SOLACI
SOCIEDAD LATINOAMERICANA DE CARDIOLOGIA INTERVENCIONISTA

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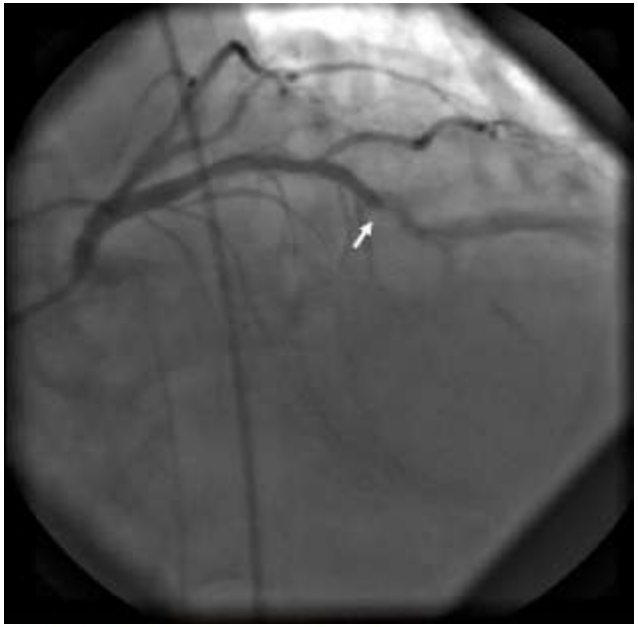
Oclusión Total Crónica. ¿Cuándo debemos tratarlas? Técnicas de tratamiento.

Dr. Lucio Padilla
(Interventional Cardiology)

SOLACI SBHCI 2013
IN PARTNERSHIP WITH TCT
SAO PAULO - BRAZIL - JULY 24-26, 2013

Chronic Total Occlusions

"A lesion with TIMI 0 flow within the occluded segment that is judged to be at least 3 months in duration".



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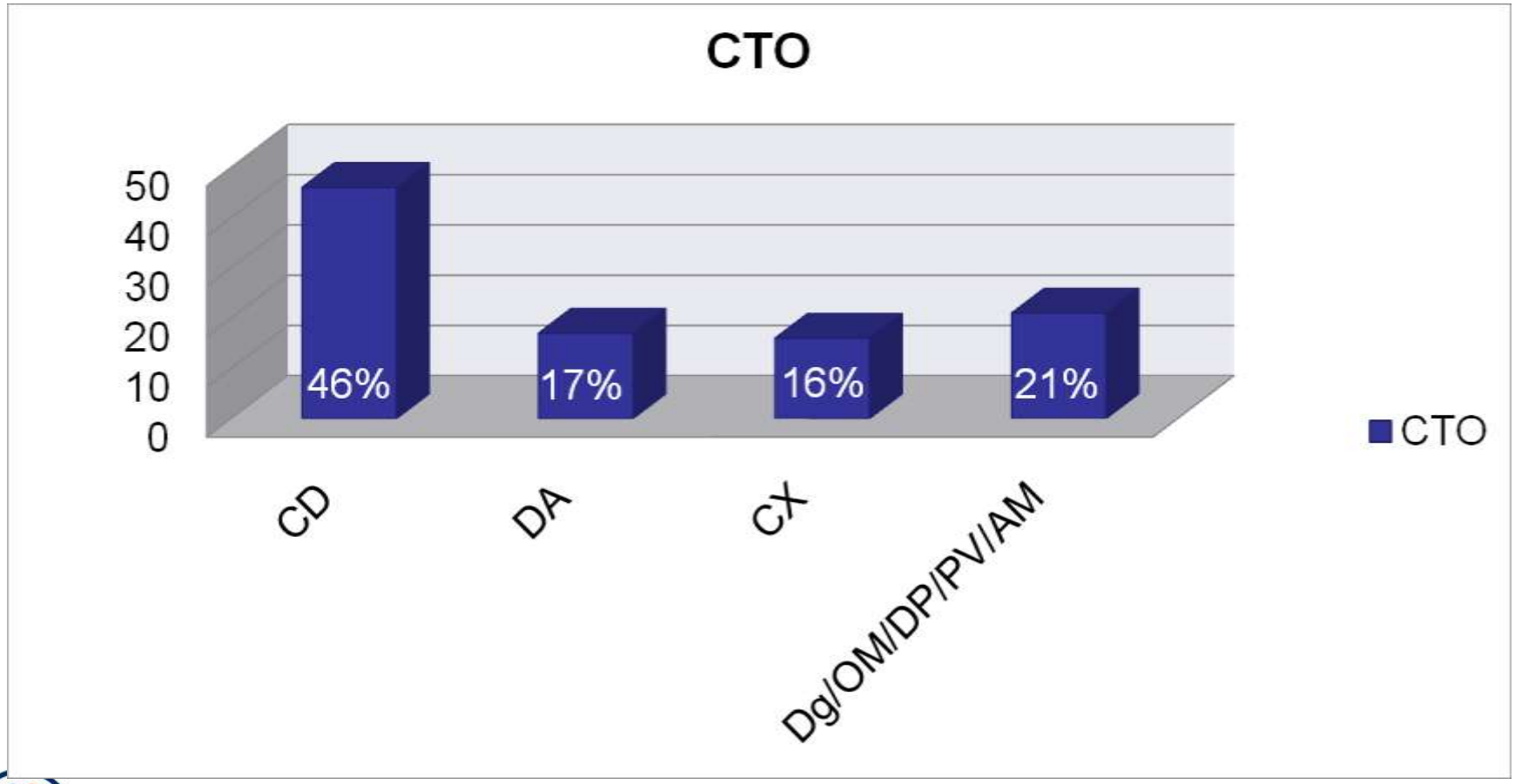
Eurointerven 2007 :30:43

Heart 2012;98:822-828

Location of CTO



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Christofferson Am J Cardiol 2005 1088-91

Clinical assessment

- Symptoms or extension of ischemic myocardial territory
- Extension of CAD
- LV functional parameters
- Estimation of duration of CTO

Clinical characteristics of patients with OTC

Variable	CTO No (n=1.475)	CTO Yes (n=1.612)	*P*
Age (years)	62 ± 10	62 ± 10	*0.53*
HTA (>140/90)	875 (59%)	1.023 (63%)	*0.02*
DBT	405 (27%)	481 (30%)	*0.14*
IMB >25 kg/m²)	221 (15%)	276 (17%)	*0.11*
Smoking	711 (48%)	840 (52%)	*0.03*
Dyslipidemia *(>200 mg/dl)*	657 (44%)	732 (45%)	*0.63*
Peripheral vascular disease	157 (11%)	279 (17%)	*<0.0001*
Fey (%)	60 ± 14	53 ± 16	*<0.0001*
Multivessel coronary disease	620 (42%)	1.064 (66%)	*<0.0001*

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Christofferson Am J Cardiol 2005 1088-91

Recanalization of a CTO
Why?

- Reduce long-term mortality
- Reducing the need for CABG
- Improve LV function
- Reduce myocardial ischemia
- Reduce recurrent angina / residual

