²** TCTAP2024

CCT @ TCTAP 2024 Treatment of CTO With CHIP

Kazuhiro Ashida, MD, PhD Seire Yokohama Hospital, Kanagawa, Japan Country



Disclosure

Speaker's name : Kazuhiro Ashida

• I do not have any potential conflict of interest to declare





CHIP(Complex High-risk and Indicated Patients) Population

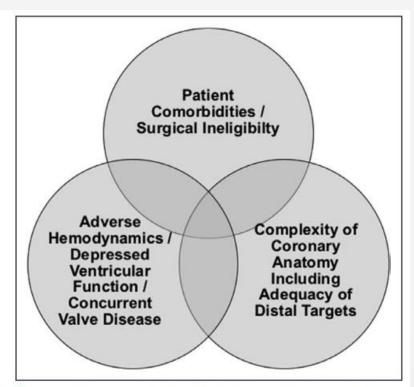
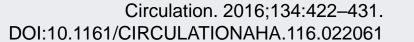


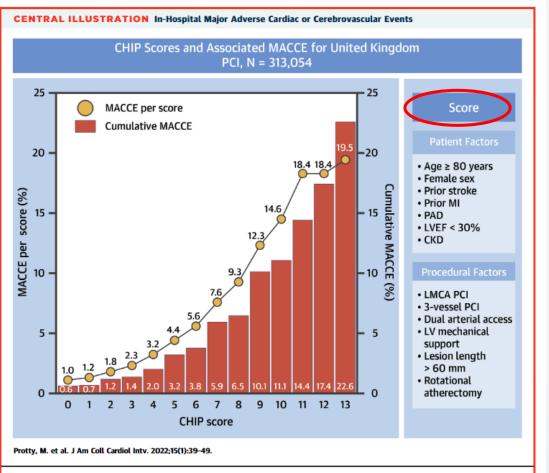
Figure. The increasingly high-risk patient population with indications for revascularization who may be considered for percutaneous coronary intervention.

TCTAP2024





CHIP score

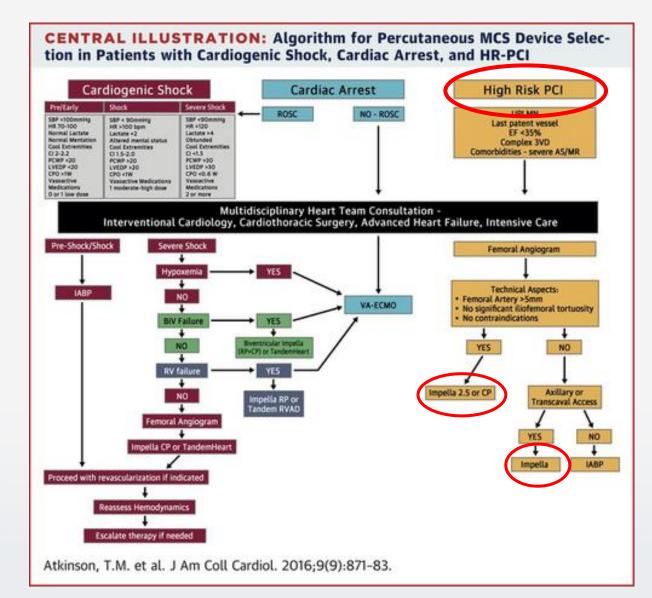


Red bars plot in-hospital major adverse cardiac or cerebrovascular events (MACCE) by the number of complex high-risk indicated PCI (CHIP) factors present in patients undergoing percutaneous coronary intervention (PCI) in the United Kingdom 2006-2016. Yellow circles plot cumulative in-hospital MACCE of that number of factors or more/case, that is, cumulative in-hospital MACCE of 3 or more CHIP factors/case is 3.0%.

- BCIS CHIP score includes 7 patients and 6 procedural factors
- Predicts in-hospital MACCE for patients undergoing PCI



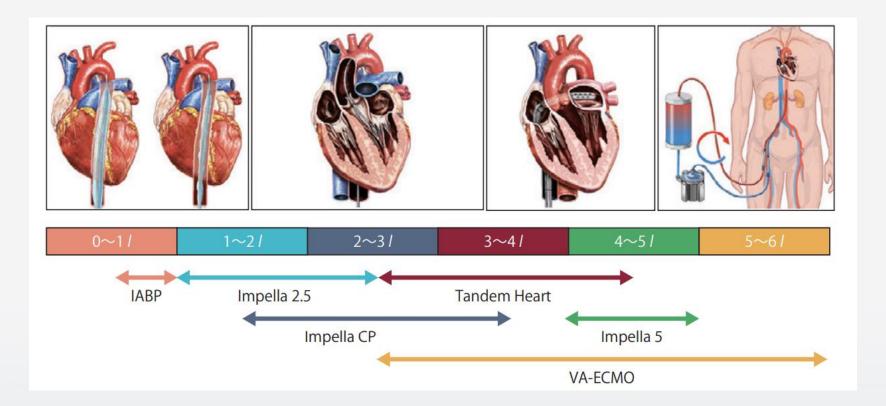
One of the algorithm for MCS selection in CHIP



TCTAP2024



Cardiac Support (Flow)

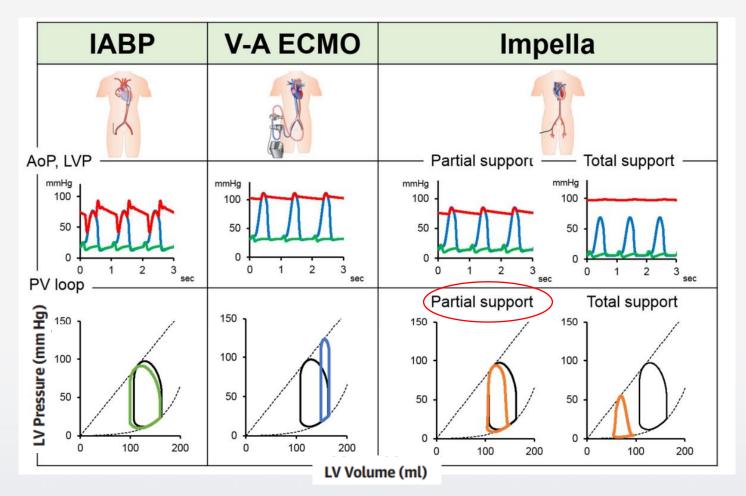


JACC Cardiovasc Interv 9 : 871—883, 2016.



