

# UPDATE IN THE PERCUTANEOUS MANAGEMENT OF CORONARY CHRONIC TOTAL OCCLUSIONS.

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JACC INTERVENTION, APRIL 2018.

# INTRODUCTION

- CHRONIC TOTAL OCCLUSION (CTO) PERCUTANEOUS CORONARY INTERVENTION(PCI) IS A RAPIDLY EVOLVING AREA OF INTERVENTIONAL CARDIOLOGY .
- IMPROVEMENT IN EQUIPMENT AND TECHNIQUES .
- CTO PCI SHOULD BE PERFORMED WHEN THE ANTICIPATED BENEFITS EXCEEDS THE POTENTIAL RISK .

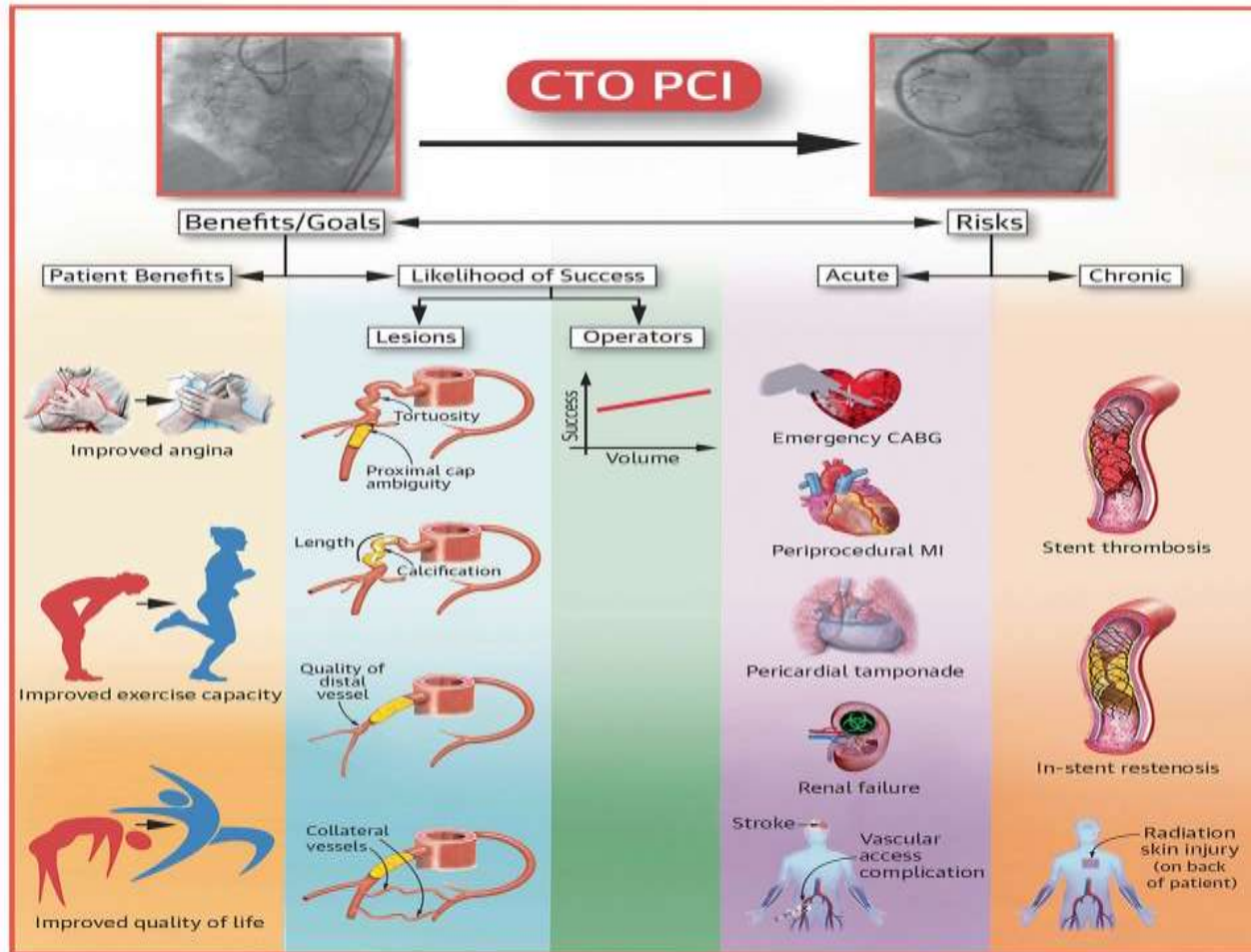
# INCIDENCE

- CTO ARE FOUND IN 16 TO 25% OF PATIENTS .
- SWEDISH REGISTRY - 16%.
- CANADIAN REGISTRY - 20%.