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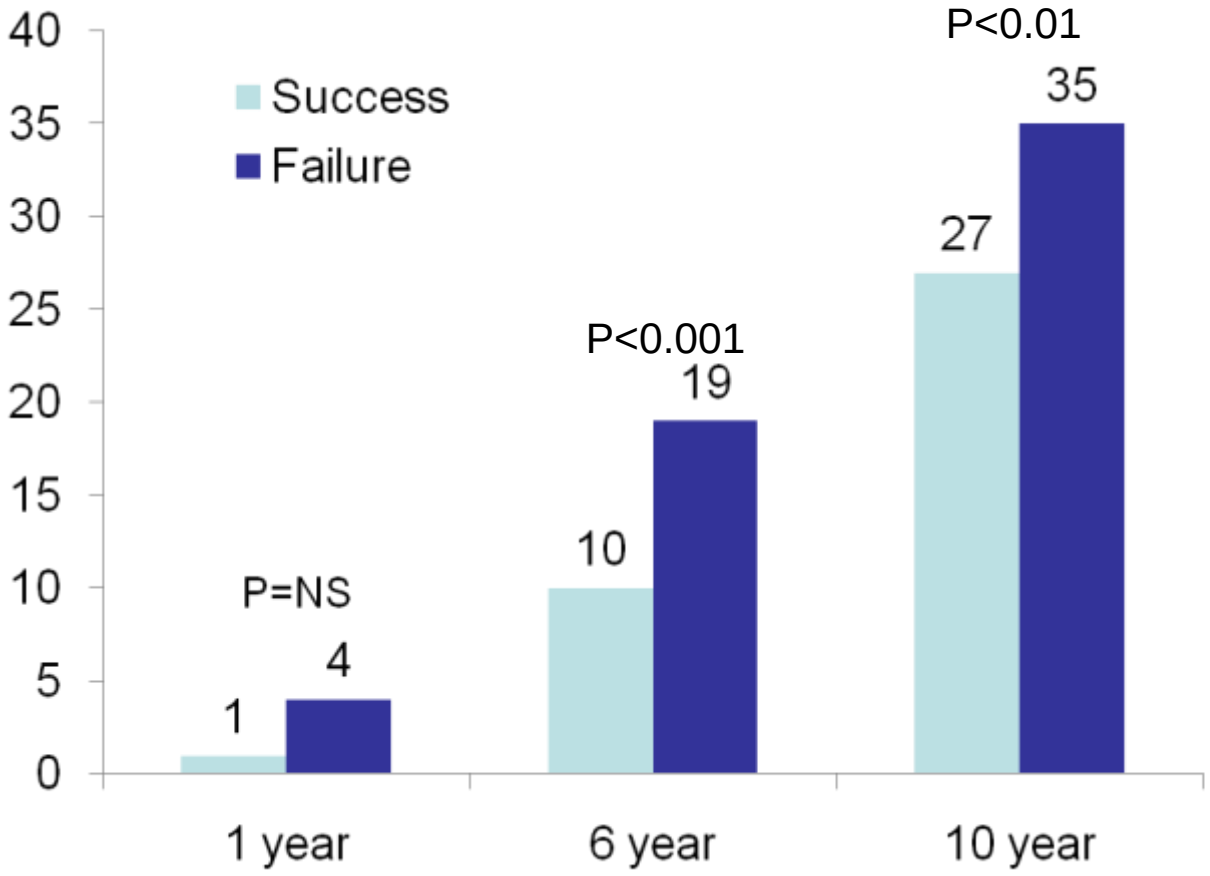
Kenneth M Kent. Washington Hospital Center TCT 2009

Mortality from 3 different registries



TOAST-GISE
n=286 (73 failed)
1 year f/u

British Columbia Cardiac Registry
n=1118 (340 failed)
6 year f/u

Mid-American Heart Institute
n=1491 (514 failed)
10 year f/u

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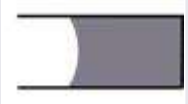
Angiographic assessment

- **Recanalization feasibility**
  - TIMI 0 (no microchannels) vs TIMI 1 (microchannels)
  - Visualization of the distal bed
  - Presence of collateral circulation (bridging collaterals)
  - Lesion length
  - Calcification burden
  - Lesion angulation
  - Proximal tortuosity
  - Occlusion morphology (tapered stump versus blunt or flush occlusion)
  - Occlusion at a side branch
  - Proximal or distal segment
  - Vessel size

Angiographic Predictors of failure

European Registry of Chronic Total Occlusions (ERCTO)

	Predictors: Multivariate Analysis		
	OR	IC 95%	*p*
Blunt stump 	11	0.435-0.807	0.001
CTO > 20mm	9.6	0.352-0.79	0.002
Severe calcification	29.2	0.241-0.515	<0.001

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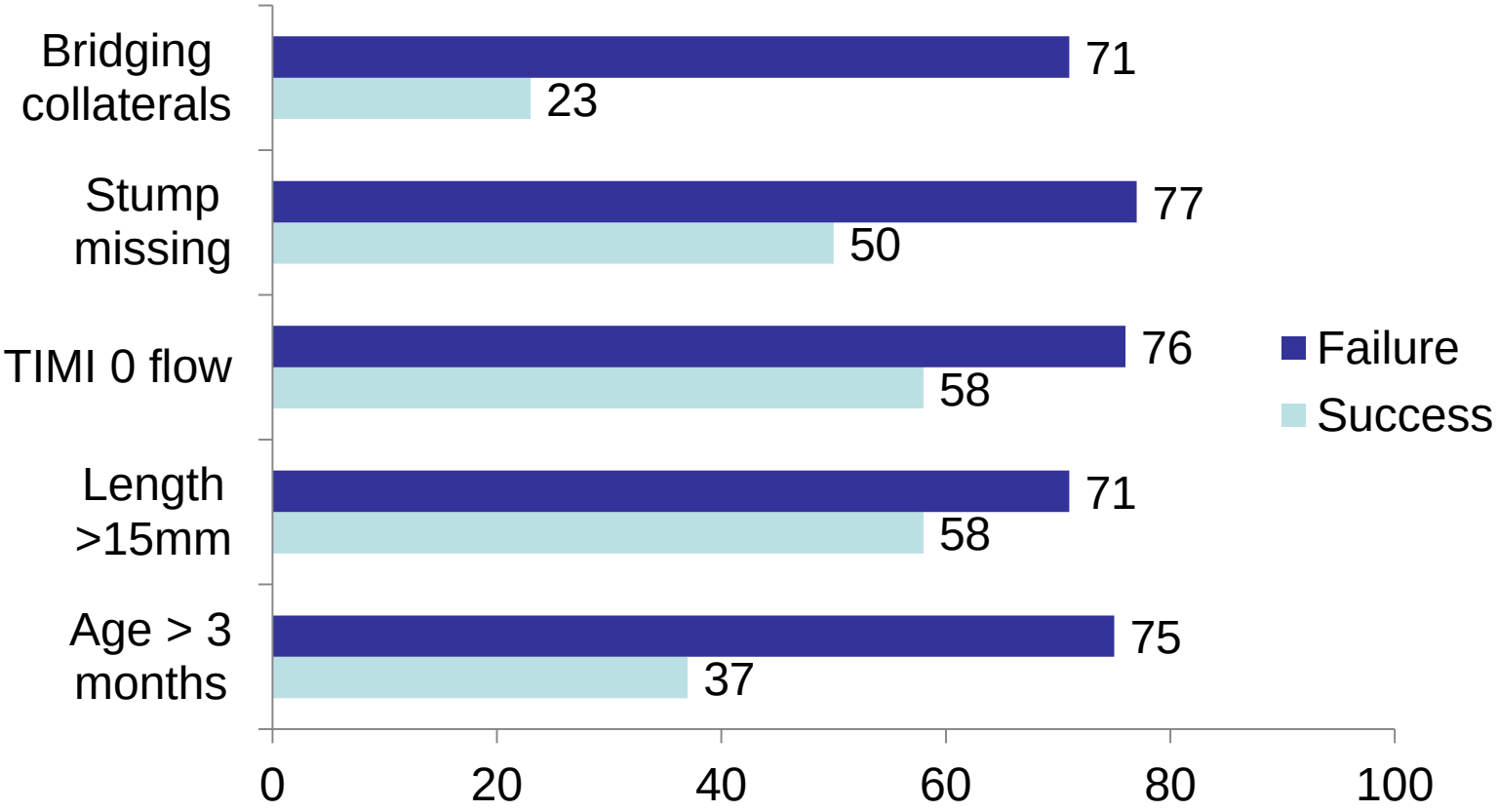
L Constanzo. EuroPCR 2010

Success rates of recanalization



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Suero J, Marso S JACC 2001, 38, 409-414

IPC in CTO

J-CTO Registry (CTO Japanese Registry):

- **Success: ± 90%**
- Mortality: 0.2-0.4%
- Tamponade: 0.4%
- STEMI: 0.2%
- Contrast nephropathy: 1.2%

N°498/528 CTO

JACC Intv. 2010;3;143-151

Drug eluting stents (DES)

Restenosis significantly reduced relative to conventional stents.

Colmenarez y col JACC 2010
Saeed y col CCI 2010

Strategy approach

- MSCT assesment
- Guiding catheter
- Contralateral angiography
- CTO wires
- Over the wire balloons – Microcatheters
- Devices to cross a CTO: Tornus, low profle balloons, rotablator
- DES vs. BMS
- Role of IVUS

Role of MSCT in CTO

- To plan revascularization strategy.

- Noninvasive evaluation:

-Proximal and distal diameter.

-Length of the CTO.

-Plaque characterization.

-Side branch?