TCTAP2024

LV unloading; Total support with Impella is most powerful unloading, but partial one is slightly higher than IABP



TCTAP2024

For partial support; the case which cardia output is maintained to some extent

IABP vs Impella for high-risk PCI and/or shock

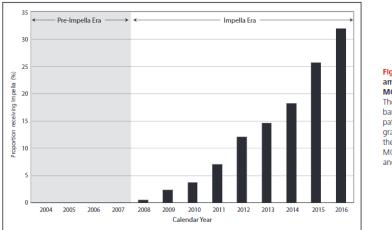


Figure 1. Trends in the use of Impella among patients undergoing PCI requiring MCS.

The x axis depicts the calendar year. The black bars represent proportion of Impella use among patients undergoing PCI requiring MCS. The gray box represents the pre-Impella era in which the Impella devices had not become available. MCS indicates mechanical circulatory support; and PCI, percutaneous coronary intervention.

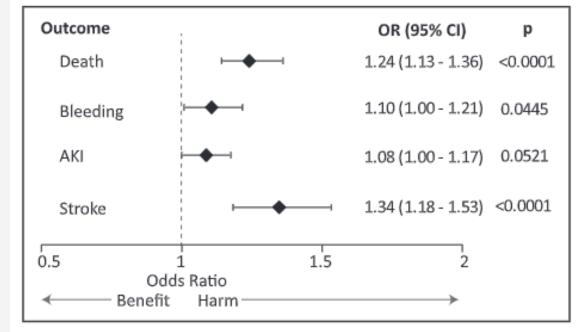


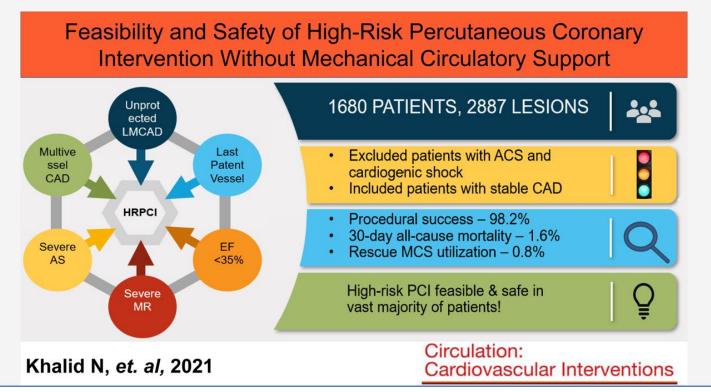
Figure 3. Association of Impella versus IABP use with clinical outcomes.

The number of Impella in use is increasing every year

IABP has better outcome than Impella

Circulation. 2020;141:273–284. DOI: 10.1161

Real practice for CHIP intervention



High-risk PCI as defined by the professional societies without elective MCS is feasible and safe in the majority of patients, challenging the current recommendations and practice.



Nauman Khalid. Circulation: Cardiovascular Interventions. Feasibility and Safety of High-Risk Percutaneous Coronary Intervention Without Mechanical Circulatory Support, Volume: 14, Issue: 6, DOI: (10.1161/CIRCINTERVENTIONS.120.009960)

MCS support for CHIP CTO PCI

• Purpose

To avoid acute heart failure (crush condition)

To avoid refractory VT/VF

To avoid ischemic accident (procedural MI)

Except few cases of shock with MVD cases, CTO should be treated at stable conditions (patient background, hemodynamics)





