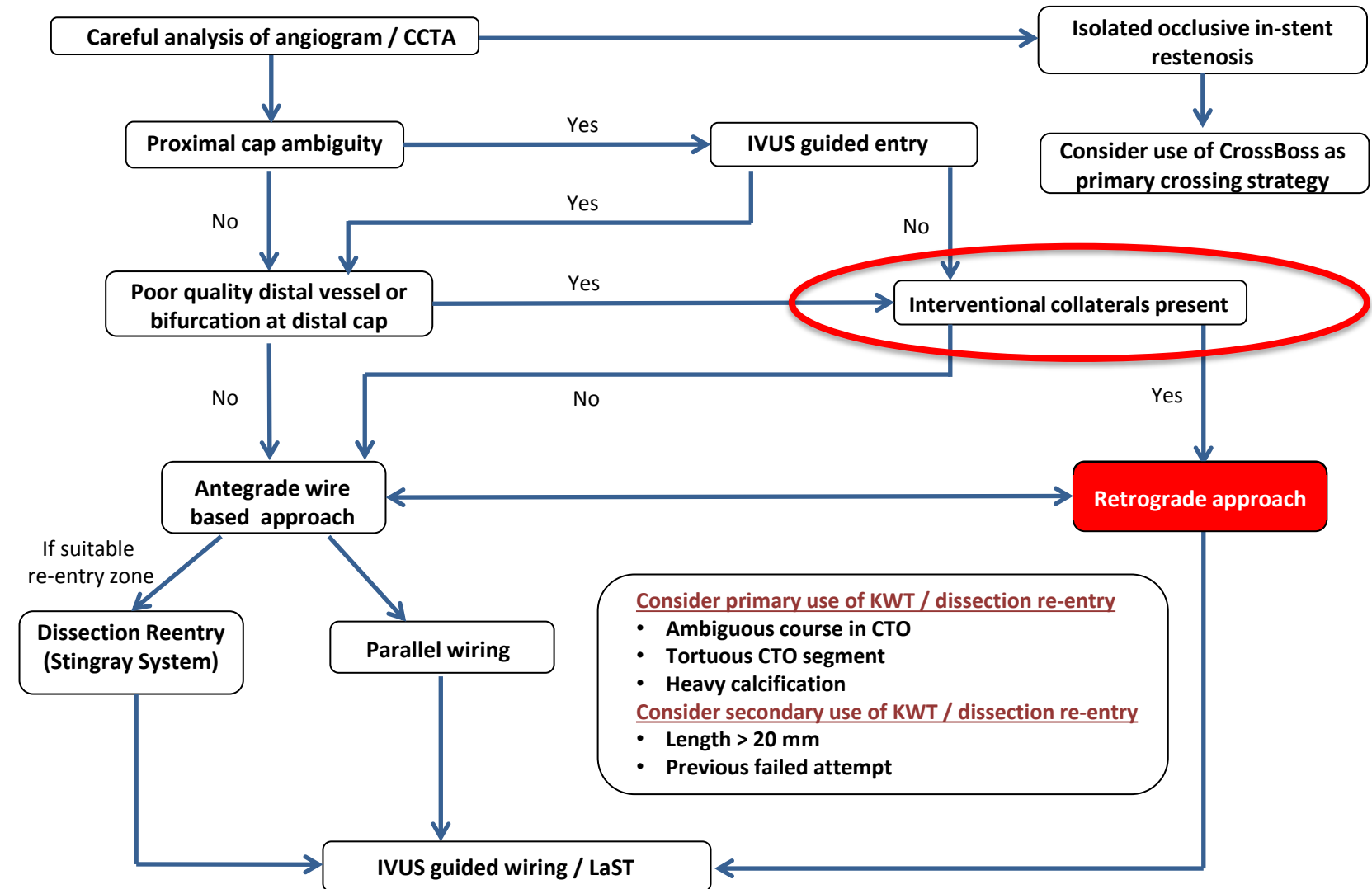


Characteristics and Definition of Interventional Collateral by View from Master's Eye



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APCTO Club Main Algorithm



Consider stopping if >3 hours, 3.7 x eGFR ml contrast, Air Kerma > 5 Gy unless procedure well advanced