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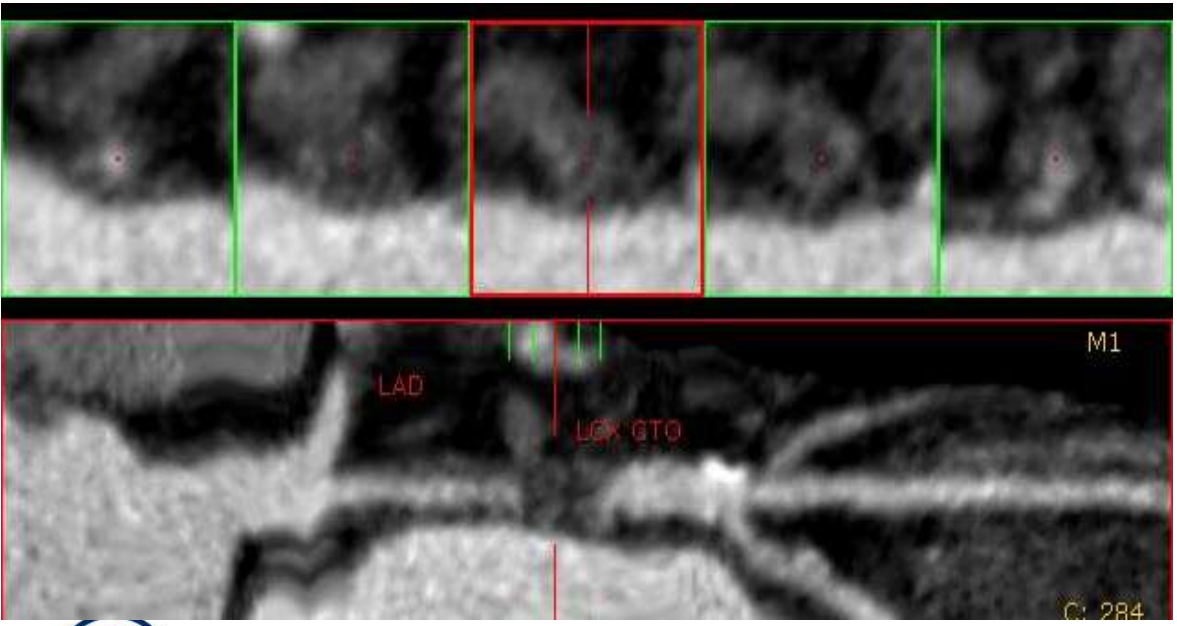
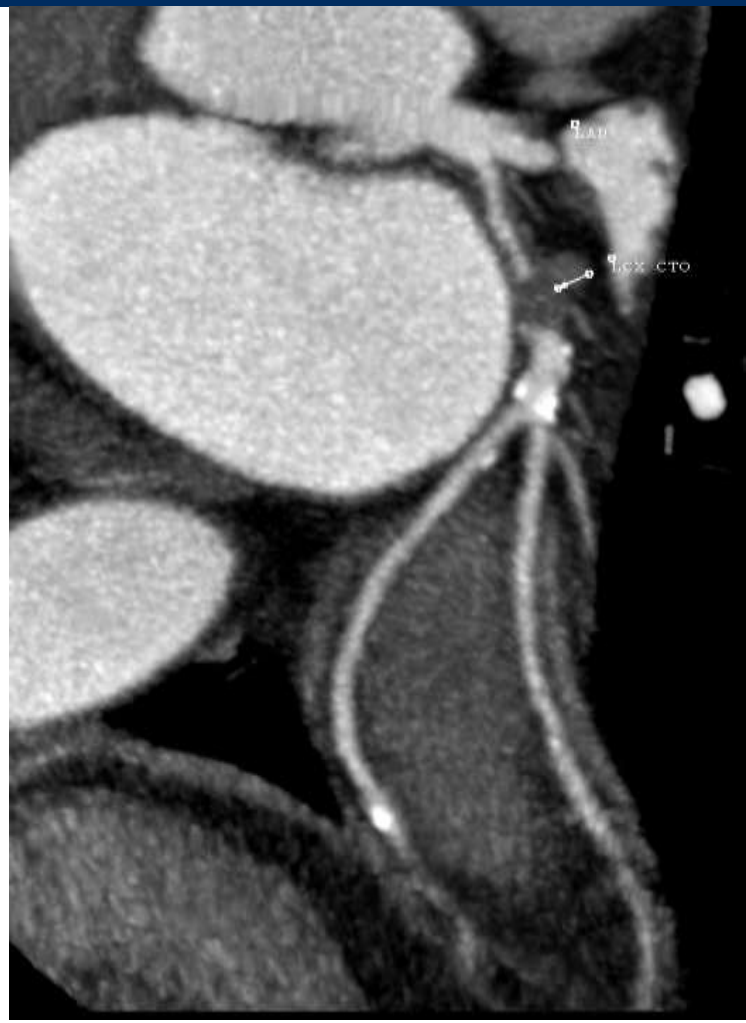
Success Predictors

-Length < 20 mm.
-Plaque soft.
-Moderate calcification (< 50%).





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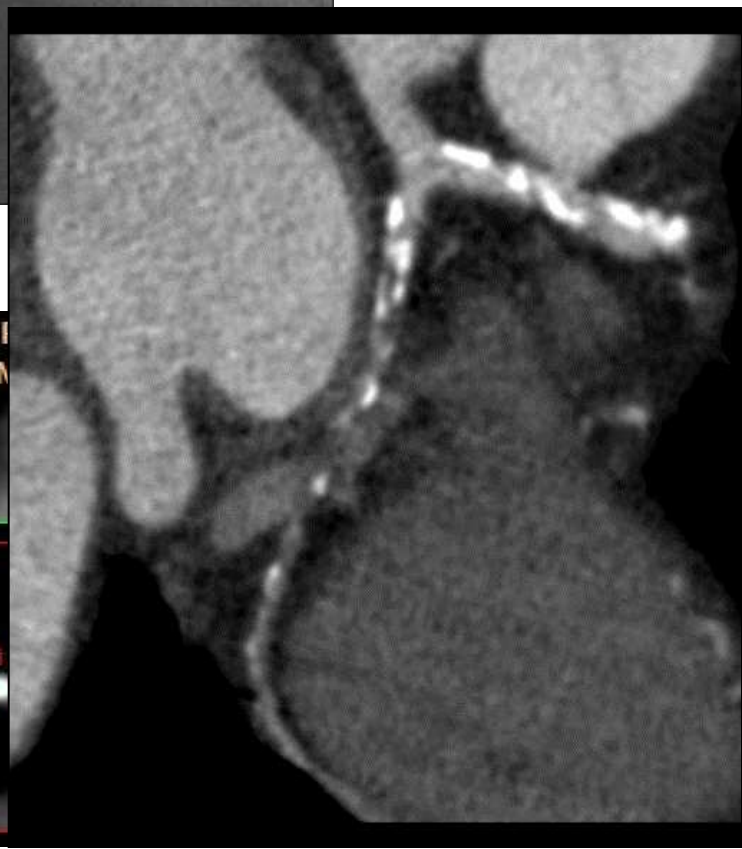
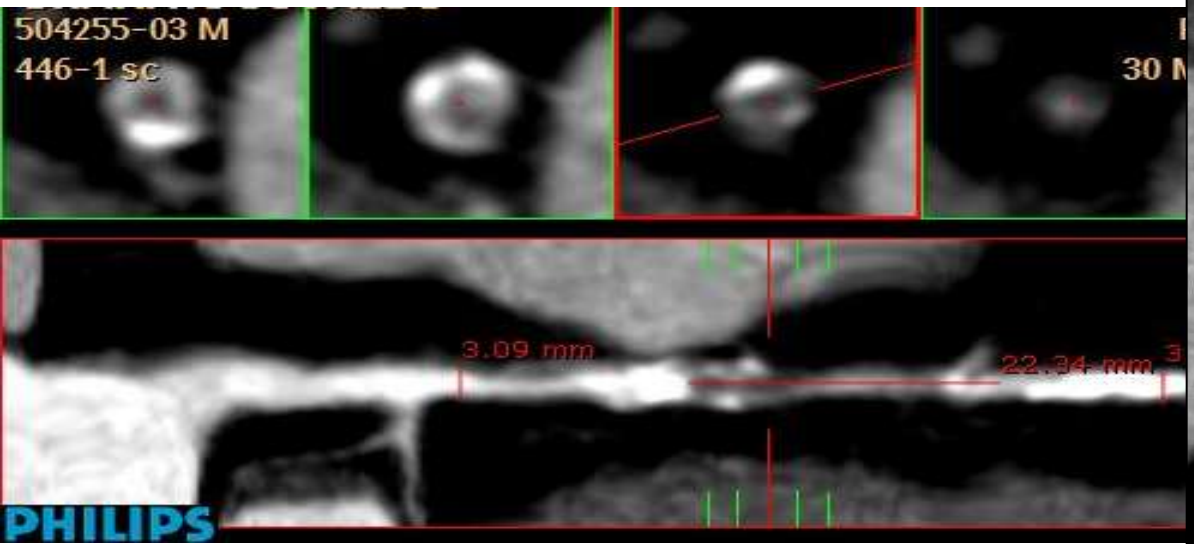
Garcia et al, Eurointervention 2009
Hsu et al, Int J Cardiology, 2011

Failure Predictors

-Length > 20 mm.
-Calcification plaque protuding > 50%.
-Side branch





Experience ICBA
MSCT pre-CTO

Recanalization in 24 cases.