| year | No of CTO PCI | CTO_PCI day | IABP | PCPS | Impella | temporary PM or CHDF | No of death | comment |
|------|---------------|------------------------|--------|------|---------|----------------------|----------------|--|
| 2014 | 1215 | 2014/3/28 | 1 | 0 | 0 | | 0 | |
| 2015 | 1414 | 2015/2/26 | 1 | 0 | 0 | | 1 | |
| | | 2015/4/22 | 1 | 0 | 0 | | 0 | |
| | | 2015/5/5 | 0 | 1 | 0 | | 1 | LMT+3VDにて挿入/手技無関連死 |
| | | 2015/5/29 | 1 | | | 1 | ? | 手技不成功 |
| | | 2015/6/4 | 1 | 1 | 0 | | 0 | 心タンポにて挿入 |
| | | 2015/10/16 | 1 | 1 | 0 | | 1 | 心停止で挿入/手技無関連死 |
| | | 2015/11/28 | 1 | 0 | 0 | | 0 | |
| 2016 | 1529 | 2016/2/9 | 1 | 0 | 0 | | 1 | 手技無関連/QMI |
| | | 2016/2/27 | 1 | 0 | 0 | | 0 | |
| | | 2016/6/16 | 1 | 0 | 0 | | 0 | |
| 2017 | 1668 | 2017/1/4 | 0 | 1 | 0 | | 1 | CABG待期例急変で搬送にて挿入/手技無関連死 |
| | | 2017/1/27 | 0 | 1 | 0 | | 0 | CTO治療前のnonCTO病変治療時ショックのため挿入 |
| | | 2017/2/6 | 1 | 0 | 0 | | 1 | LowEF,CABG後CRF,高齢のHigh risk例/イレウスショック 開腹術→DIC/MOFで死亡/手技無関連死 |
| | | 2017/3/1 | 1 | 0 | 0 | | 0 | Low EFにて挿入 |
| | | 2017/3/13 | 1 | 0 | 0 | | 0 | LAD-AMI時挿入、離脱困難で後日そのままRCA-CTO |
| | | 2017/4/6 | 0 | 1 | 0 | | 0 | 術後帰室後に心タンポ判明→心停止ありにて挿入 |
| | | 2017/5/17 | 1 | 0 | 0 | | 0 | |
| | | 2017/7/20 | 1 | 0 | 0 | | 0 | |
| | | 2017/10/24 | 1 | 0 | 0 | | 0 | |
| 2018 | 1560 | 2018/1/4 | 1 | 1 | 0 | | 1 | CPAで搬送され緊急カテにて挿入/手技無関連死 |
| | | 2018/1/11 | 1 | 0 | 0 | | 0 | |
| | | 2018/3/9 | 1 | 0 | 0 | | 0 | |
| | | 2018/3/14 | 1 | 0 | 0 | | 0 | |
| | | 2018/5/25 | 1 | 0 | 0 | | 0 | |
| | | 2018/8/13 | 0 | 1 | 0 | | 0 | VT stormで挿入 |
| | | 2018/10/17 | 1 | 0 | 0 | | 0 | |
| | | 2018/11/2 | 1 | 0 | 0 | | 0 | |
| 2019 | 1380 | 2019/1/21 | 1 | 0 | 0 | | 0 | |
| | | 2019/1/22 | 1 | 0 | 0 | | 0 | |
| | | 2019/3/1 | 0 | 1 | 0 | | 0 | CHF+持続性VTにて |
| | | 2019/3/18 | 1 | 0 | 0 | | 0 | |
| | | 2019/4/19 | 1 | 0 | 0 | | 0 | ステント内多量血栓にて吸引後もTIMI2にて挿入 |
| | | 2019/4/19 | 0 | 1 | 0 | | 1 | CPAで搬送/低酸素脳症で死亡/手技無関連死 |
| | | 2019/5/20 | 1 | 0 | 0 | | 0 | |
| | | 2019/6/18 | 1 | 0 | 0 | | 0 | CTO手前の枝にSlow flowあり挿入 |
| | | 2019/7/9 | 1 | 0 | 0 | | 0 | |
| | | 2019/7/10 | 1 | 0 | 0 | 1 | 0 | |
| | 1001 | 2019/8/15 | 1 | 0 | 0 | | 0 | Slow flowにて挿入 心停止で送管/PCPS挿入後PCI |
| 2020 | 1091 | 2020/4/10 | 0 1 | 1 | 0 | | 0 | |
| | | 2020/5/13 2020/9/24 | 1 | 0 | 0 | | 0 | 心原性ショック離脱困難にて挿入下でPCI |
| | | 2020/9/24 | 1 | 0 | 0 | | 0 | 低心機能にて |
| 2021 | 959 | 2020/11/18 | 0 | 1 | 1 | | 1 | CPAで来院 LADのSTEMI/RCA,LCX CTO |
| 2021 | 555 | 2021/3/12 | 1 | 0 | 0 | | 0 | |
| | | 2021/3/12 | 1 | 0 | 0 | | 0 | |
| | | 2021/4/16 | 1 | 0 | 0 | | 0 | |
| | | 2021/5/20 | 1 | 0 | 0 | | 0 | |
| | | 2021/10/11 | 1 | 0 | 0 | | 0 | |
| 2022 | 859 | 2022/5/24 | 1 | 0 | 0 | | 0 | |
| | | 2022/10/31 | 1 | 0 | 0 | | 0 | |
| | | | | | | | | |
| | | | 42 | 12 | | | 9 | |

Japanese CTO expert Registry From 2014 to 2022; n=11675

Impella was available from 2017 in Japan. Impella is not approved for use only during PCI procedures.

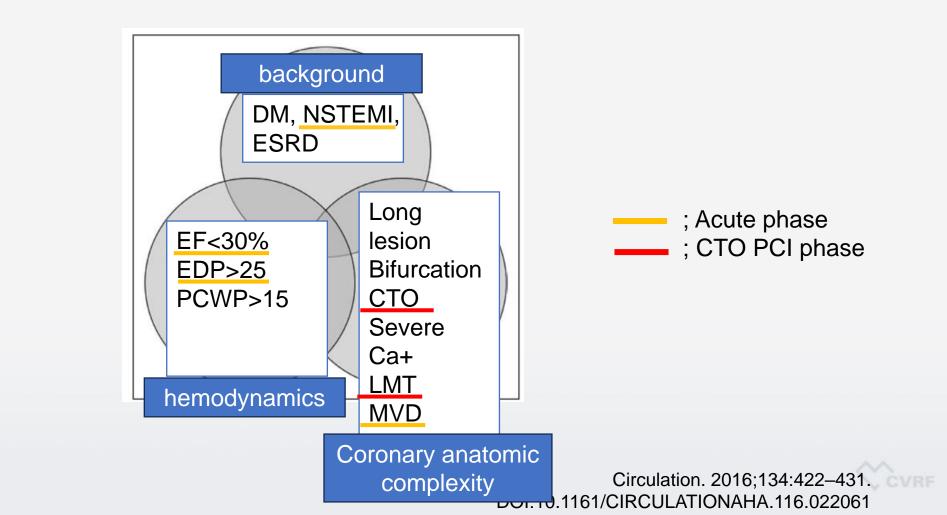
IABP 42 cases (0.35%) ECMO (PCPS) 12 cases (0.1%) Impella 1case (CPA)