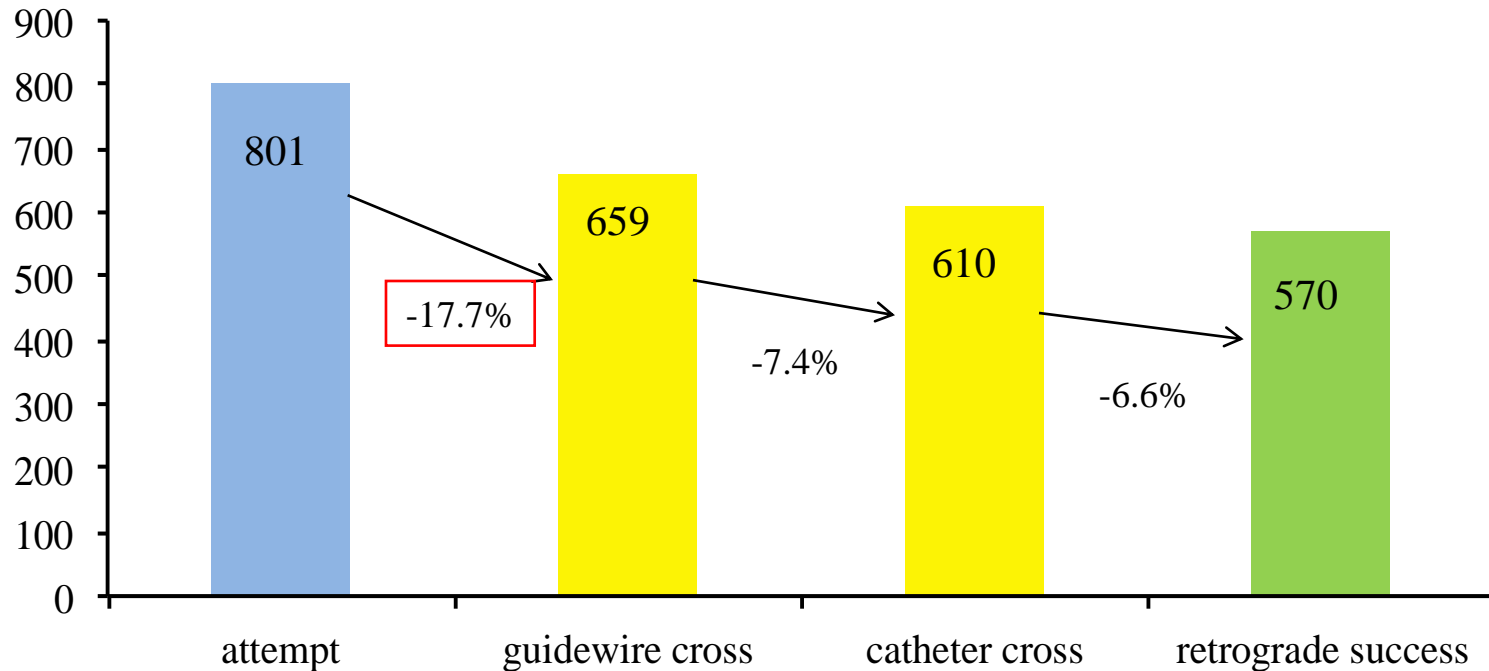
What is an Interventional Collateral?

Definition:

An interventional collateral is a collateral channel that the operator thinks is suitable to attempt crossing given their skill set and the available equipment

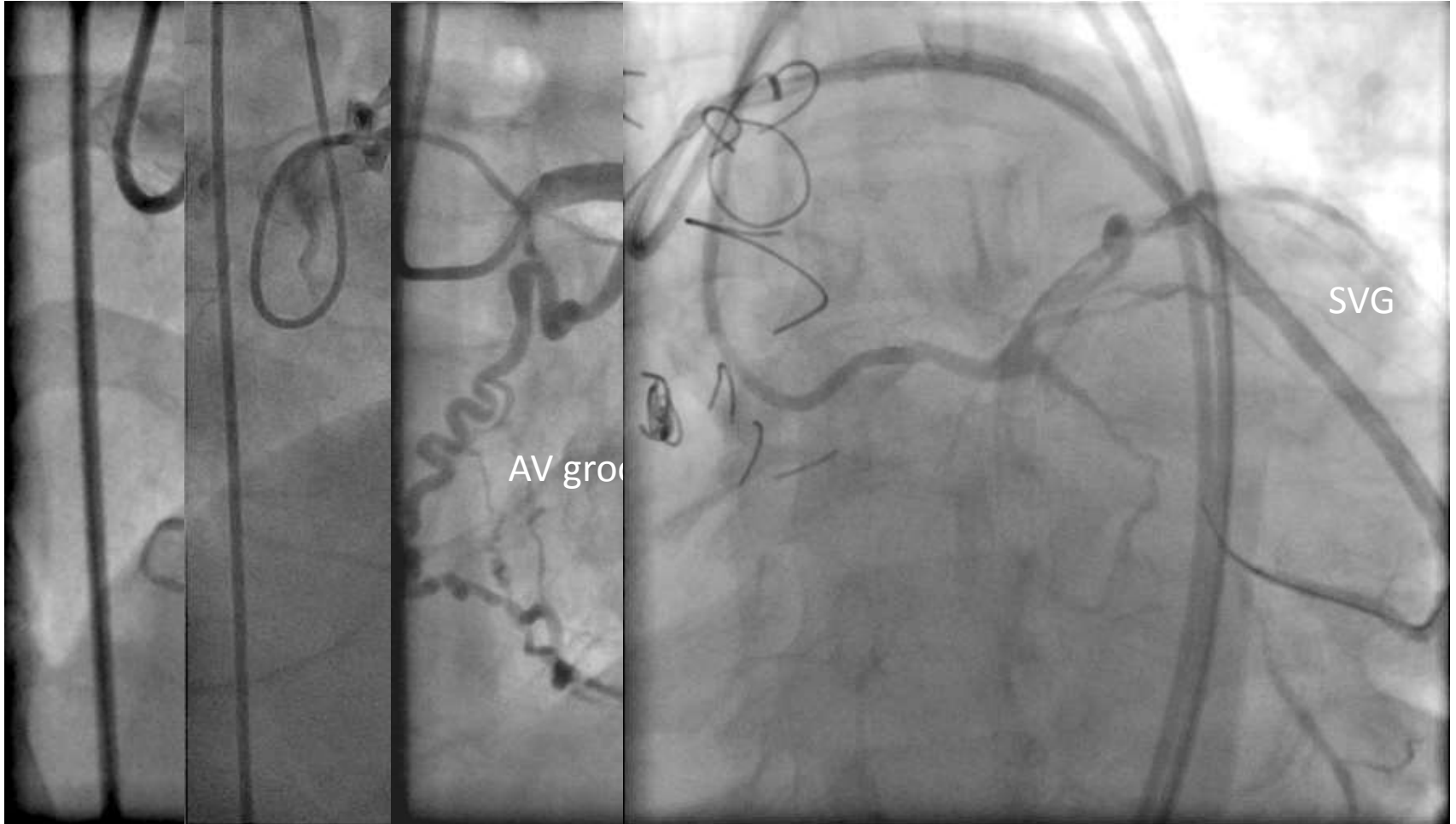
Therefore existence of an IC is dependent on operator experience and device availability

