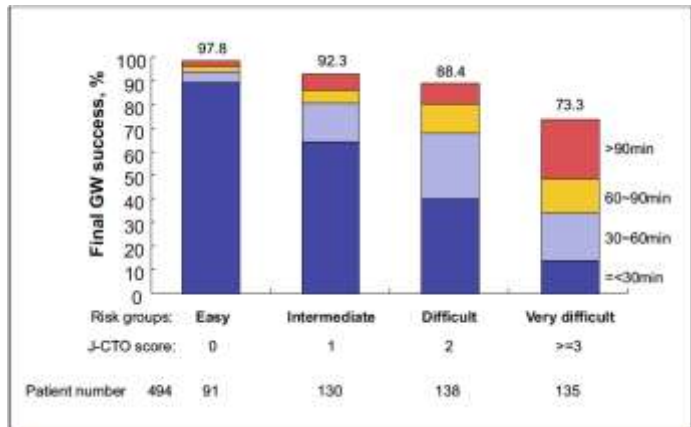
Table 3. Univariate Correlates of Successful GW Crossing Within 30 Min in the Derivation Set.

	Successful (n = 240)	Unsuccessful (n = 249)	p Value
Age (70 yrs)	30.0%	25.1%	0.1
Male	73.6%	84.0%	0.007
Prior PCI	28.8%	46.8%	0.1
Prior CABG	4.8%	12.8%	0.007
EF <40%	11.2%	16.6%	0.1
Heart failure	11.0%	13.0%	0.8
Prior myocardial infarction	42.5%	46.1%	0.2
Multivessel disease	62.5%	67.8%	0.3
Stroke	12.3%	11.8%	0.8
Hemodialysis	1.0%	5.5%	0.01
Hypertension	70.0%	77.0%	0.1
Dyslipidemia	51.3%	52.7%	0.8
Current smoker	18.0%	20.7%	0.4
Diabetes	42.5%	46.2%	0.7
Brain-treated	11.0%	3.0%	0.2
Family history of MI	13.8%	12.4%	0.7
Target lesion			0.3
ICA	21.9%	18.6%	
LAD	46.6%	33.7%	
LMCA	3.0%	0.6%	
RCA	27.2%	46.2%	
Previously failed lesion	1.0%	17.2%	<0.0001
Distal location	16.4%	10.7%	1.0
Side branch	79.4%	85.2%	0.2
Sharp stump type at entry	24.1%	52.7%	<0.0001
Catheterization	35.0%	73.4%	<0.0001
Stidge collateral	21.3%	31.4%	0.4
Bending	23.8%	62.7%	<0.0001
Occlusion length <20 mm	8.9%	24.2%	<0.0001
Retrospectively collateral grade <3	90.7%	75.7%	0.0001



Determining complexity: J-CTO Score

<p>Tapered</p>	<p>Blunt</p> <p>Entry with any tapered tip is simple indicating direction of the lesion is categorized as 'tapered'.</p>	<p>Entry shape</p> <input type="checkbox"/> Tapered (0) <input type="checkbox"/> Blunt (1) points
<p>Catheterization</p> <p>Regardless of severity, 1 point is assigned if any catheterization is detected within the CTO segment.</p>	<p>Catheterization</p> <input type="checkbox"/> Absence (0) <input type="checkbox"/> Presence (1) points	
<p>Bending >45degrees</p> <p>One point is assigned if bending > 45 degree is detected within the CTO segment. Any tortuosity associated from the CTO segment is excluded from this assessment.</p>	<p>Bending >45°</p> <input type="checkbox"/> Absence (0) <input type="checkbox"/> Presence (1) points	
<p>Occlusion length</p> <p>Using good collateral images, try to measure "true" distance of occlusion, which tends to be shorter than the first angiogram.</p>	<p>Occl.Length</p> <input type="checkbox"/> <20mm (0) <input type="checkbox"/> ≥20mm (1) points	
<p>Re-try lesions</p> <p>Is this re-try (1st attempt) lesion 1 (previously attempted but failed)</p> <input type="checkbox"/> No (0) <input type="checkbox"/> Yes (1) points	<p>Re-try lesion</p> <input type="checkbox"/> No (0) <input type="checkbox"/> Yes (1) points	
<p>Category of difficulty (Total points)</p> <input type="checkbox"/> Easy (0) <input type="checkbox"/> Intermediate (1) <input type="checkbox"/> Difficult (2) <input type="checkbox"/> Very difficult (≥3)	<p>Total</p> 4 points	