# WHEN SHOULD CTO PCI BE PERFORMED ?

- ANTICIPATED BENEFITS EXCEED THE POTENTIAL SHORT AND LONG TERM RISK .
- SYMPTOMS IMPROVEMENT IS CONSIDERED MAIN BENEFIT OF CTO PCI .

## CENTRAL ILLUSTRATION: Overview of the Potential Risks and Benefits of CTO PCI



Tajti, P. et al. *J Am Coll Cardiol Interv.* 2018;11(7):615-25.

# CTO PCI BENEFITS:RANDOMIZED STUDIES.

- EXPLORE TRIAL .

CTO-PCI VS MEDICAL THERAPY.

CARDIAC MRI .

LVEF AND LV END VOLUME.

- DECISION CTO .

DES VS OPTIMAL MEDICAL MANAGEMENT .

OMT AND OMT + PCI .

# CTO PCI BENEFITS: RANDOMIZED STUDIES.

- EURO CTO :  
PCI VS MEDICAL THERAPY.  
407 PATIENTS .  
CTO PCI HAD IMPROVEMENT IN ANGINA.  
EUROPCR MEETING 2017.

# CTO PCI BENEFITS - OBSERVATIONAL STUDIES.

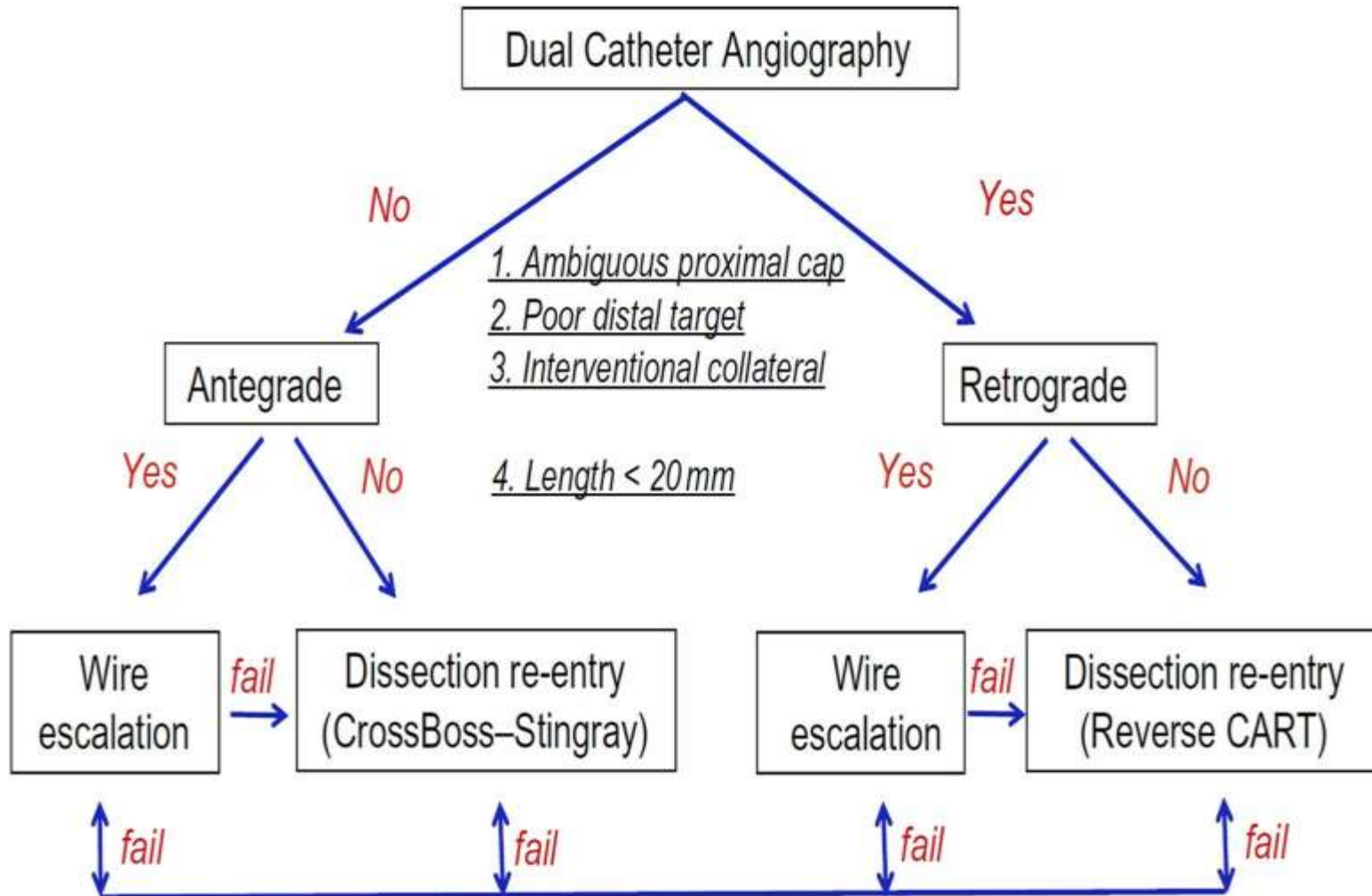
- CLINICAL BENEFITS LIKE ANGINA, DYSPNOEA, DEPRESSION, EXERCISE CAPACITY AND RISK OF ARRHYTHMIAS.
- OPEN CTO  
1000 PATIENTS.  
LOWER MORTALITY IN CTO PCI.  
6 MIN WALKING DISTANCE.  
DEPRESSION IMPROVEMENT.