Collateral crossing is the key step



93.4% procedural success was achieved after successful collateral cross

Collateral Channel types

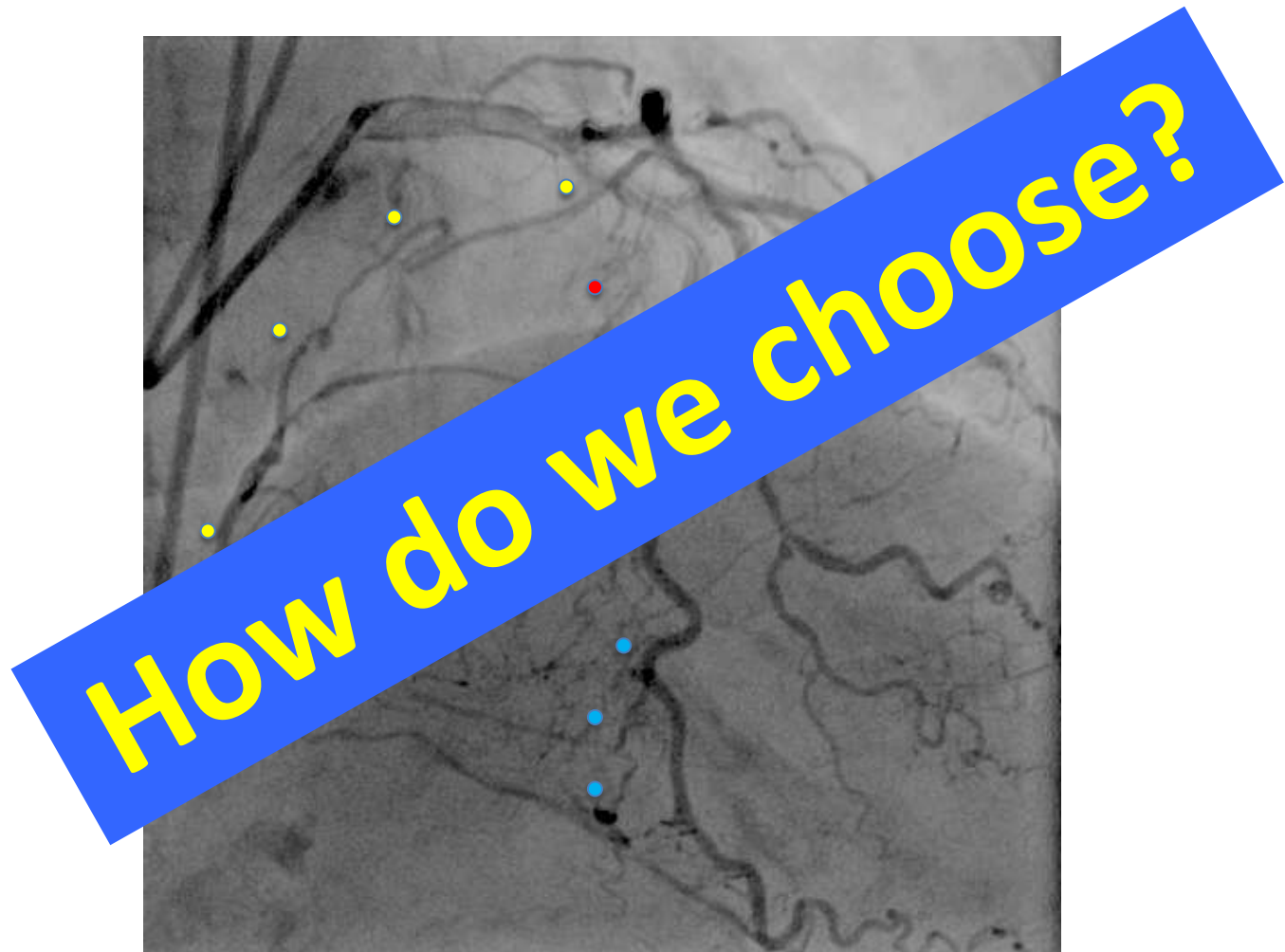


Classification of CC type is important