Length:

-Success: 11mm (8-16,5 mm).
-Failure: 34,12 mm (12-63mm)

Plaque composition:

-Success: -Soft plaques (71%).
-Mixed plaques (28,57%)
-Calcification < 50% (no protution)
-Failure: Mixed plaque with calcification > 50%
Lesion length (25-63mm)

Guiding catheters

- Guiding catheter support: Back-up catheters or deep engagement
- Catheter resistance
- Curve memory
- Tip radio-opacity
- Tip softness

CTO coronary wire

Cross-it 100-400XT, Asahi wires 3-12 g, Cross wire, Shinobi

Tip stiffness from 0.009 to 0.014

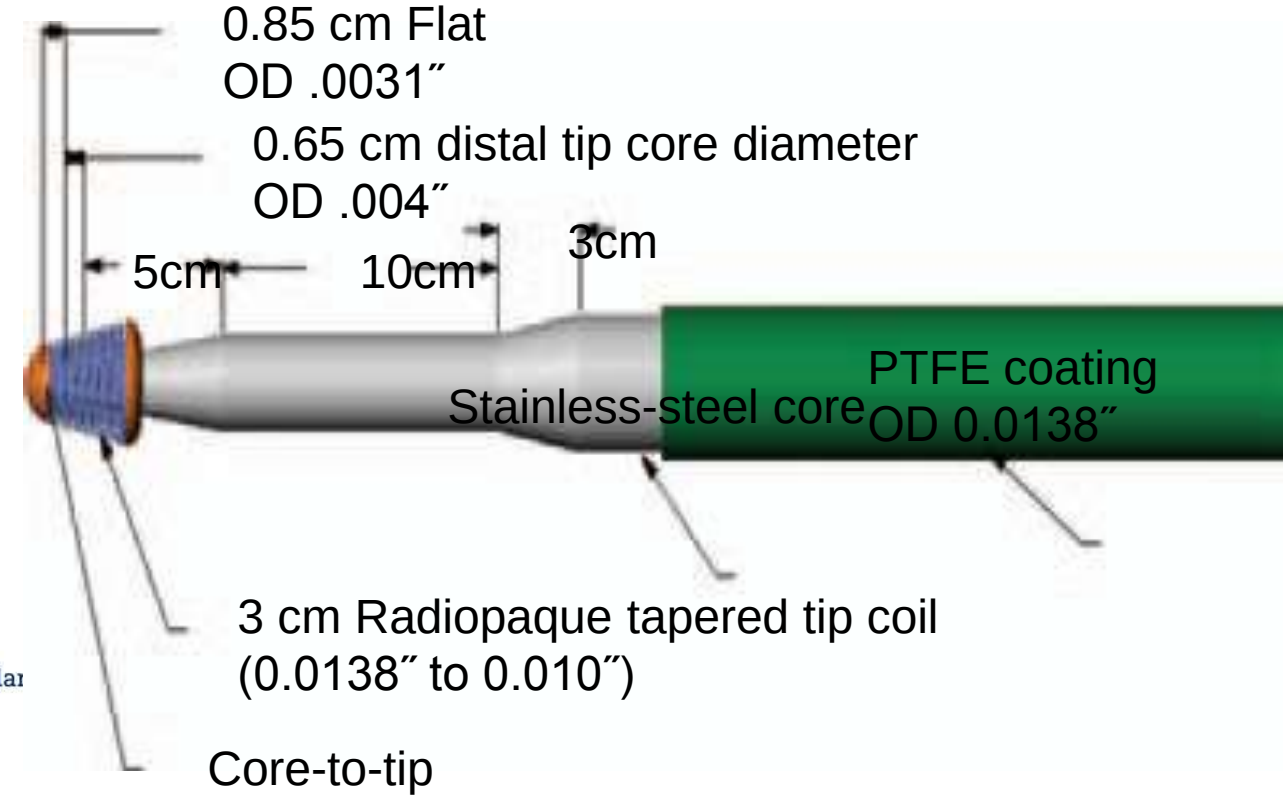
Pushability

Torque response

Core to tip

Torque transmission

Hydrophilic coating



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Guides Wires

Guías para las oclusiones coronarias totales crónicas

Fabricante	Guía	Diámetro de la punta (pulgadas)	Carga de la punta (g)	Características de recubrimiento
Abbott Vascular	Cross-It® 100, 200, 300, 400	0,0140-0,0110	2, 2, 3, 4	Hidrófilo
	Pilot® 50, 150, 200	0,0140	2, 3, 6	Recubrimiento de polímero
	Whisper® LS, ME, ES	0,0140	1, 1	Recubrimiento de polímero
	HT Progress 40, 80, 120	0,0140	4,8, 9,7, 13,9	Recubrimiento de polímero
	HT Progress® 140T	0,0105	12,5	Recubrimiento de polímero
	HT Progress® 200T	0,0090	13,3	Recubrimiento de polímero
Abbott/Asahi	Miracle® 3, 4,5, 6, 9, 12	0,0140	3, 4,5, 6, 9, 12	Hidrófugo
	Confianza®	0,0140-0,0090	9	Hidrófugo
	Confianza Pro® 9, 12	0,0140-0,0090	9, 12	Hidrófilo, excepto la punta
	Confianza® 8-20	0,0140-0,0080	20	Hidrófilo, excepto la punta
	Fielder FC®	0,0140	1	Recubrimiento de polímero
	X-treme®	0,0140-0,0120	0,8	Recubrimiento de polímero
Terumo	Runthrough NS®	0,0140	1-3	Hidrófilo
	Crosswire NT®	0,0140	12	Recubrimiento de polímero

Las guías de polímero blando son Pilot® 50, Whisper® LS, HT Progress® 40 y Fielder XT® (extremo fino), las guías de resorte de peso medio Miracle® 3 g, y 4.5 g y Cross-it® 100 (extremo fino), y las guías de alto gramaje Cross-it® 400 (extremo fino), Miracle® 12 g, HT Progress® 200T (extremo fino) y Confianza Pro® (extremo fino) 9 y 12 g.

Microcatheters

Microcatéteres aplicables para las oclusiones coronarias totales crónicas

Fabricante	Catéter	Longitud (cm)/diámetro (Fr) del eje	Luz interna (pulgadas)
Cordis	Prowler® 14	150/1,9	0,017
	Prowler® 10	150/1,7	0,015
	Transit®	135/2,5	0,021
Abbott/Asahi	Tornus® 2,1 Fr	135/2,1	0,016
	Tornus 88 Flex® 2,6 Fr	135/2,6	0,024
	Corsair®	135/150/2,6	0,016
Terumo	Pro Great®	130/150/2,4	0,019
	Finecross®	130/150/1,8	0,018
Boston	Excelsior®	175/2	0,019
	Excel® 14	150/1,9	0,017
Fabricante	**OTW**	**Tamaño de la esfera (mm)/longitud del eje (cm)/calibre (Fr)**	**Perfil de la punta (pulgadas)**
Terumo	Ryujin Plus®	1,25 × 10/148/2,5	0,017
Invatec	Falcon®	1 × 10/140-160/2,2	0,016
Abbott	Voyager®	1,50 × 12/143/2,5	0,017
Boston	Apex®	1,50 × 9/135/2,3	0,017
Medtronic	Sprinter®	1,50 × 6/138/2,5	0,016

Fr: French; OTW: *over the wire* 'sobre la guía'.