ECMO Case; CPA, VT-VF storm, cardiac tamponade

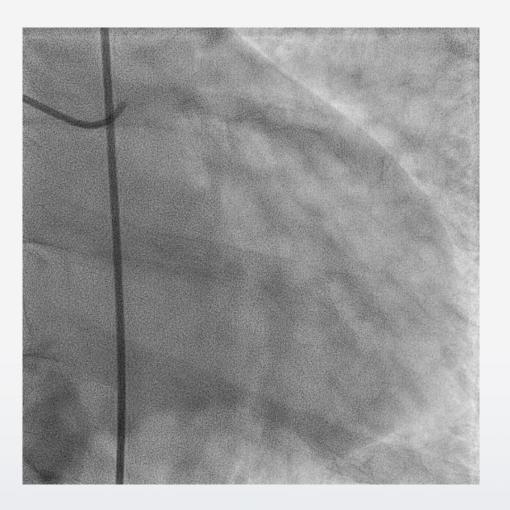
Support device for almost complex CTO cases; IABP were used in Japan.



Case presentation;Case1 CHIP population

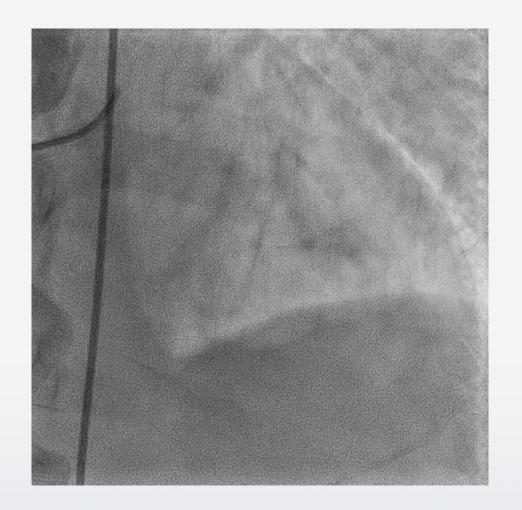


Case1; NSEMI (proximal LAD 99% stenosis), mid RCA 90% stenosis, LCX CTO





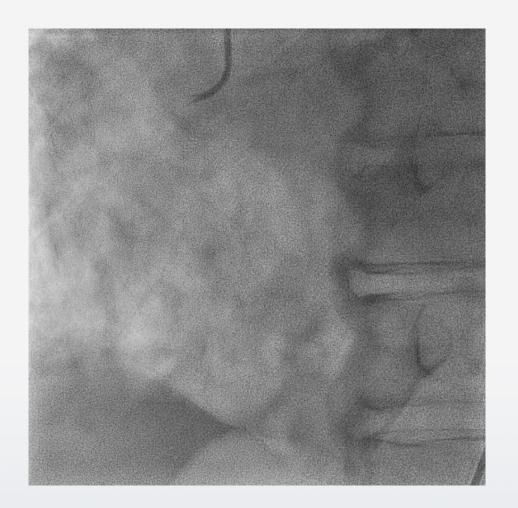








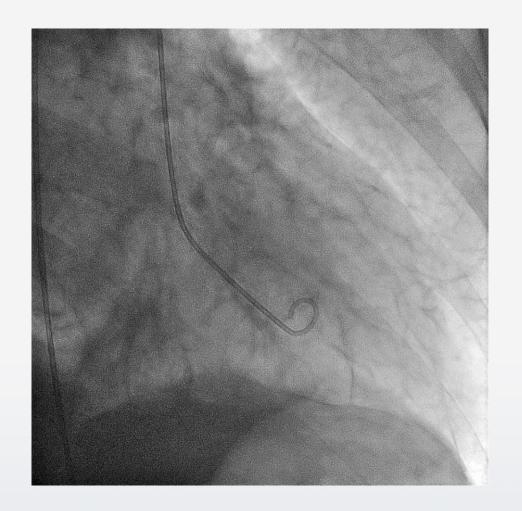
Mid RCA 90-99% stenosis







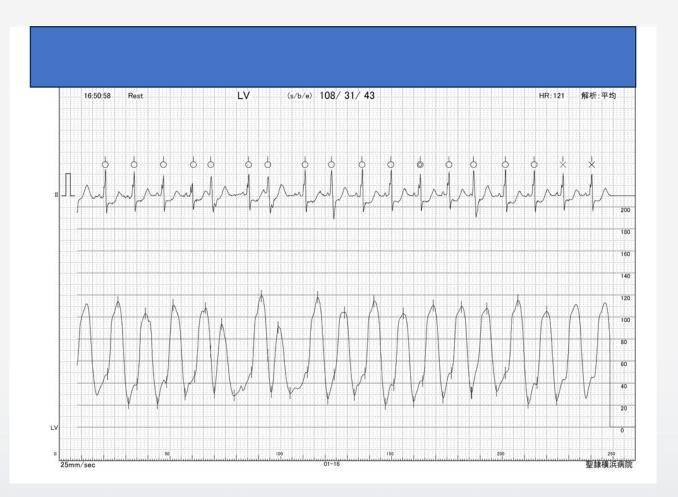
Low LV function







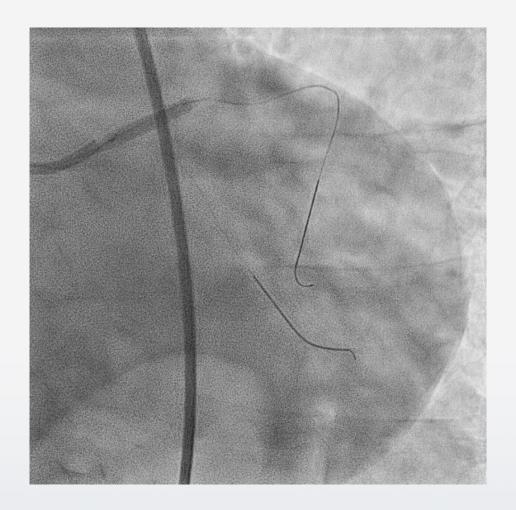
LVEDP>35



TCTAP2024



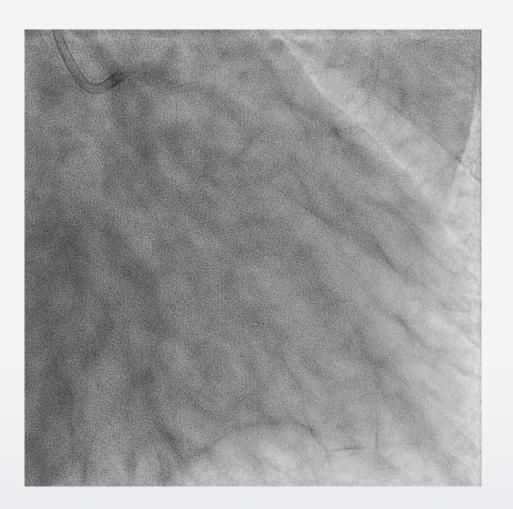
Primary PCI for LMT-prox LAD