Angioplasty

Validation of the J-Chronic Total Occlusion Score for Chronic Total Occlusion Percutaneous Coronary Intervention in an Independent Contemporary Cohort

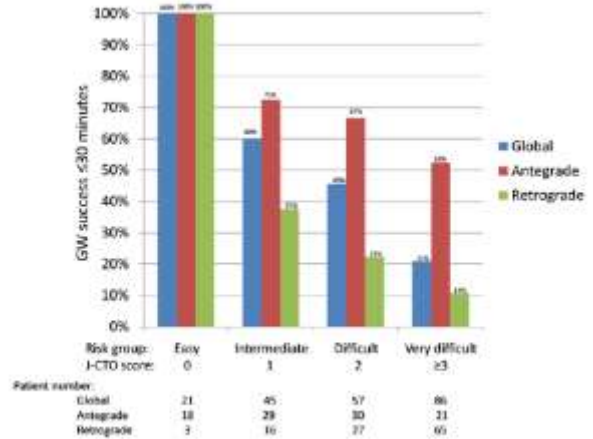
Luis Nombela-Franco, MD; Marina Urena, MD; Miguel Jerez-Valero, MD; Cao Minh Nguyen, MD; Henrique Barbosa Ribeiro, MD; Yoram Banal, MD; Josep Rodés-Cabau, MD; Stéphane Blanche, MD, SM

Background—Chronic total occlusion (CTO) recanalization is a complex and technically challenging procedure. The J-CTO score has been proposed to stratify case complexity and procedural success rates. However, the score has never been tested outside the setting of the original study. Moreover, its predictive value when using a hybrid antegrade or retrograde approach is unknown. We investigated the performance of the J-CTO score for predicting procedure complexity and success in an independent contemporary cohort.

Methods and Results—A total of 209 consecutive patients who underwent CTO recanalization by a high-volume operator were included. Clinical and angiographic data were prospectively collected. The J-CTO score was applied for each patient, and discrimination and calibration were evaluated in the whole cohort, and according to the approach (antegrade 47% and retrograde 53%). Clinical and angiographic differences were noted between the original and studied cohort. The mean J-CTO score was 2.16±1.26, and successful guidewire crossing within 30 minutes and final angiographic success were 42.5% and 81.4%, respectively. The J-CTO score demonstrated good discrimination (c statistic, >0.70) and calibration (Hosmer-Lemeshow P=0.1) in the whole cohort and for antegrade and retrograde approaches. However, the final success rate was not associated with the J-CTO score.

Conclusions—In this independent cohort, the J-CTO score showed good discriminatory and calibration capacity for guidewire CTO crossing within 30 minutes but it does not for final success rate. The J-CTO score helps to predict complexity of CTO recanalization, and the simplicity of the score supports the widespread use as a clinical tool. (Circ Cardiovasc Interv. 2013;6(4):415-443.)