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Parallel wire technique

1st wire in false channel

⇩

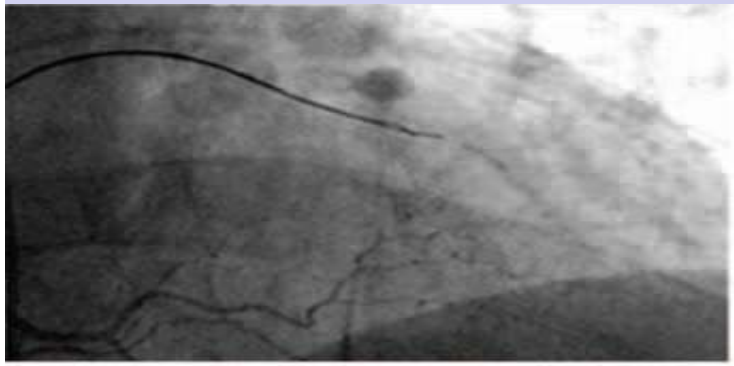
left in situ

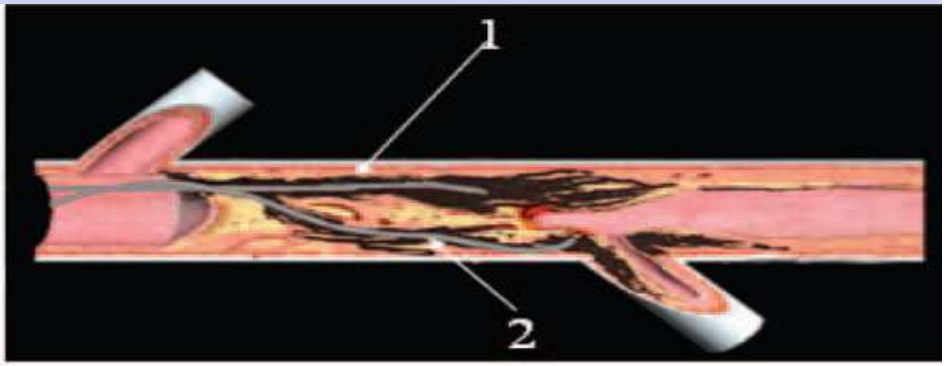
⇩

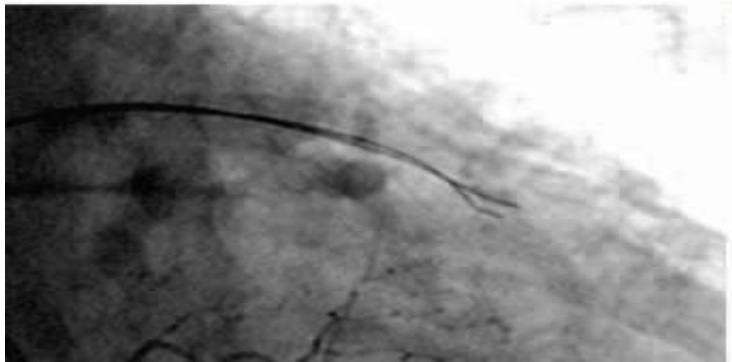
2nd stiffer wire advanced parallel to first wire in same path