# CTO PCI SUCCESS RATES

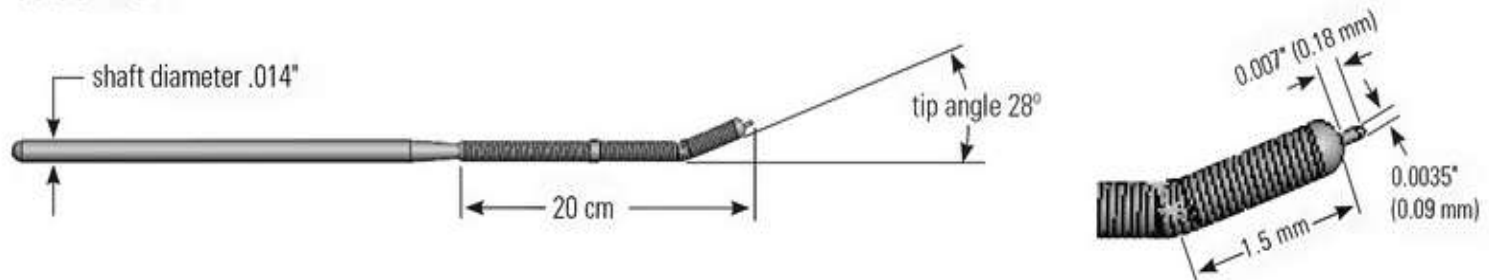
- EQUIPMENTS.
- TECHNIQUES.
- HYBRID ALGORITHM.
- EXPERIENCED OPERATORS.
- DEDICATED CTO PCI CENTERS.