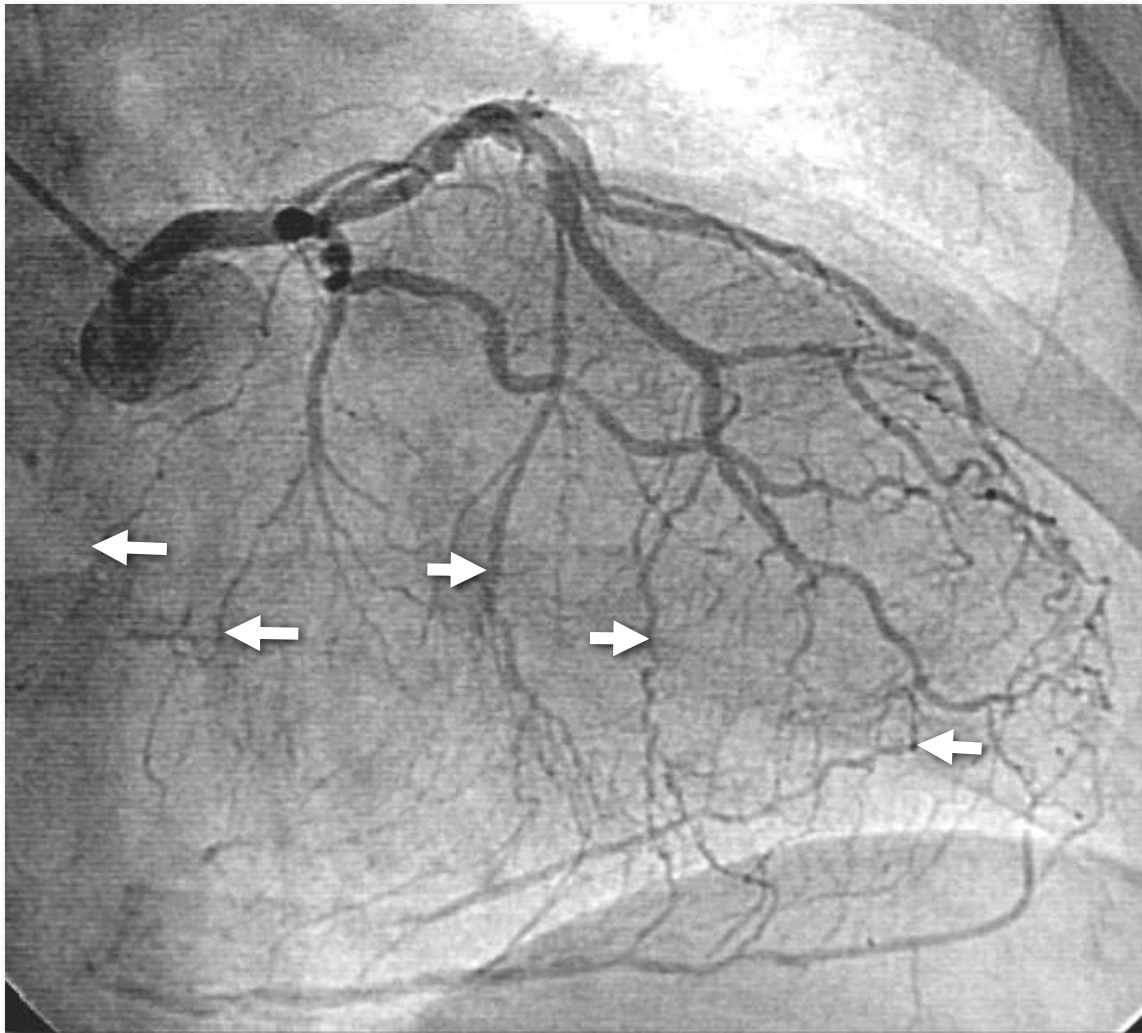


- Requires different devices/technique to track
- Channel injury results in different specific complications
- Mandates different complication salvage/management