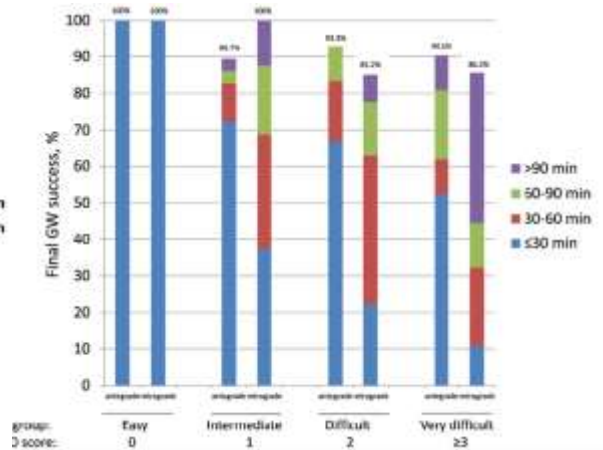
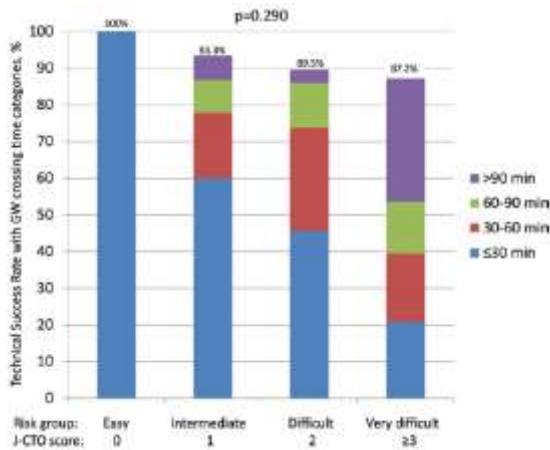
Key Words: chronic disease ■ coronary occlusion ■ percutaneous coronary intervention



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J-CTO limitations



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Determining complexity: PROGRESS-CTO Score

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 DEVELOPED BY CARDIAC

TYPE: ORIGINAL RESEARCH
 ORIGINAL RESEARCH ARTICLE

CLINICAL RESEARCH

OVERVIEW

Development and Validation of a Novel Scoring System for Predicting Technical Success of Chronic Total Occlusion Percutaneous Coronary Interventions

The PROGRESS CTO (Prospective Global Registry for the Study of Chronic Total Occlusion Intervention) Score

Georgios Chalkias, MD; David S. Kandath, MD; Robert W. Fols, MD, MBA; James A. Sforzo, MD, PhD; Dimitris Karamanolis, MD; Michael R. Wyman, MD; Basilios Alexand, MD; William Lombardi, MD; J. Aaron Quinones, MD; Jeffrey Moses, MD; Georgios Chalkias, MD; Muhammad J. Neeraj, J. Feroz, MD; Hussein N. Kung'u, MD; Nicholas Landon, MD; Santiago Garcia, MD; Isabella Taylor, MD; Dany A. Thompson, MD, BMS; J. Srinivas Ramana, MD; Anwarul H. Siddiqi, MD, PhD

ABSTRACT

OBJECTIVE: This study sought to develop a novel anonymous score for predicting technical success of chronic total occlusion (CTO) percutaneous coronary intervention (PCI) performed using the hybrid approach.

BACKGROUND: Predicting technical success of CTO PCI can facilitate clinical decision-making and procedural planning.

FIGURE 1 Summary of the PROGRESS CTO Score

Proximal cap ambiguity (1 point)		Poor cap visualization or absence of clearly tapered stump
Absence of "interventional" collaterals (1 point)		
Moderate/severe tortuosity (1 point)		2 bends > 70 degrees or 1 bend > 90 degrees
Circumflex CTO (1 point)		