# HYBRID ALGORITHM

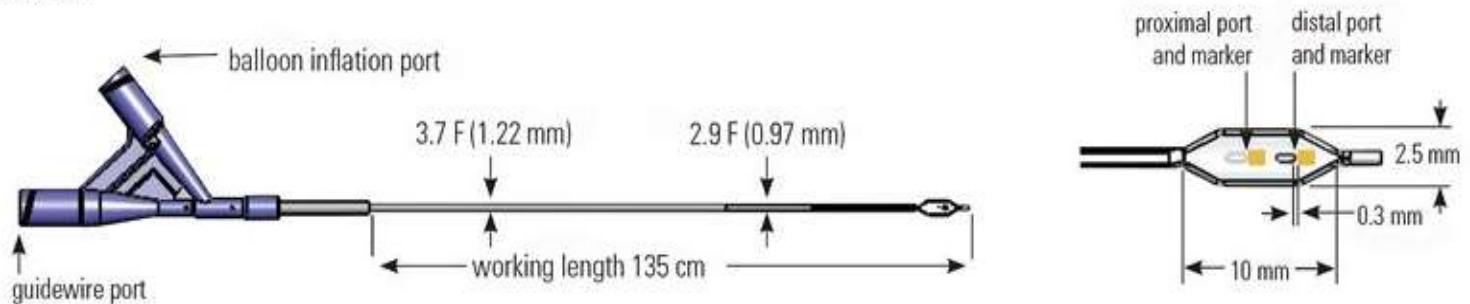


# STINGRAY CATHETER AND WIRE.

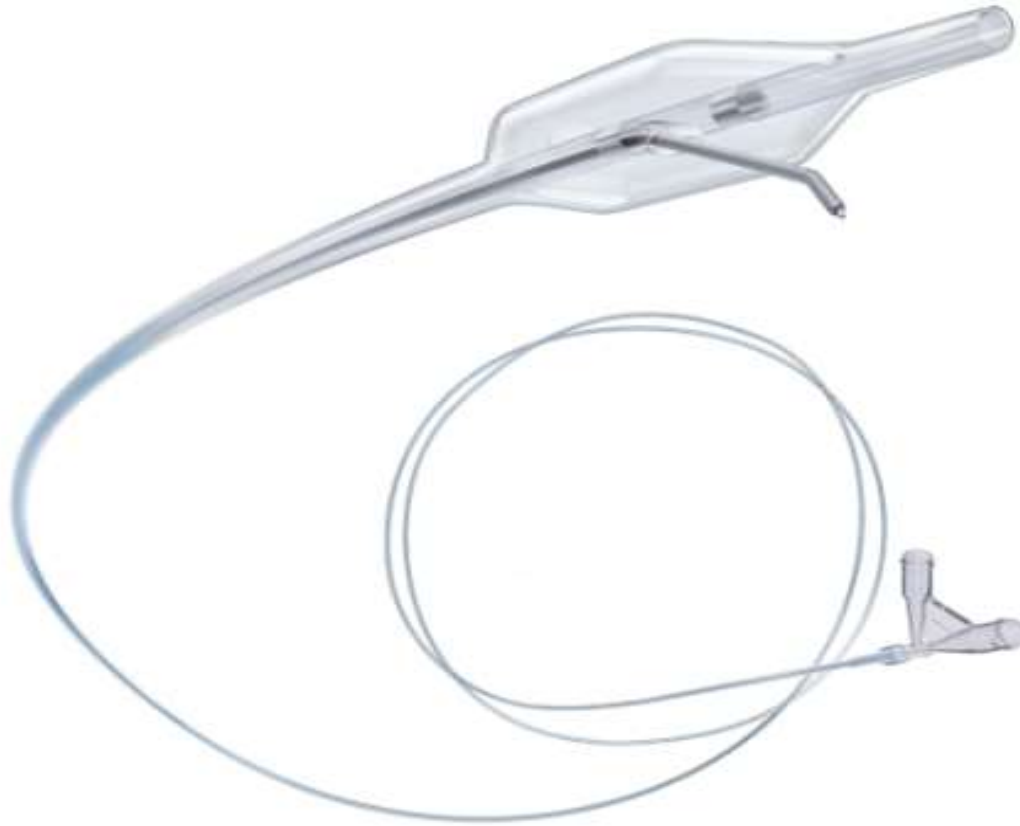
Guidewire



Catheter



# STINGRAY CATHETER



# CROSBROS CATHETER



# GAIA WIRE

ASAHI  
**Gaia**  
PTCA GUIDE WIRE



Not difficult but different

## Micro-cone tip

The micro-cone tip makes it easier to create the entry route to the hard tissue and fibrous cap.