Multiple IC's are often seen in 1 CTO



Assessment of collaterals

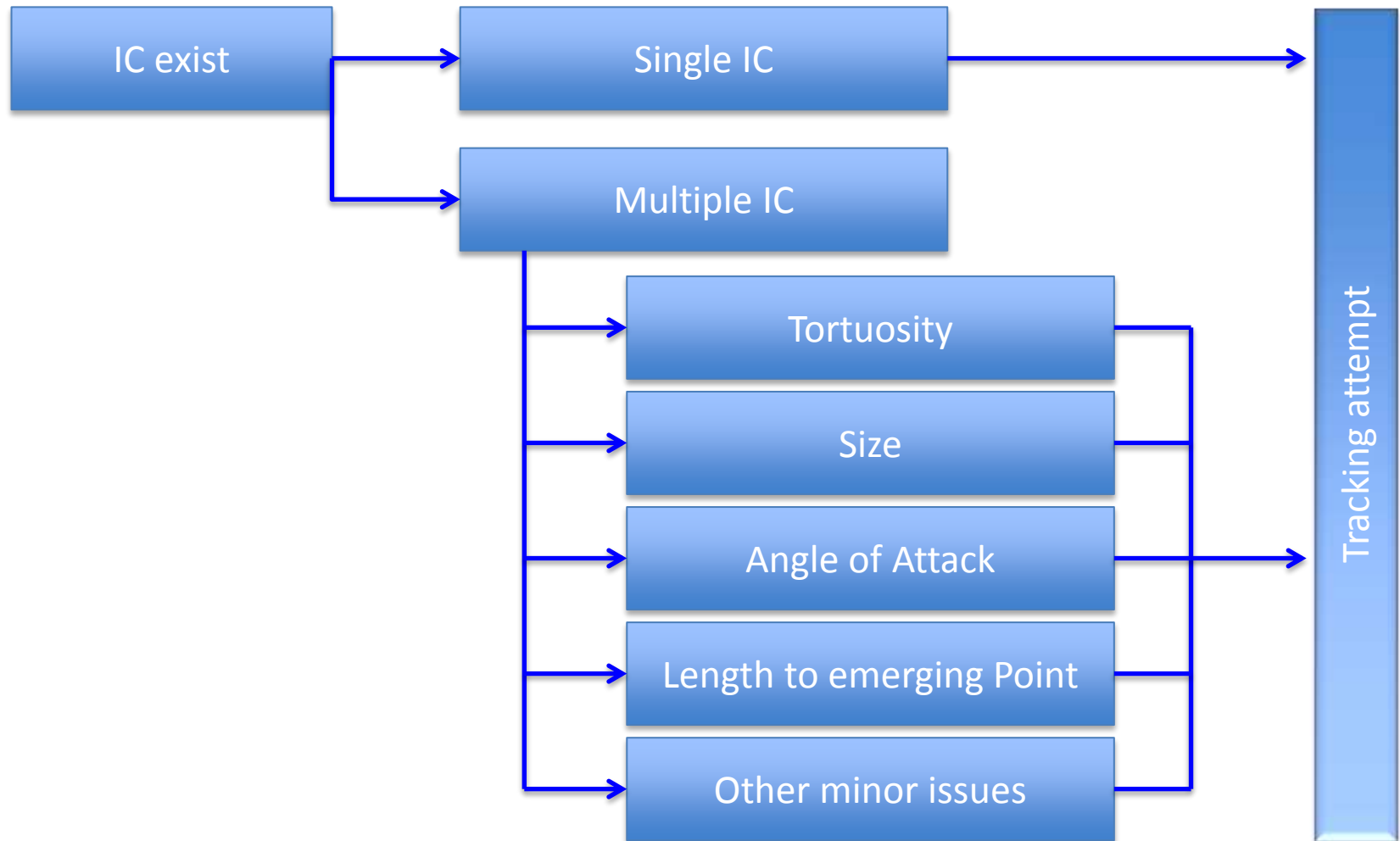


- Bilateral injections
- Have a field size large enough so you don't miss epicardial collaterals
- Don't pan
- Take optimal / multiple views
- Tip injection or rotational angiography and may be required.

How should we select which CC to start with?

- Current (J-CTO, PROGRESS CTO) scores predict mainly antegrade success rate, but offers little help in retrograde procedures
- Likelihood of success
 - Objective IC selector or predictor for retrograde PCI success ??
- Safety
 - We should preferentially choose safer IC types (septal usually preferred)