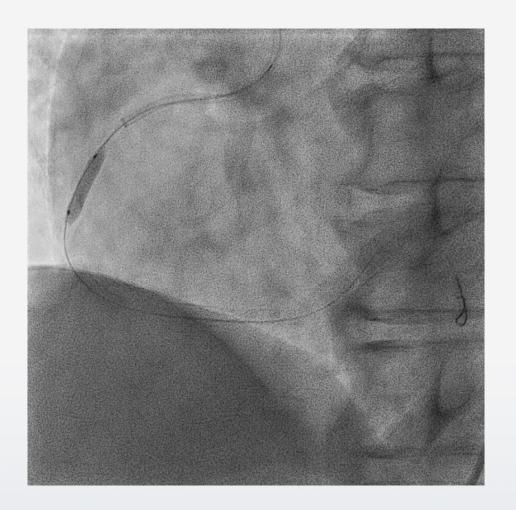
Primary PCI for LAD



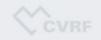




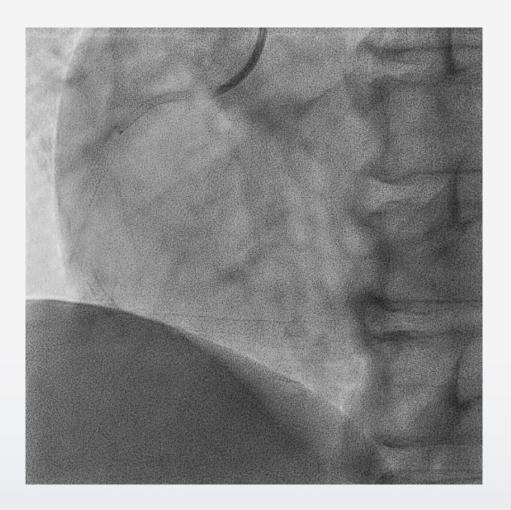
Staged PCI for RCA







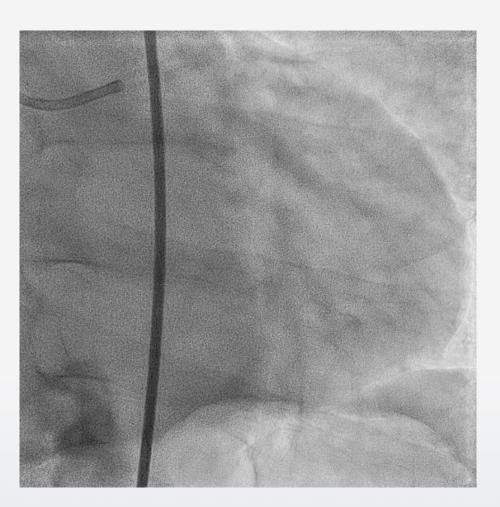
Staged PCI for RCA







Next staged PCI for LCX CTO (LVEDP18mmHg)



✓ Patient condition; stable
No CKD, no anemia
No COPD

✓ If LVEDP>25; antegrade approach only

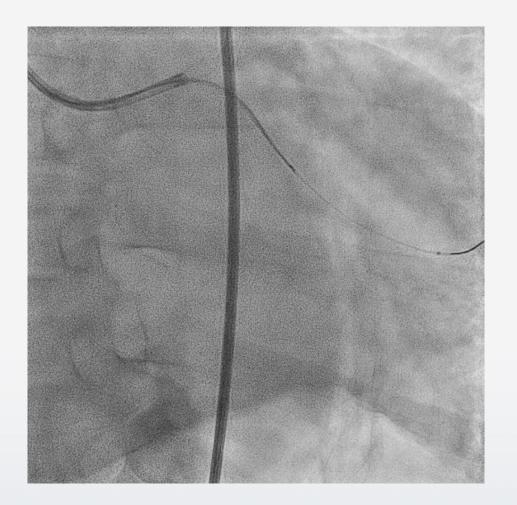
If we must chose retrograde approach, rendezvous technique after retrograde wire crossing is recommended (not externalization).

LVEDP; 18mmHg⇒Both antegrade and retrograde approach are permitted.