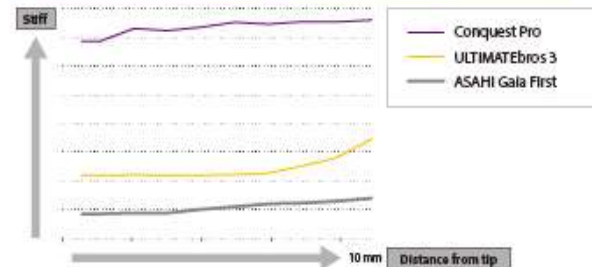


ASAHI Gaia micro-cone tip



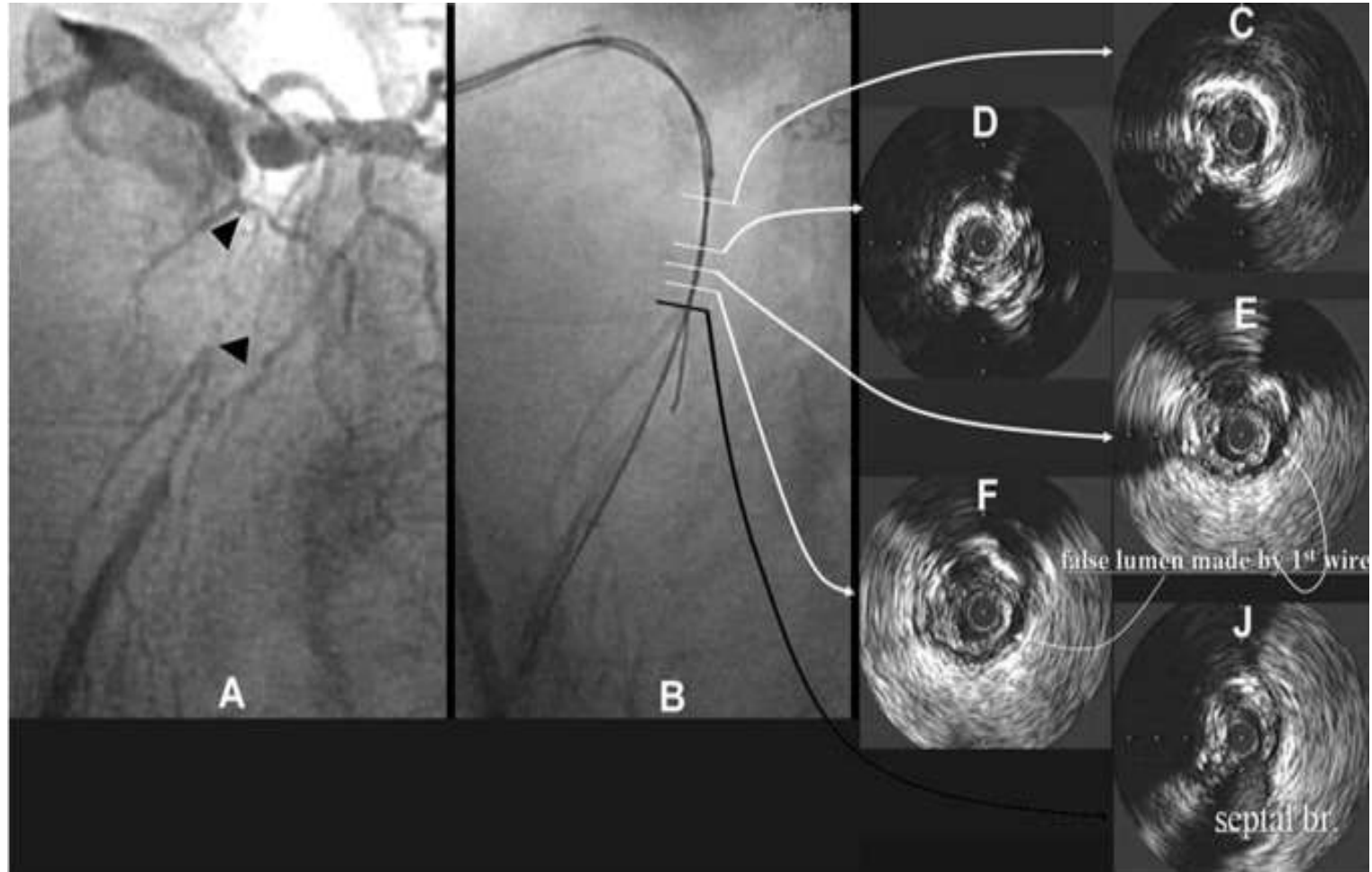
Conventional guidewire ball tip

## Flexible tip



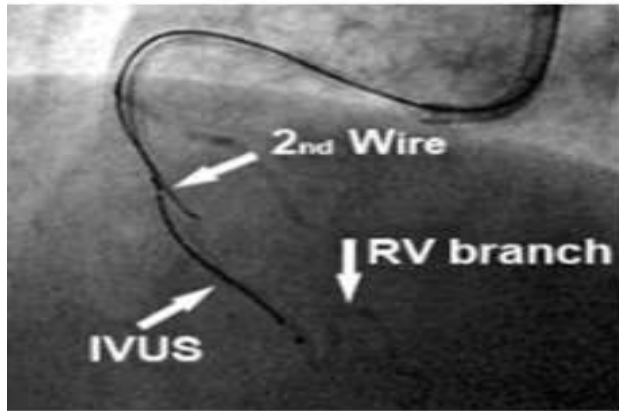
The above data was obtained by company standardized test, which may differ from industry standardized tests.  
The above data does not prove that all devices have exactly the same performance with the samples used for these tests.