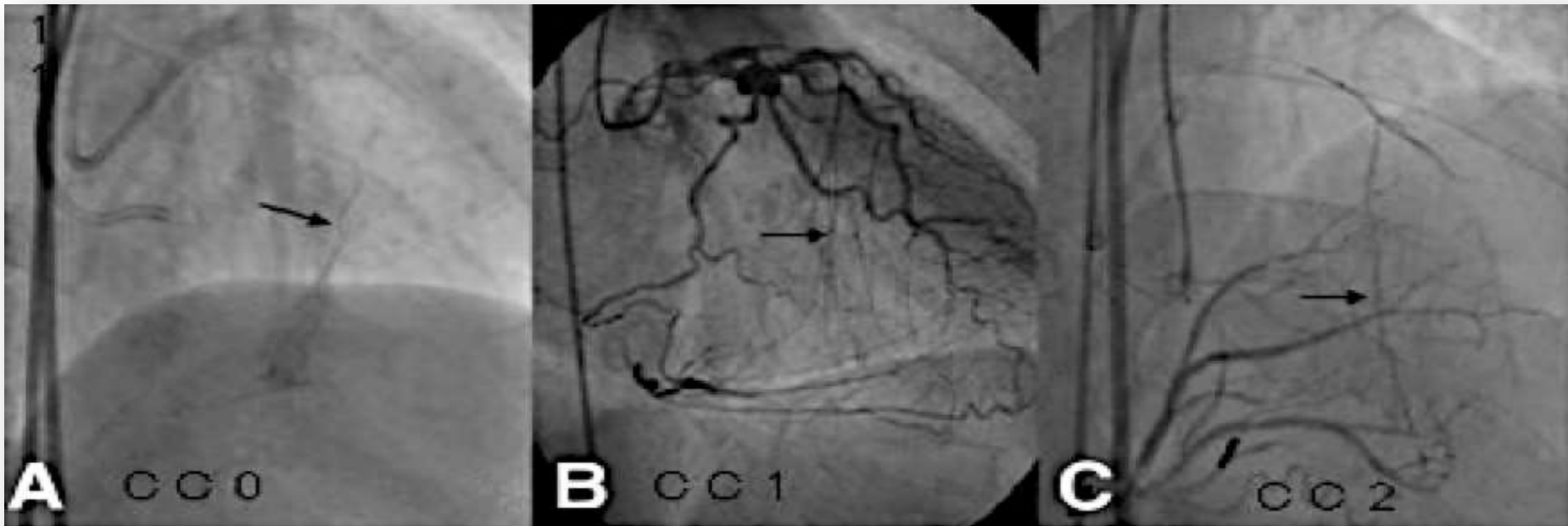
CC selection algorithm



Channel size

Werner Classification

- A CC0 = no visible connection between donor and recipient artery
- B. CC1 = continuous, thread-like connection
- C. CC2 = small side branch-like size of the channel