Determining access options

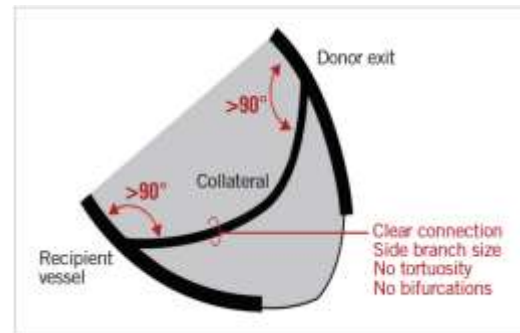
<p>LAD CTO (n=153) collateral patterns (n=13)</p> <ol style="list-style-type: none"> 1) RPA septals to LAD 52.3% 2) RV branch to LAD 26.8% 3) OM to Diagonal 22.9% 4) Diagonal to dLAD 20.9% 5) RA branch to LAD 17.9% 6) pLAD to lLAD 15.7% 	<p>Cx CTO (n=87) collateral patterns (n=12)</p> <ol style="list-style-type: none"> 1) Diagonal to OM RD 32.3%, LD 27.3% 2) PLV to dCx RD 18.4%, LD 36.4% 3) Bridging RD 18.4%, LD 9.1% 4) OM to OM RD 10.5%, LD 16.2% 5) RPA to OM 9.2% (all RD) 6) RA branch to dCx 8.0% (all RD) 	<p>RCA CTO (n=278) collateral patterns (n=20)</p> <ol style="list-style-type: none"> 1) LAD septals to RPA 72.3% 2) AVCs to PLV 50.0% 3) Bridging 39.3% 4) Apical LAD to RPA 14.3% 5) LAD to RV branch 11.8% 6) RA branch to dRCA 8.1%
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Collaterals

- Development of collaterals is mandatory to maintain viability (their presence however does not guarantee it)
- Less than 10% of collaterals show normal functional reserve during stress (microvascular disease, impaired VD, coronary steal)
- Types: bridging (autocollaterals), septal, epicardial

The perfect collateral



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Septal vs. Epicardial collaterals

	Septal	Epicardial
Advantages	Perforation less likely to lead to tamponade	Can be larger than septal collaterals
	Hardly the dominant collateral	Crossing usually well-tolerated
Disadvantages	Frequently associated with chest pain	Perforation more likely to cause tamponade
	Can be difficult to cross	Frequently the dominant collateral
		Can be very tortuous



Collateral grading

Table 1: Rentrop and Werner Classification of Coronary Collateral Circulation

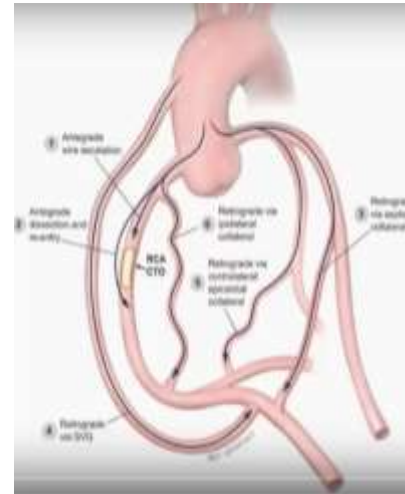
Rentrop ClassificationTM (Developed for Occluded and Non-occluded Arteries)

0	no filling of collateral vessels
1	filling of collateral vessels without any epicardial filling of the target artery
2	partial epicardial filling by collateral vessels of the target artery
3	complete epicardial filling by collateral vessels of the target artery (in CTDs, Rentrop 3 is prevalent in 85% of lesions)

Collateral Connection GradeTM

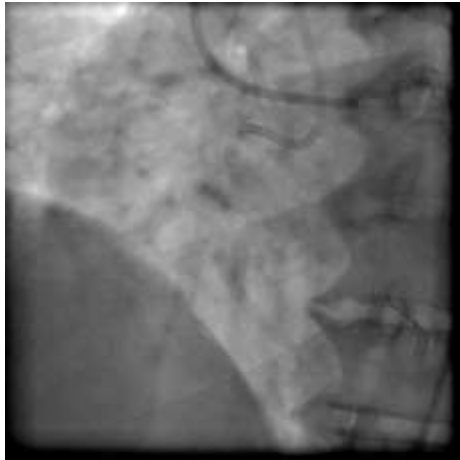
CC0	no continuous connection
CC1	threadlike continuous connection
CC2	side branch-like connection (≥ 0.4 mm)
CC3	> 1 mm diameter of direct connection (not included in the original description)

CTO = chronic total occlusion.