# SUBINTIMAL APPROACH

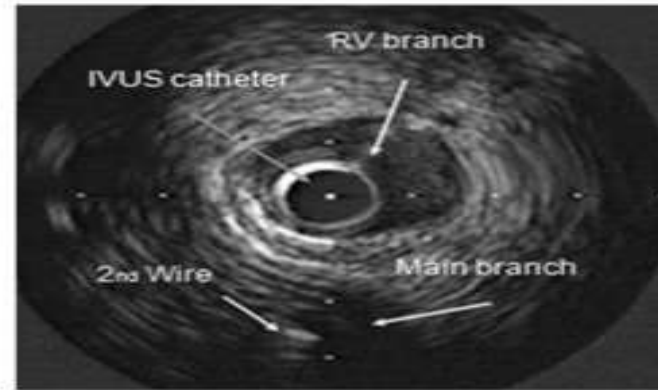


# IVUS GUIDED CTO PCI

**A**



**B**

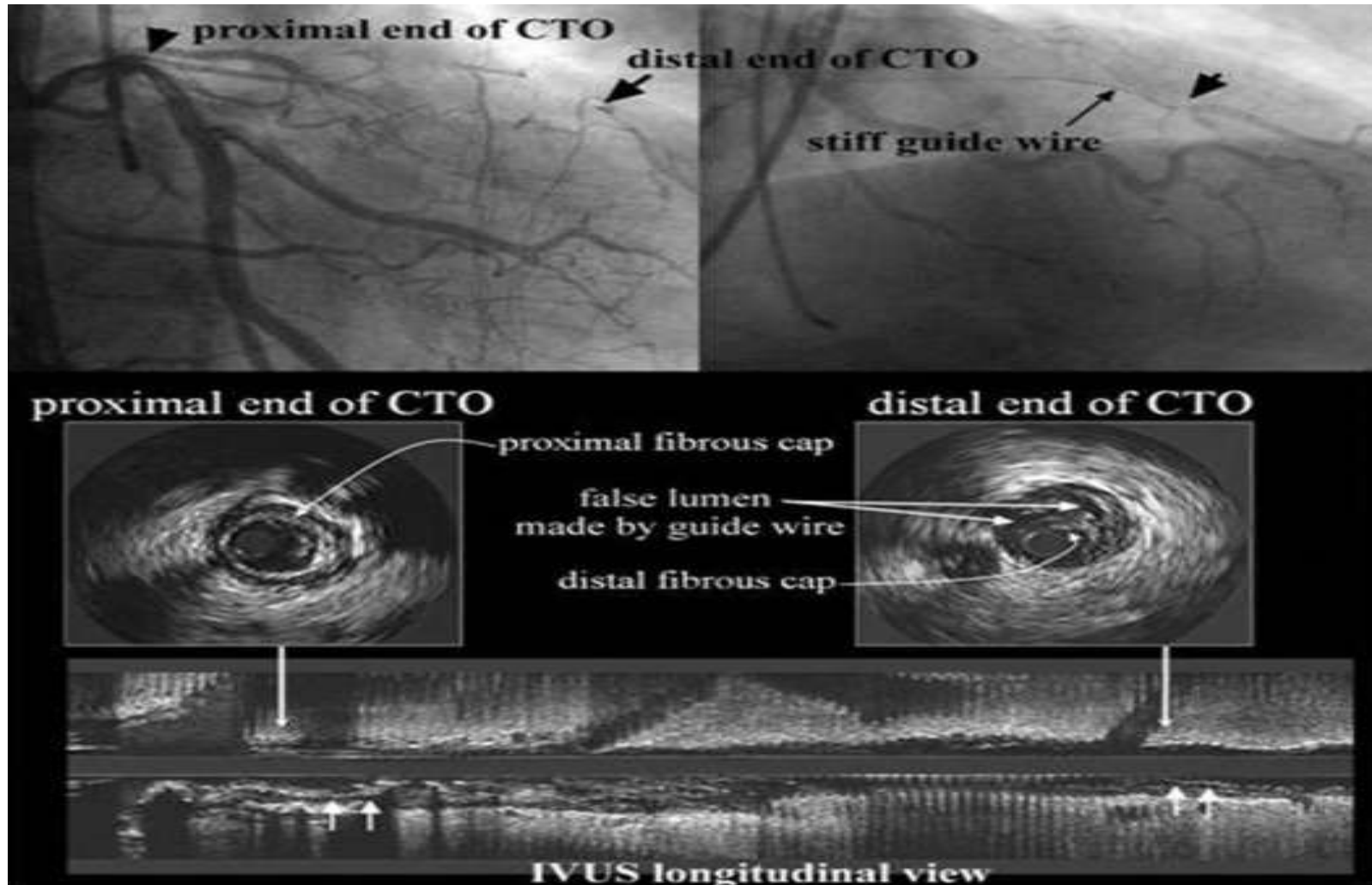


**C**



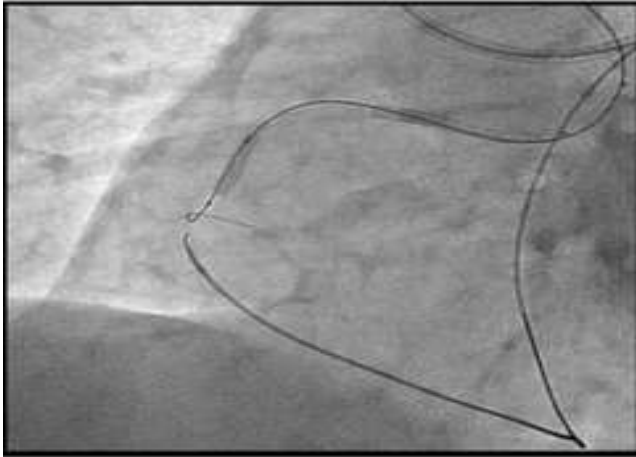


# IVUS GUIDED CTO PCI

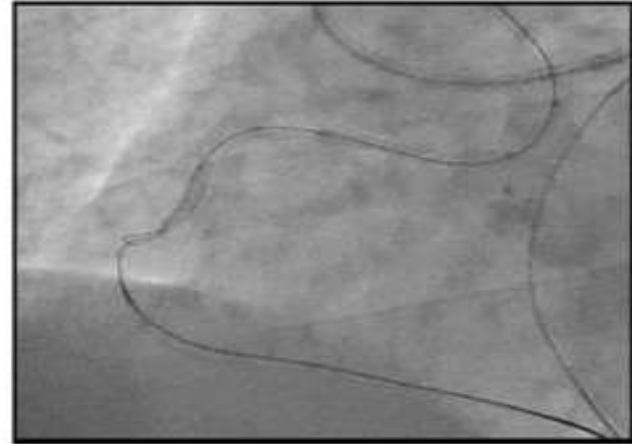


# REVERSE CART TECHNIQUE

A



B

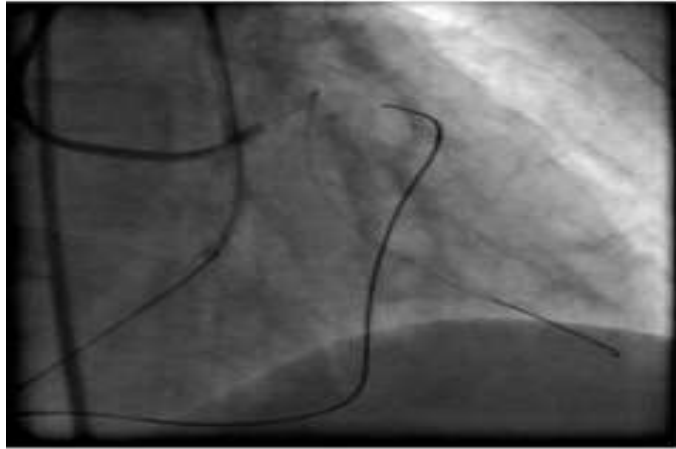


C

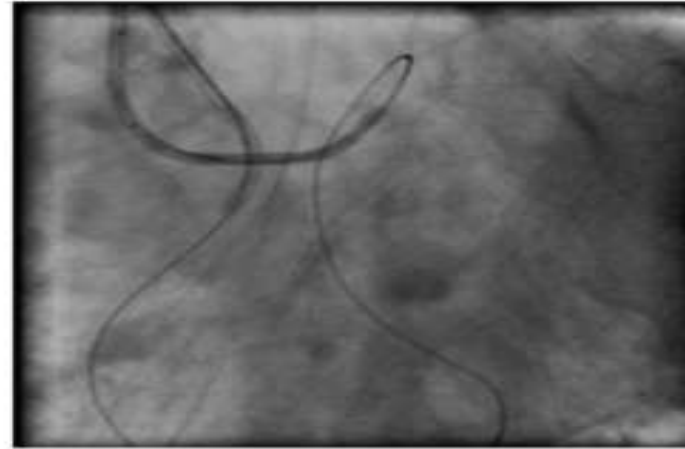


# RETROGRADE TECHNIQUE

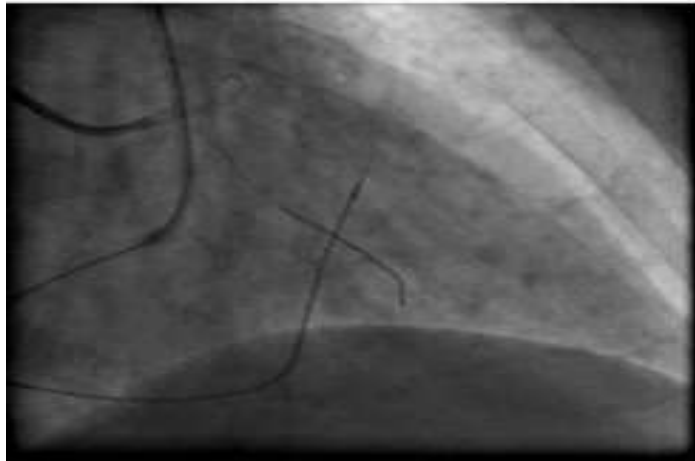
A



B



C



D



# CTO PCI SCORE

- J-CTO SCORE.
- PROGRESS CTO SCORE.
- RECHARGE SCORE.
- CL SCORE.
- ORA SCORE .
- ELLIS SCORE.

**TABLE 2** Summary of Available Scoring Systems for Procedural Planning in CTO PCI

	J-CTO Score (27)	PROGRESS-CTO Score (31)	RECHARGE Score (32)	CL Score (33)	ORA Score (34)	Ellis Score (35)	PROGRESS Complications Score (37)
Stump morphology	Blunt stump (1)	Ambiguous proximal cap (1)	Blunt stump (1)	Blunt stump (1.0)	–	Ambiguous proximal cap (1)	–
Length	>20 mm (1)	–	>20 mm (1)	>20 mm (1.5)	–	>10 mm (1)	≥23 mm (2)
Ostial location	–	–	–	–	Ostial location (1)	Ostial location (1)	–
Target vessel	–	Circumflex target vessel (1)	Bypassed CTO target vessel (1)	Non-LAD (1.0)	–	–	–