⇩

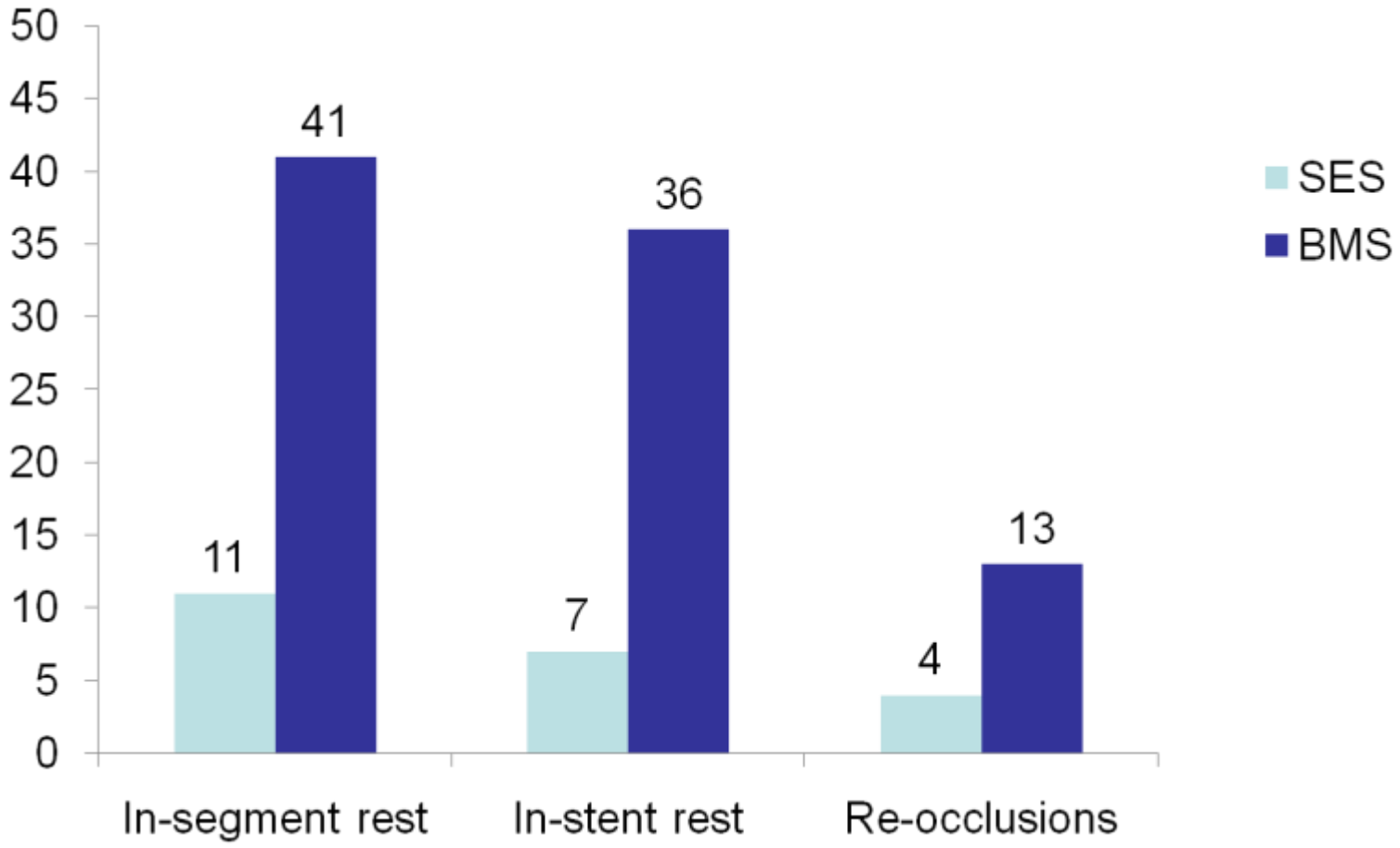
redirected to enter distal true lumen







DES vs BMS: PRISON III trial



P<0.0001 P<0.001 P<0.04

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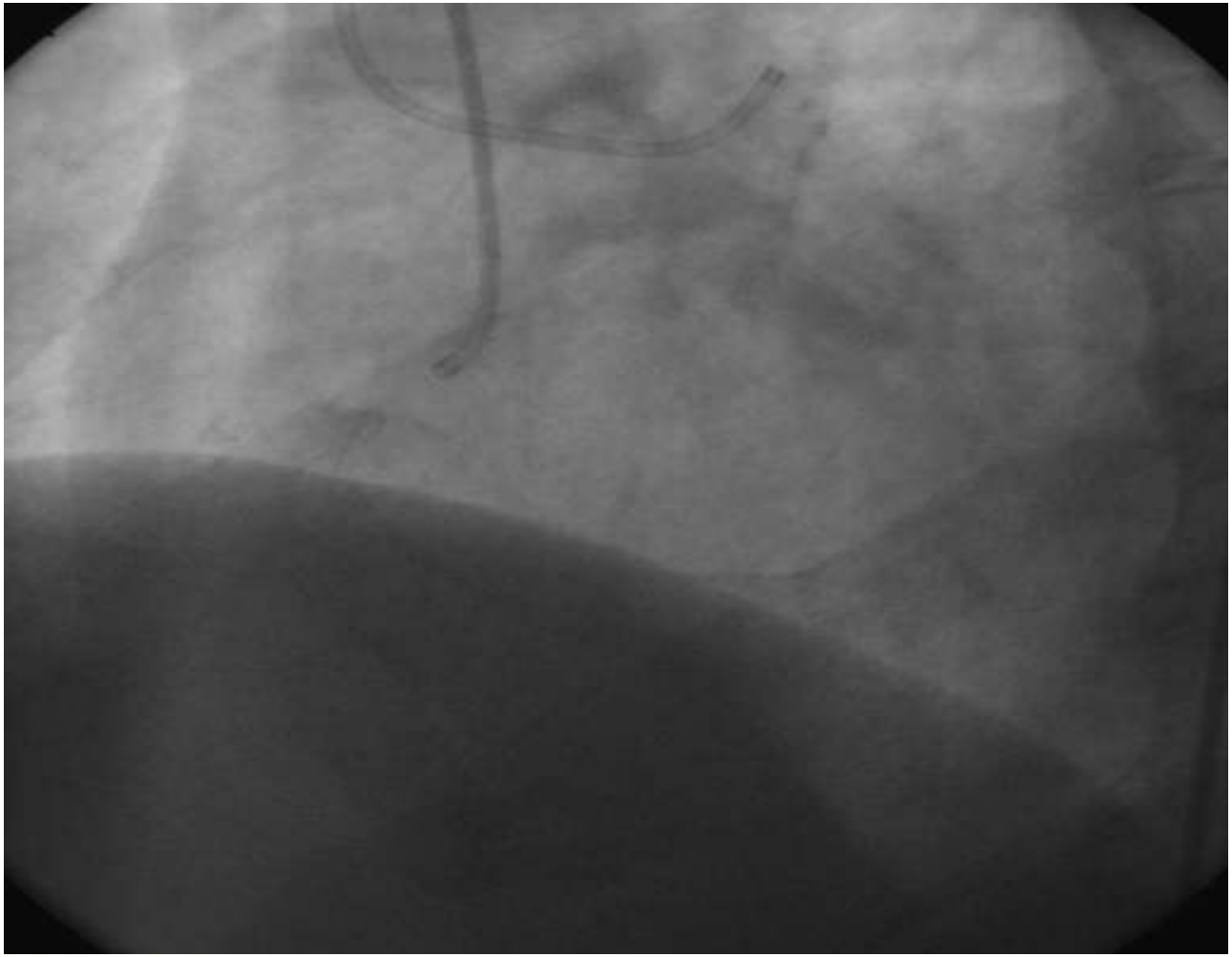
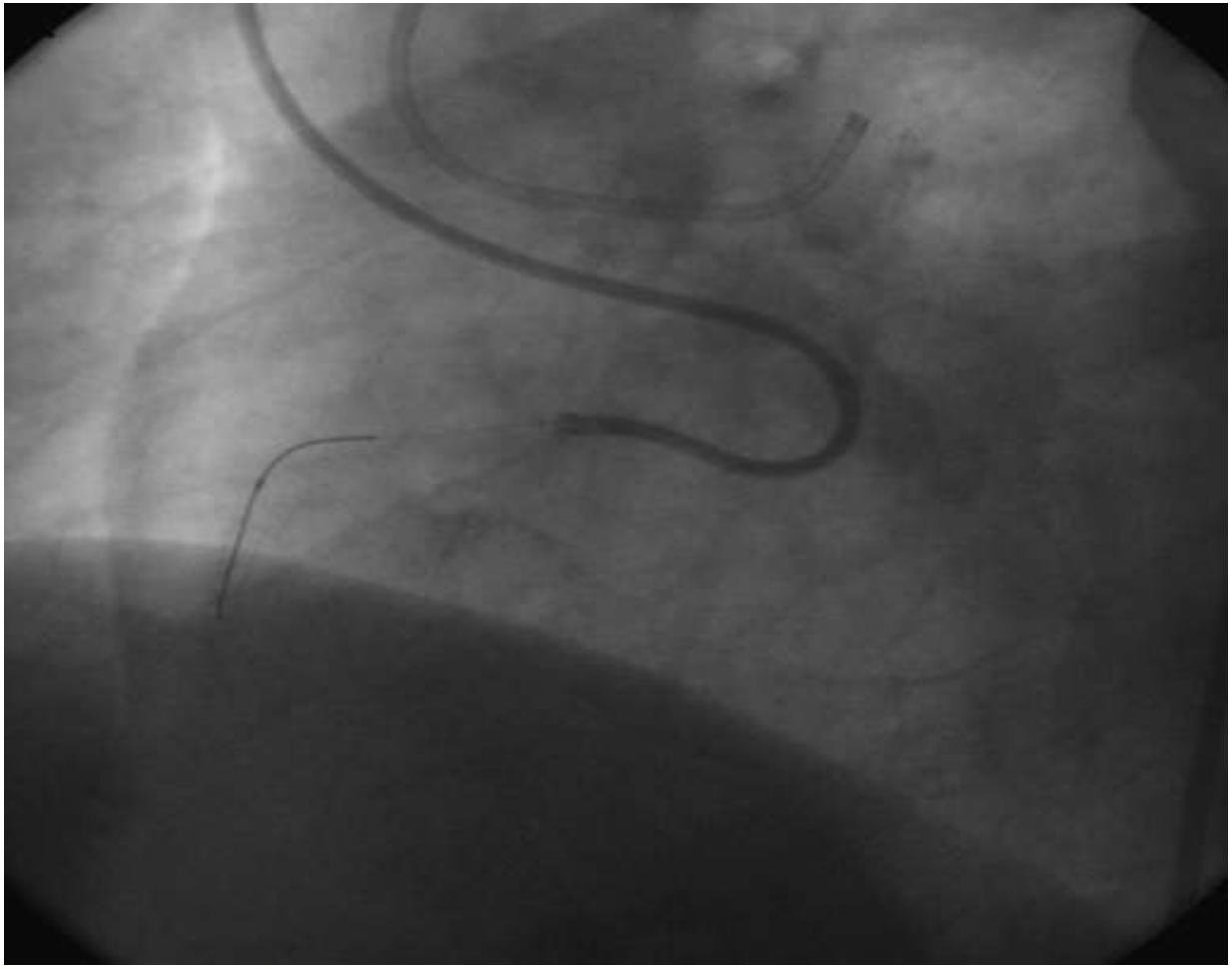
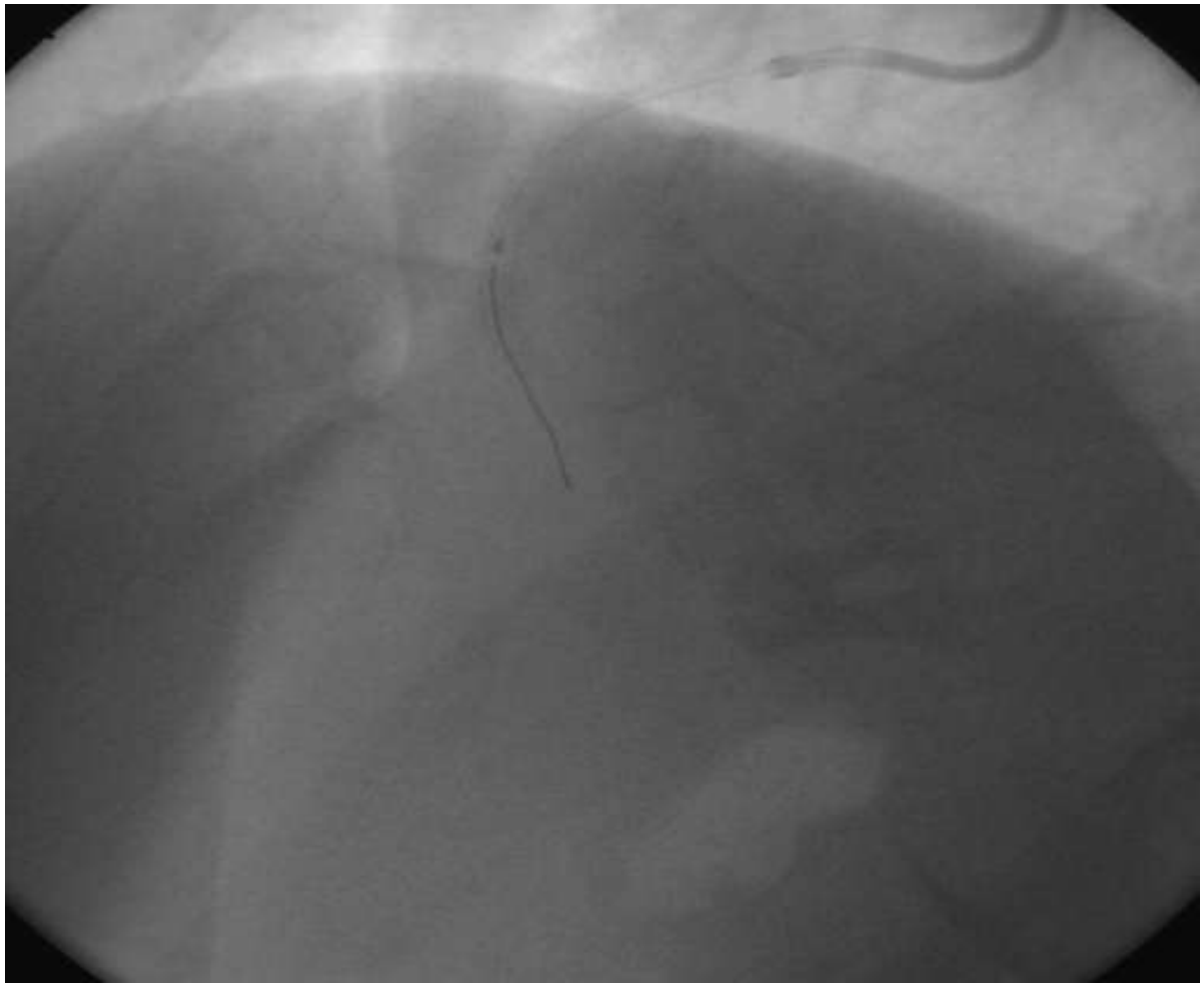
Suttorp M. PRISON III, Circulation 2006, 114, 921-928