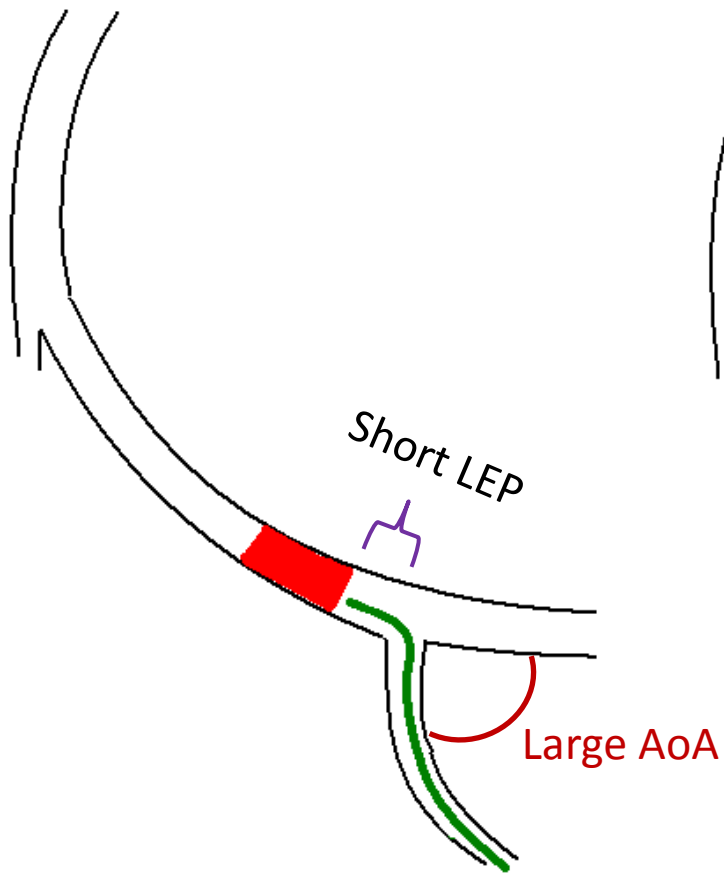


Channel tortuosity

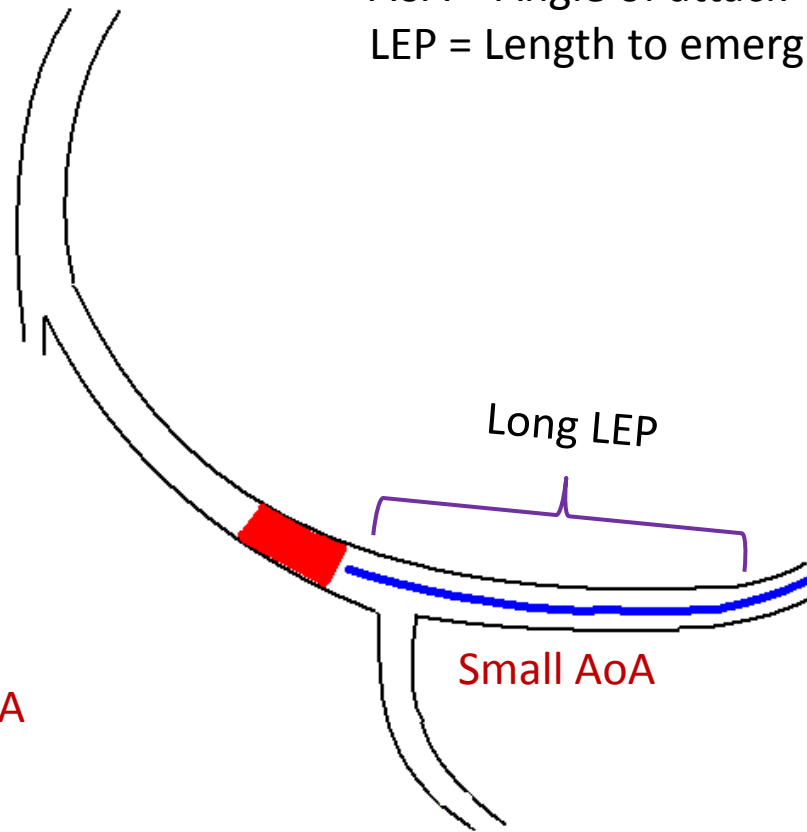
- ≥ 2 high-frequency successive curves (within 2mm) in epicardial CC, or ≥ 1 high-frequency curve that failed to uncoil in diastole for septal CC
- A high-frequency curve is defined as a curve that is $>180^\circ$ within a segment length <3 times the diameter of the collateral

AoA and LEP

AoA = Angle of attack
LEP = Length to emerging point



Crossing from septal into PDA



Crossing from atrial channel into PLV

Predictors of Retrograde Failure

Variables	Odds Ratio	95% C.I	P value
Channel used (epicardial)	0.515	0.28-9.57	0.656
CC-Recipient vessel angle not visible	47.09	1.65-1340.42	0.024
Tortuosity of CC-corkscrew	8.31	1.63-42.36	0.011
CC Type 1	2.16	0.43-10.74	0.346
Bridging Collaterals	1.09	0.29-4.00	0.896
Significant Side Branch	1.51	0.33-6.72	0.588
Severe tortuosity	.757	0.11-4.94	0.771
Severe Calcification	2.67	0.51-13.93	0.243
CTO Length>20mm	0.971	0.93-1.01	0.138
Ostial location	1.34	0.22-7.98	0.744

Predictors of successful CC crossing



	Univariate Analysis		Multivariate Analysis	
	OR (95%CI)	P value	OR (95%CI)	P value
IC >CC2	4.14(2.05-8.38)	<0.001	3.19(1.49-6.87)	0.003
Tortuosity (-)	9.93(4.32-22.83)	<0.001	8.45(3.62-19.72)	<0.001
AoA<45°	1.82(0.9-3.69)	0.096		
LEP>5mm	0.66(0.2-2.12)	0.483		
AV groove	1.27(0.46-3.49)	0.645		
Epicardial	1.13(0.55-2.32)	0.748		
Septal	0.80(0.41-1.59)	0.526	0.69(0.32-1.51)	0.361
J-CTO score	0.75(0.47-1.2)	0.228		