Example



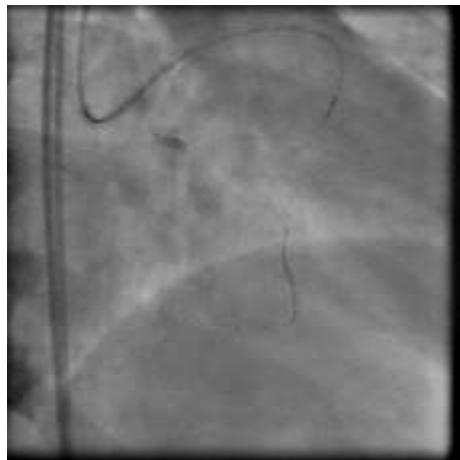
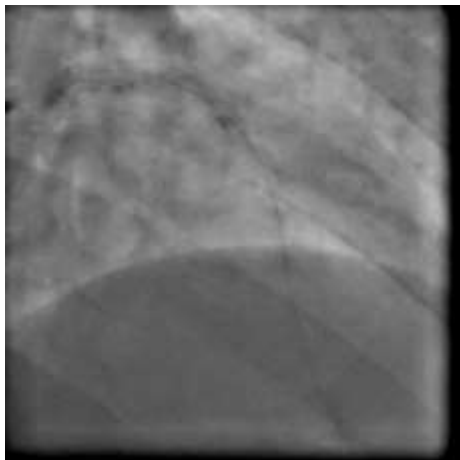


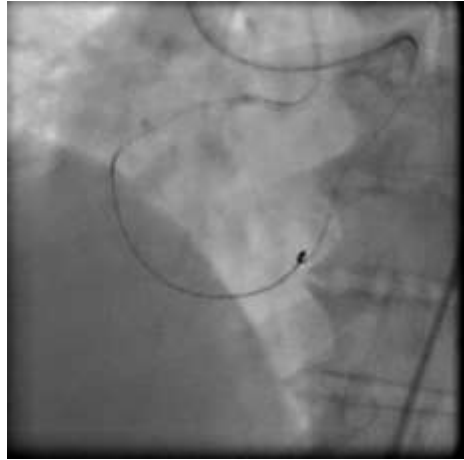
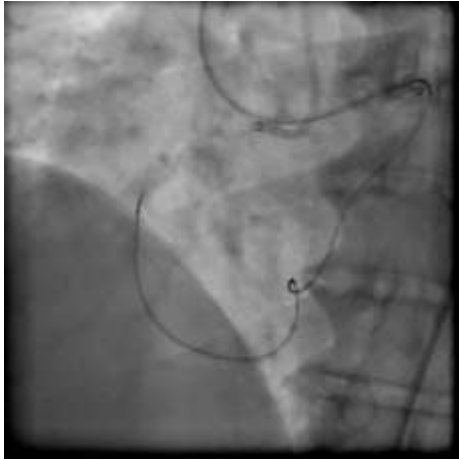
Robert 22.04.17

Access: antegrade
 Length: 15mm
 Distal vessel: good quality
 Inlet attached: yes CC-2 (AO) sealed
 No calcifications
 No sharp bends

PLAN

1. PTA to prox LAD: Contrast: do not use 2nd seal
2. Tirof. antegrade - brief
3. Retrograde wire escalation - XT - 2nd seal
 - Gena 1st
 - Gena 2nd
4. Retrograde dissection remedy





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Golden Rules

Planning for Success

- Proper acquisition of diagnostic images
- Careful evaluation of the lesion
- Understand collateral supply
- Revise indication for intervention
- Always use dual injection
- Always use a microcatheter (or OTW balloon)
- Supportive guiding catheters (and other support techniques)
- Keep ACT above 300-350
- Ensure “bailout” equipment are available