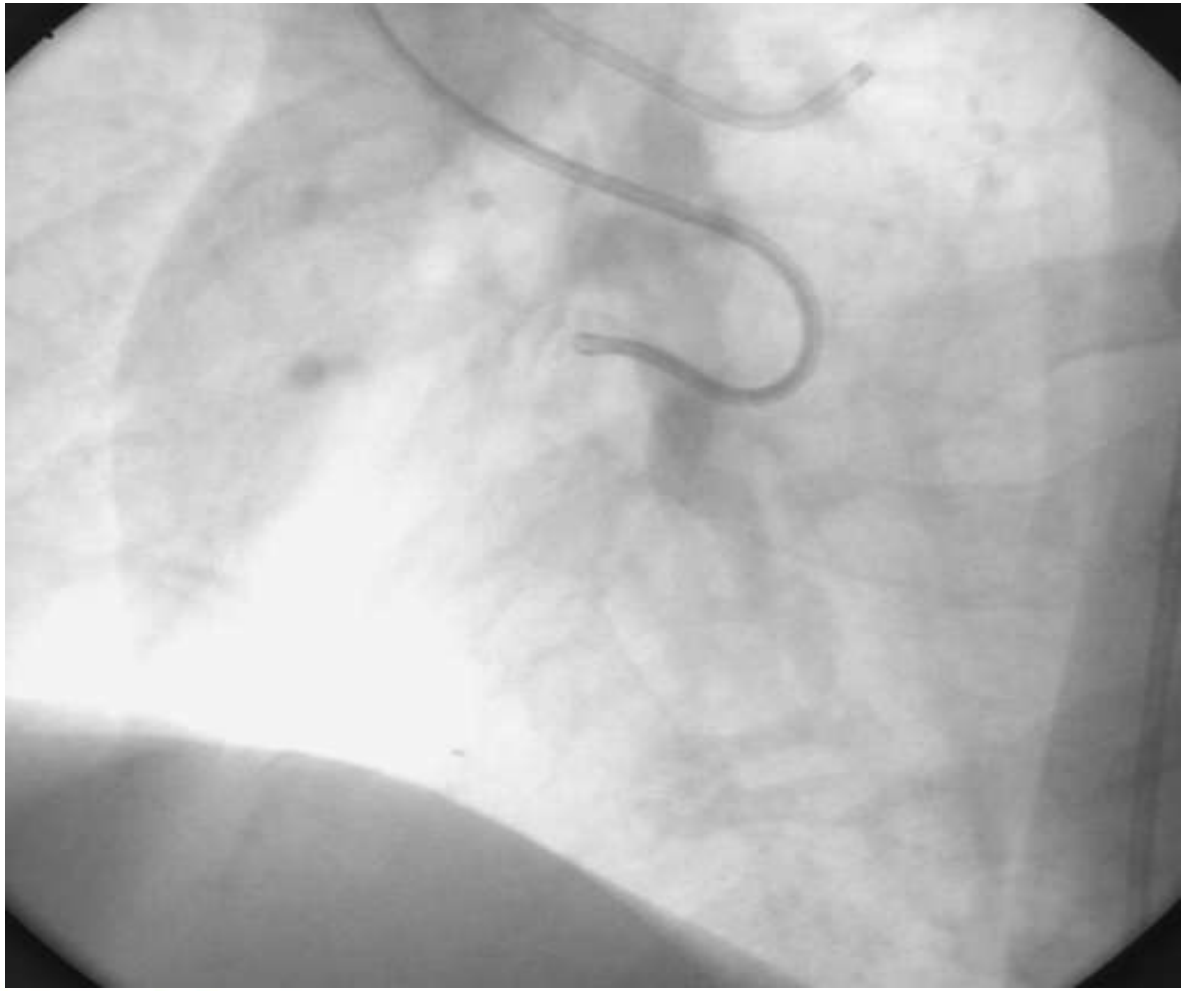
Potential complications

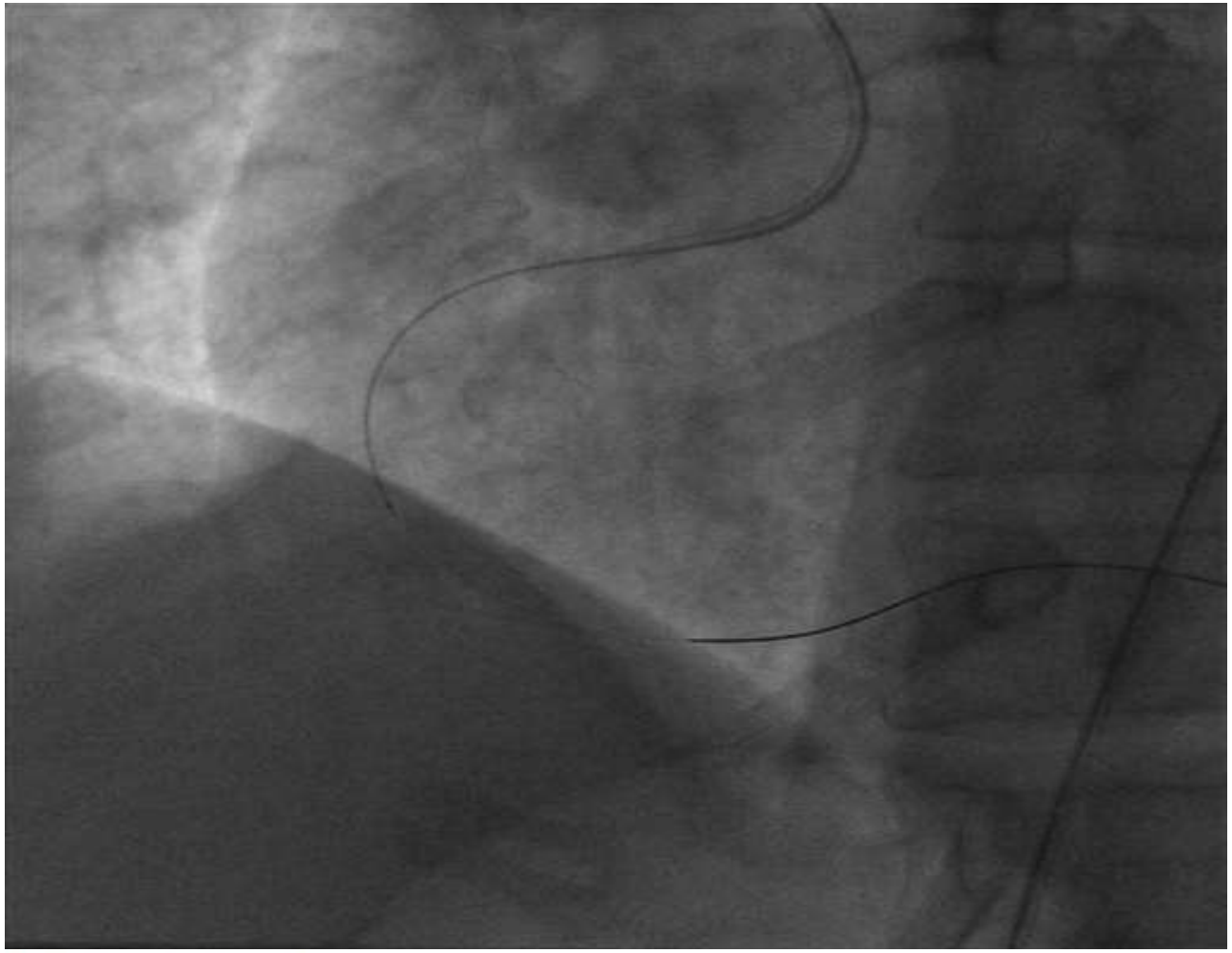
- Coronary perforation
- Distal dissection
- Compromise of collateral circulation
- Contrast nephropaty