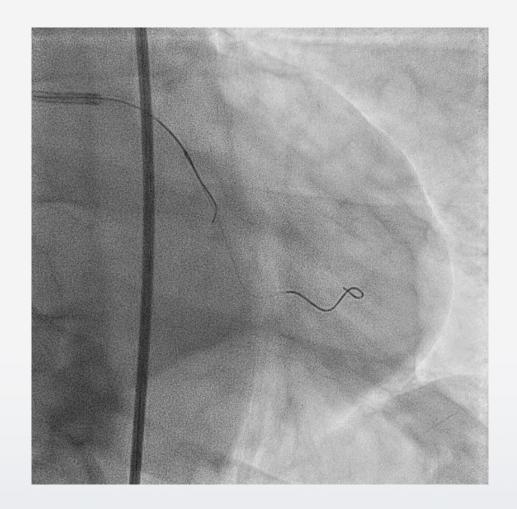
IVUS marking at entry point of CTO







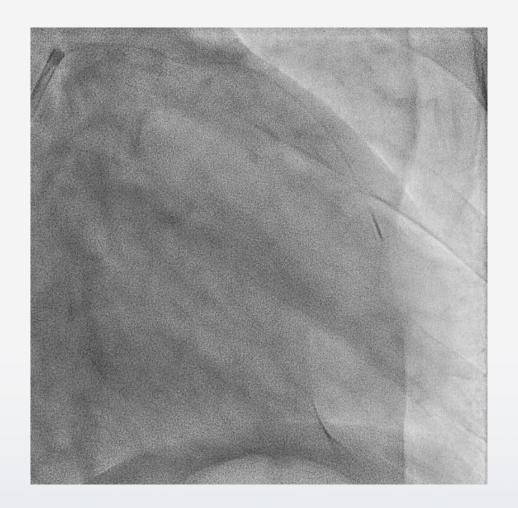
Puncture at entry point is OK, however, antegrade wiring is failed







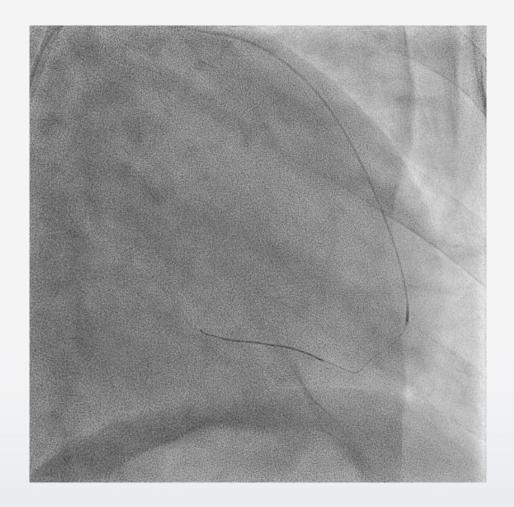
Switch to retrograde approach due to low LVEDP, to save the time







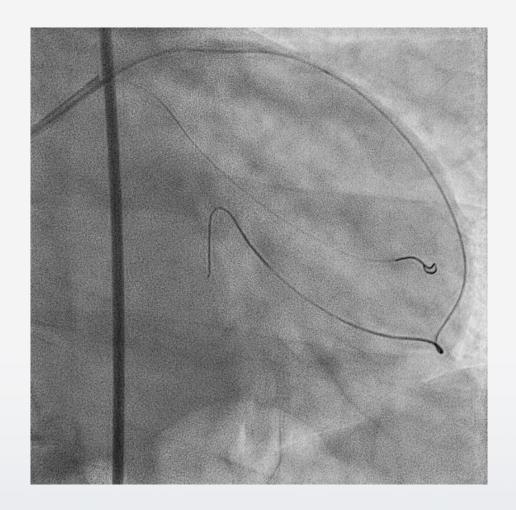
Retrograde wire was reached at distal end of CTO







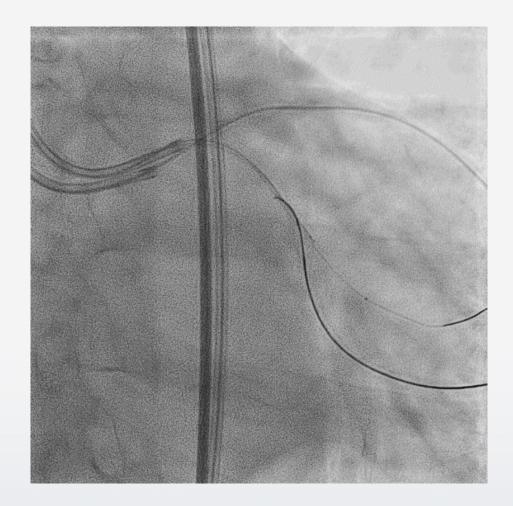
Retrograde approach







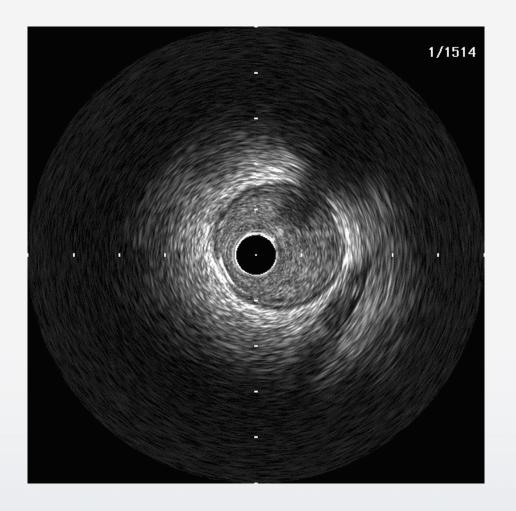
Retrograde wire crossed with IVUS guidance