Tortuosity	Intralesion bending ≥45° (1)	Moderate/severe proximal tortuosity (1)	Intralesion bending ≥45° (1)	–	–	Retrograde tortuosity (1)	–
Calcification	Mild to moderate (1)	–	Visible calcification (1)	Severe (2.0)	–	Moderate to severe (1)*	–
Procedural characteristics	Previously failed CTO attempt (1)	–	–	–	–	Operator variable (1)	Retrograde approach used (1)
Distal target/collateral vessels	–	Lack of interventional collateral vessels (1)	Diseased distal target vessel (1)	–	Rentrop 1-2 filling (2)	Poor distal target (1), collateral score (2)†	–
Clinical characteristics	–	–	–	Previous CABG (1.0) or MI (1.0)	–	–	–
Age, yrs	–	–	–	–	≥75 (1)	–	≥65 (3)
Prediction	Wire crossing in 30 min (0) 92.3% (1) 58.3% (2) 34.8% (≥3) 22.2%	Technical success (0) 98.2% (1) 97.5% (2) 91.6% (≥3) 76.7%	Technical success (0-1) 98% (2) 90% (3) 73% (4) 69% (5) 44% (6) 14%	Technical success (0.0-1.0) 88.3% (1.5-2.5) 73.1% (3.0-4.5) 59.4% (≥5.0) 46.2%	Technical success (0) 96.8% (1) 96.4% (2) 71.9% (≥3) 58.8%	Technical success (0) 100% (1) 89.1% (2) 70.2% (3) 61.9% (4) 0% (4-5) 75%*	Risk of MACE (0-2) 0.2% (3-4) 2.0% (≥5) 6.6%