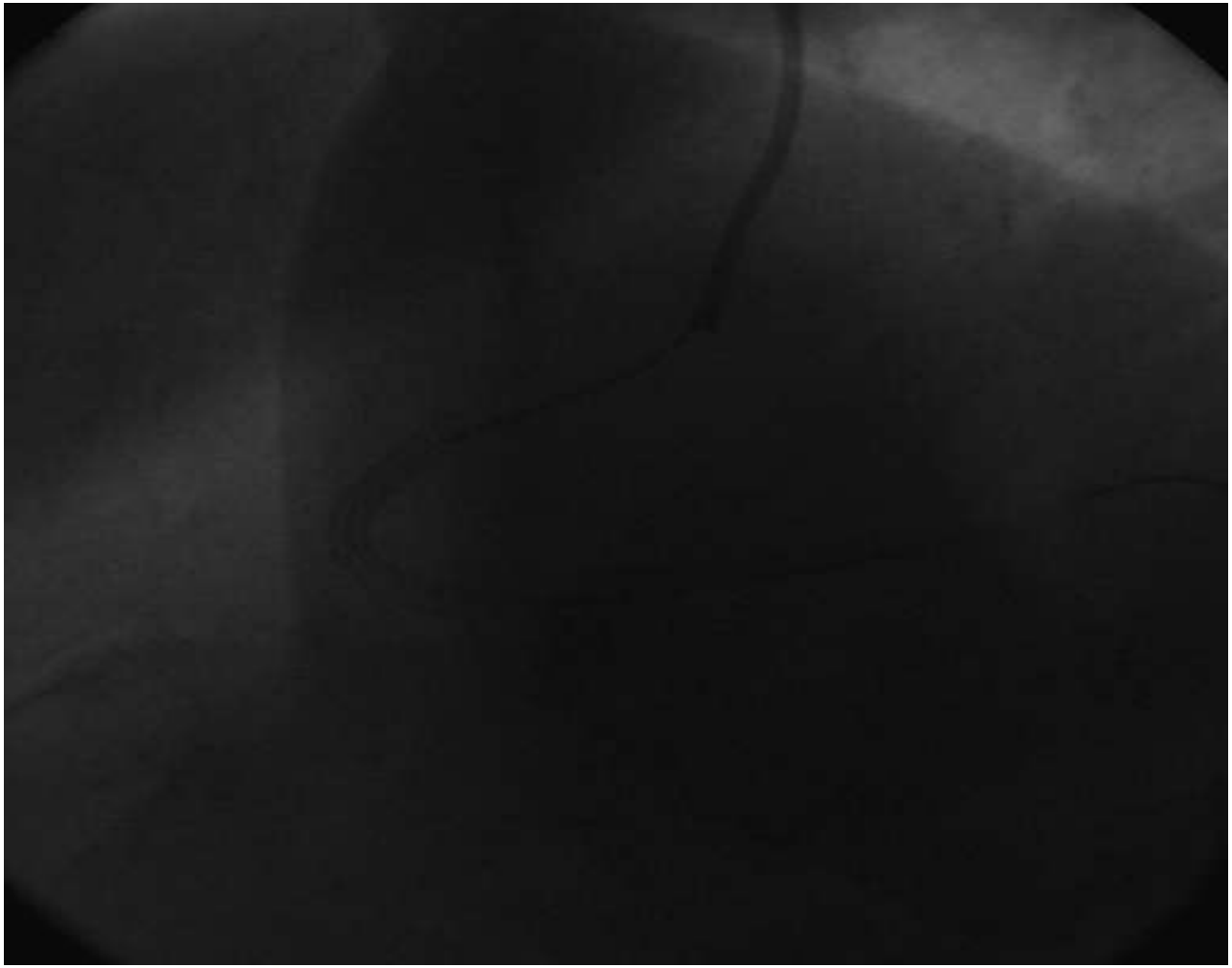


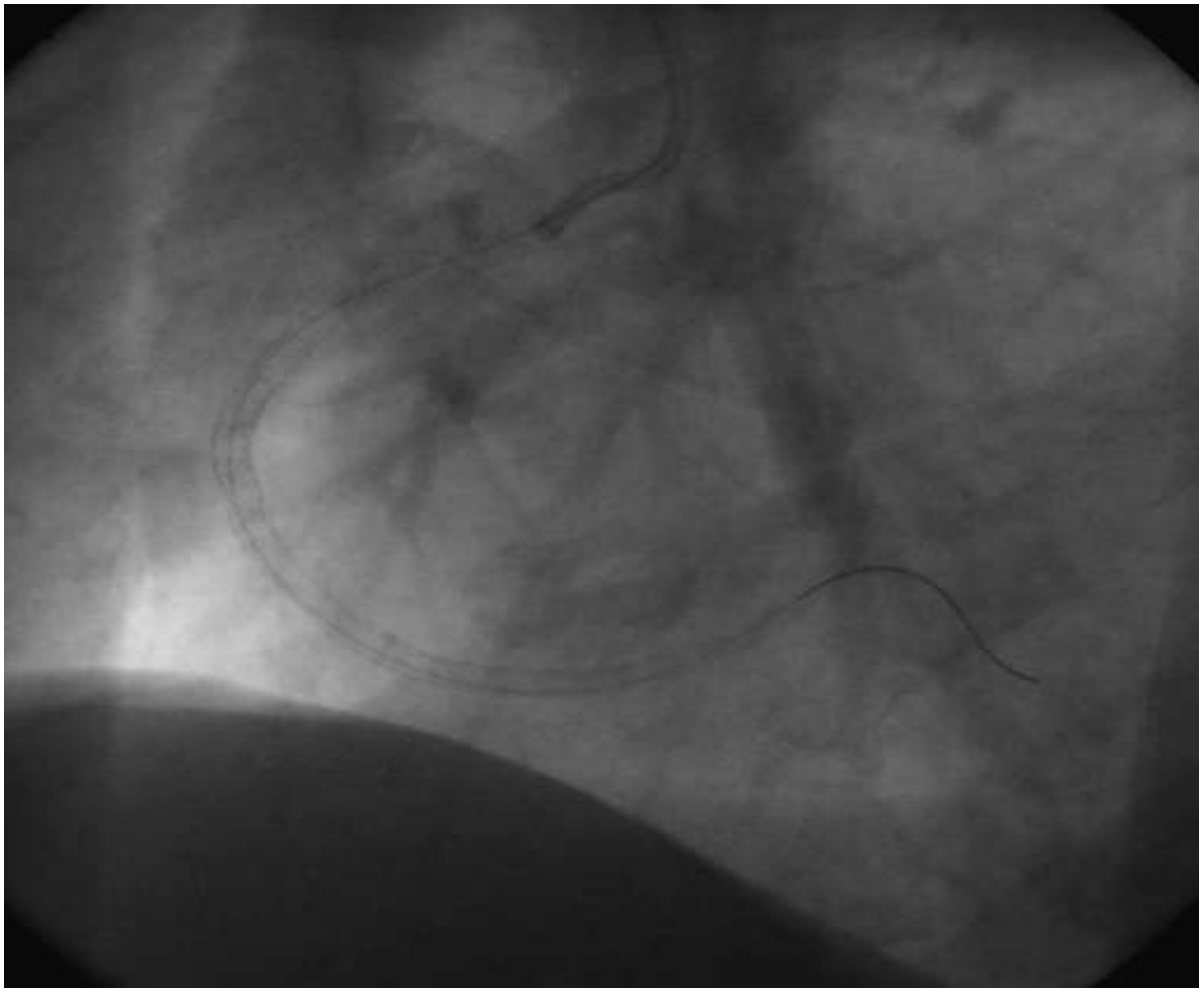












CTO ICBA

	CTO group >1month (n=339)	Non-CTO group (n=1568)
Success rate	76%	99%
Stent per patient	1.3±0.9	1.3±0.8
Overall Stent length	28.3±23.1	27.3±20.5
DES	54.7	31.9
1-y TVR (CTO-related)	14.5 (12.4)	14.3
1-y Cardiac death	3.5	3
MACE	17.4	16.9

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* $p<0.05$ vs. BMS-CTO, ** $p=0.095$ vs. BMS-CTO

CTO ICBA

	CTO group (n=339)		
	Overall	BMS-CTO (N=149)	DES-CTO (N=170)
Stent per patient	1.3±0.9	1.18±0.9	1.68±0.87*
Overall Stent length	28.3±23.1	25.1±21.9	43.5±22.5*
Multivessel PCI	35.7	33.7	45*
1-y TVR (CTO-related)	14.5 (12.4)	15.8 (13.6)	8.3** (6.7**)
1-y Cardiac death	3.5	3.9	1.7
MACE	17.4	19	10*

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* $p<0.05$ vs. BMS-CTO, ** $p=0.095$ vs. BMS-CTO

Conclusion for CTO Recanalization Success

- Selection of cases based on clinical and angiographic assessment
- MSCT scan for histological and anatomical understanding
- Plan your strategy and have enough time for the procedure
- Large back up matherials for CTO intervention (access, guiding catheter, CTO wires, devices, stents)
- Ensure long term dual antiplatelet treatment