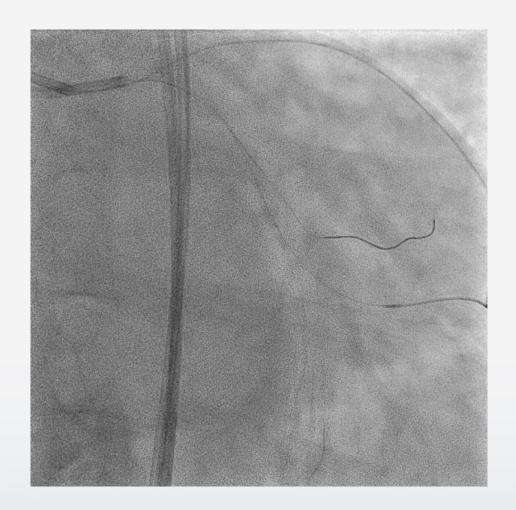
IVUS confirmed wire position at true lumen around LMT







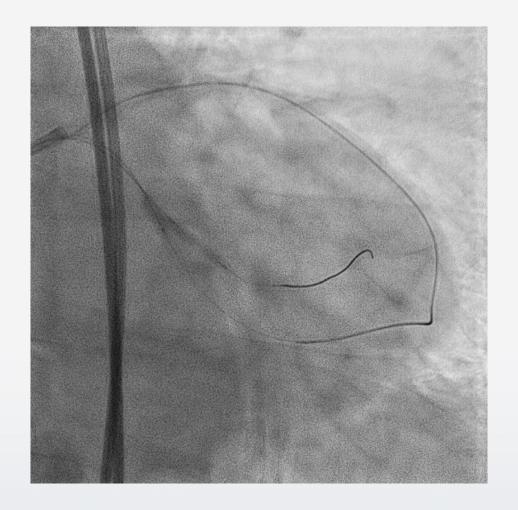
Balloon dilation







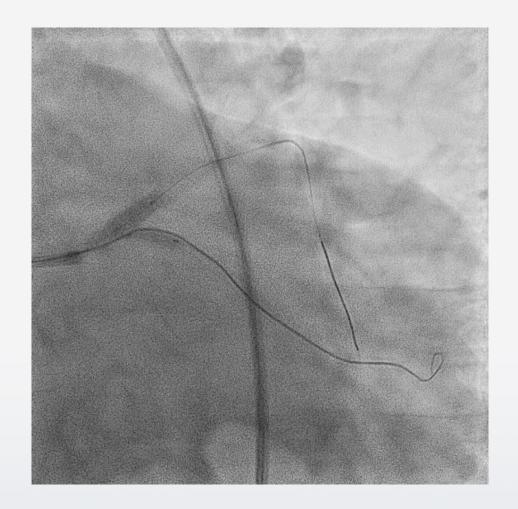
KBI at **CTO** lesion







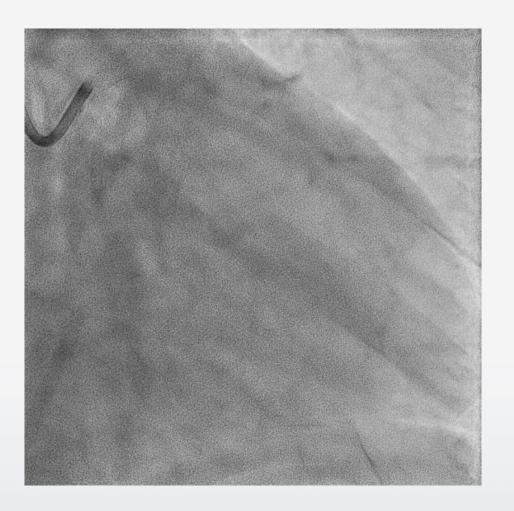
KBI at **LMT**







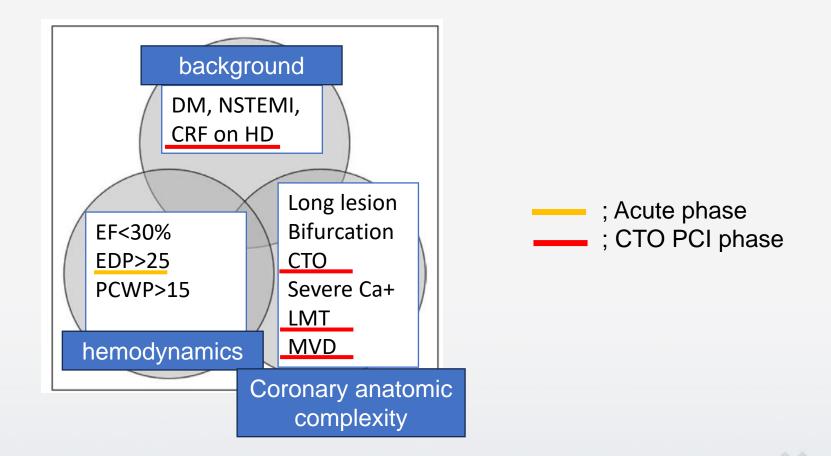
Final CAG







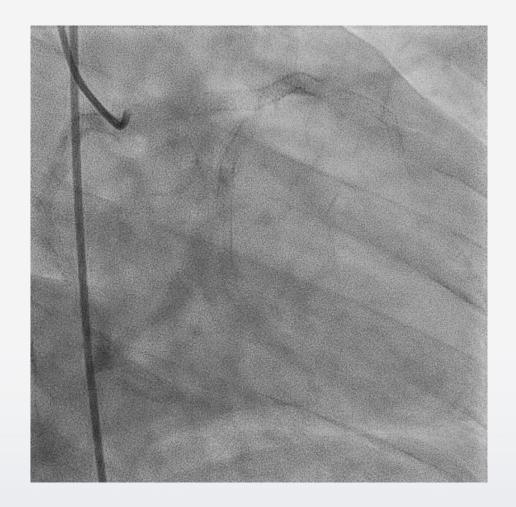
Case2 CHIP population



TCTAP2024

Circulation. 2016;134:422–431. DOI:10.1161/CIRCULATIONAHA.116.022061