# COMPLICATIONS

- AGE >65 YRS.
- > 20 MM LENGTH .
- MODERATE TO SEVERE CALCIUM.
- LOW LVEF.
- >45 DEGREE .

# PERFORATION

- MOST FEARED COMPLICATION.
- CLASSIFIED AS LARGE VESSEL, DISTAL VESSEL AND COLLATERAL VESSEL.
- LARGE VESSEL – COVERED STENTS.
- DISTAL VESSEL- FAT OR COIL EMBOLIZATION.
- COLLATERAL VESSEL – BOTH SIDE FAT/COIL.

## Perforation management

1. Inflate balloon to occlude vessel
2. Intravenous fluids / pressors
3. Pericardiocentesis if hypotension  
– ? autotransfusion
4. Notify surgeons

**“Universal” Algorithm for  
Coronary Perforations**

Persistent extravasation?

no

**Monitor pt**

yes

**Treat the cause**

Large vessel perforation  
1. Covered stent  
2. Prolonged balloon  
inflations

Distal vessel perforation  
1. embolization (fat, coil,  
thrombin, etc)  
2. Covered stent over  
perforated branch origin

**Type-specific  
Treatment**

continued extravasation?

**Reverse anticoagulation**



# SIDE BRANCH OCCLUSION

- MORE COMMON DISSECTION- REENTRY TECHNIQUE.
- CAN AFFECT BOTH SHORT AND LONG TERM RESULTS .
- MYOCARDIAL INFARCTION .

# RADIATION SKIN INJURY

- ACUTE DERMATITIS.
- CHRONIC SKIN ULCER.

# ACCESS SITE

- 8F GUIDING CATHETERS .
- TRANSFEMORAL PREFERRED.
- 7F RADIAL SHEATH.

# CTO CROSSING TECHNIQUES

- ANTEGRADE WIRE ESCALATION.
- ANTEGRADE DISSECTION OR RENTRY.
- RETROGRADE APPROACH.

PTCA Micro Catheter

# ASAHI Corsair Microcatheter



Precisely access the most challenging anatomy

# IMAGING

- IVUS IMAGING –  
PROXIMAL CAP.  
DIRECT THE GUIDEWIRE.  
CONFIRM DISTAL FREE LUMEN.  
LOWER INCIDENCE OF MACE.
- CTA – TORTOUSITY,CALCIUM SCORES,LENGTH.

# OPTIMAL STENTING IN CTO PCI

- DES –  
RESTENOSIS.  
REOCCLUSION.  
TARGET VESSEL REVASCULARISATION.

# TRAINING AND EDUCATION

- APPROPRIATE TRAINING AND CONTINUED PRACTISE.

HIGH SUCCESS RATES.

MINIMIZE RISK OF COMPLICATIONS.

EFFICIENTLY MANAGING IF OCCURS.

- DEDICATED FELLOWSHIP PROGRAMS.
- ONLINE RESSOURCES-[ctomanual.org](http://ctomanual.org) and [ctofundamentals.org](http://ctofundamentals.org).



# CONCLUSION

- CTO PCI IS A RAPIDLY EVOLVING FIELD.
- WITH IMPROVEMENT IN EQUIPMENT AND TECHNIQUES, HIGH SUCCESS RATES CAN BE ACHIEVED.
- TRIALS REGARDING OPTIMAL USE AND INDICATIONS OF CTO PCI ARE LIMITED.
- HIGH QUALITY STUDIES .
- EXPANSION OF DEDICATED CENTERS.

# CONCLUSION

- DEDICATED OPERATORS WHO CAN ACHIEVE EXCELLENT CLINICAL OUTCOMES IN THIS CHALLENGING PATIENT AND LESION SUBGROUP.
- THOUGHTFUL AND DETAILED CONSIDERATION OF THE POTENTIAL RISKS AND BENEFITS OF THE PROCEDURE CAN OPTIMIZE CLINICAL DECISION MAKING FOR EACH PATIENT WITH CORONARY CTO .