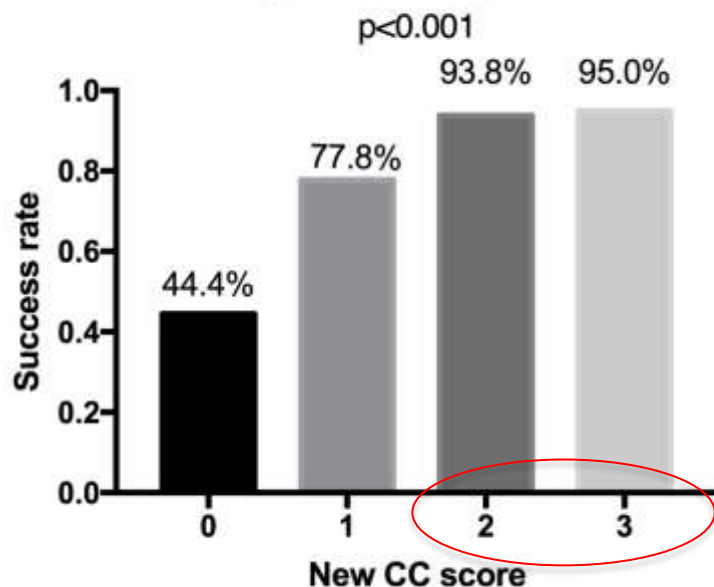
R score assignments

IC specific, can be counted individually if multiple IC choices present

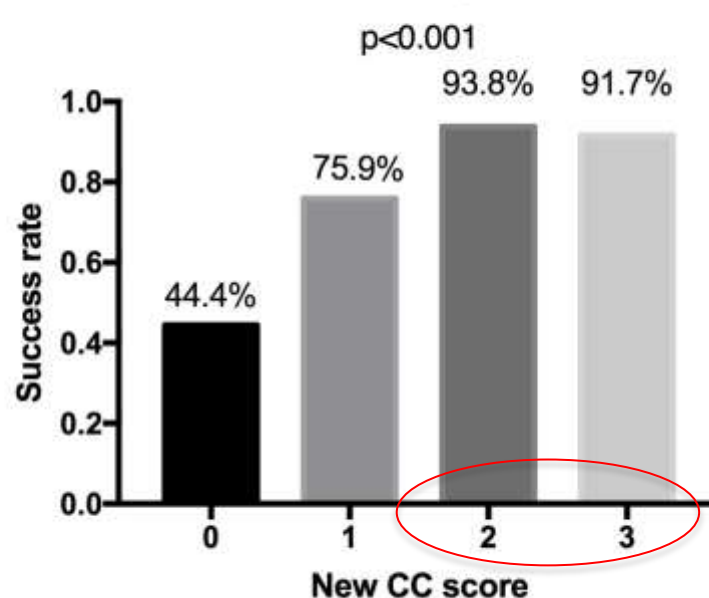
- 1 point for CC2, 0 points for CC0 or CC1
- 2 point for non-tortuous, 0 point for tortuous
- IC class, AoA, LEP, etc. are minor “technical” issues and no points assigned

Prediction based on R score

CC tracking success by new CC score



Technical success by new CC score

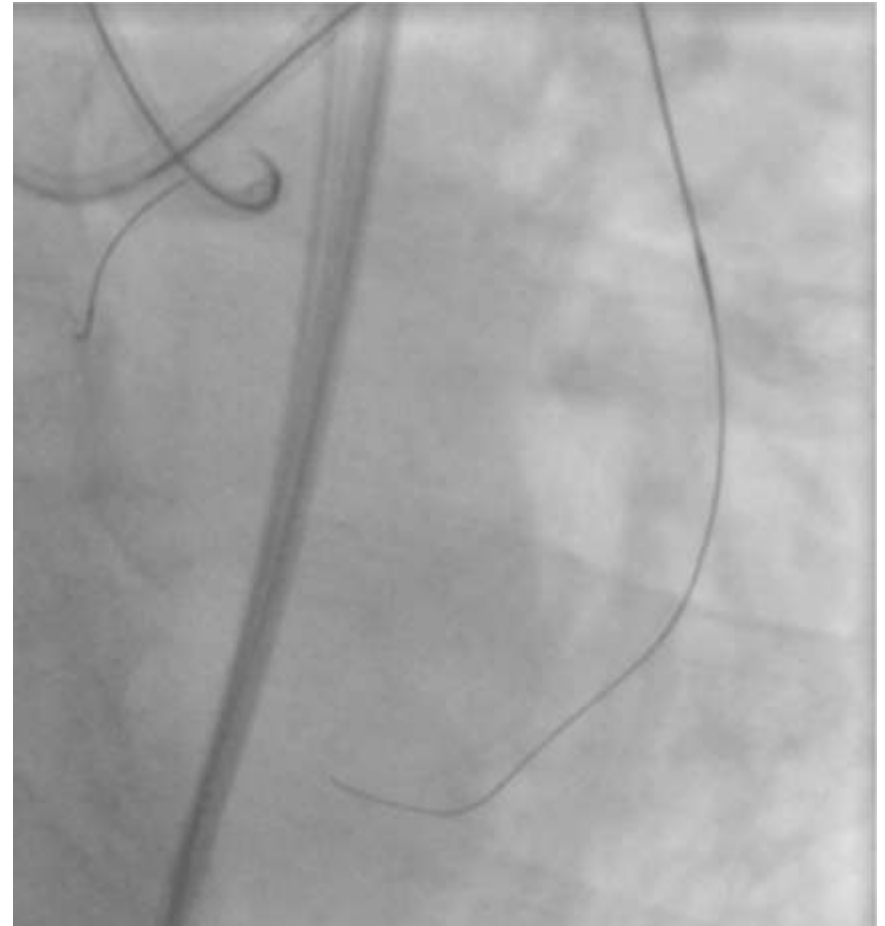


R score ≥ 2 predicts IC tracking/overall success rates of $\geq 90\%$

CC-specific results

Variables	AV groove (n=49)	Epicardial (n=105)	Septal (n=164)	P value
Technical Success	91.8 %	94.3 %	93.3 %	ns
Complication	4.1 %	4.8 %	2.4 %	ns
Procedure time, min	123.3 ± 39.4	125.1± 49.3	115.9± 33.9	ns
Fluoro time, min	52.9 ± 19.0	55.1± 24.5	49.8± 18.2	ns
AirKERMA, Gy	7.1 ± 3.0	6.9± 3.2	6.2± 2.8	ns
Contrast, ml	295.9 ± 66.0	311.7±102.0	302.0± 92.6	ns

Invisible (CCO) doesn't always mean impossible



Conclusions

- Straighter is better
- Size matters
- Invisible doesn't always mean impossible
- Combination of a Angle of attack and LEP may be important for procedural efficiency / success but is not for channel crossing