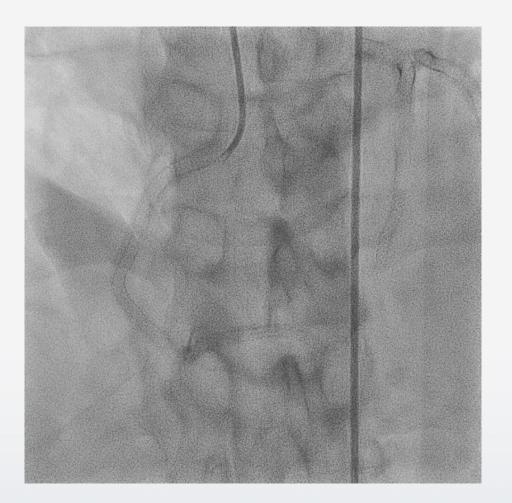
Case2; CRF on HD, just os LCX 99% stenosis



TCTAP2024



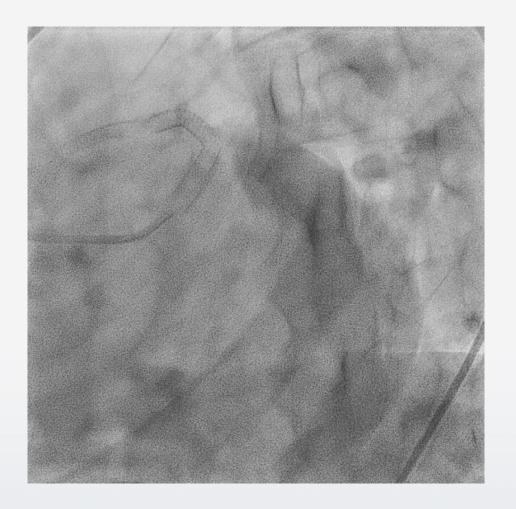




TCTAP2024



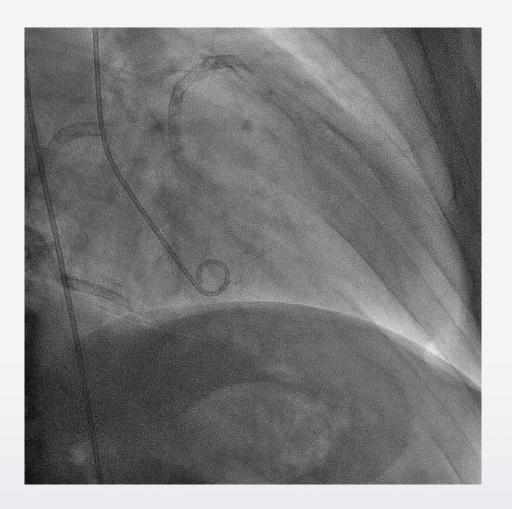
CRF on HD, just os LCX 99% stenosis, collateral to distal RCA







LVG



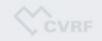




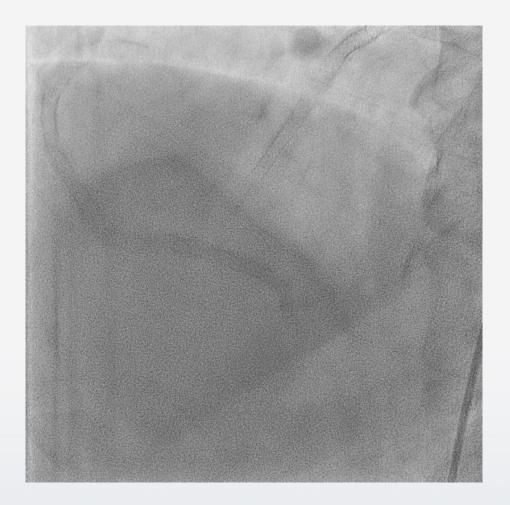
LVEDP38



TCTAP2024



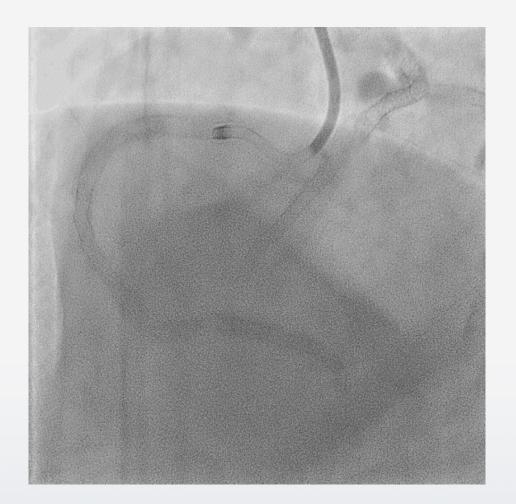
PCI to RCA via only antegrade approach







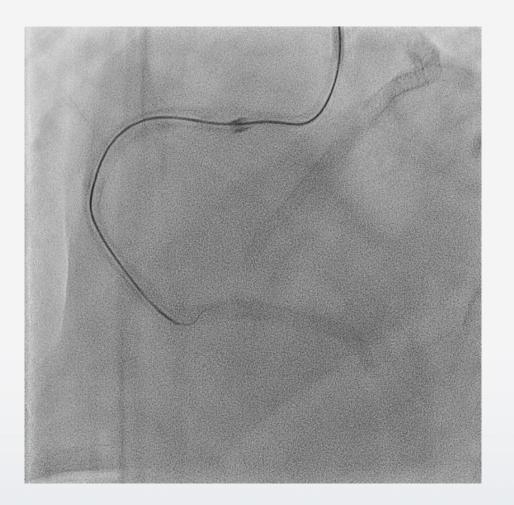




TCTAP2024



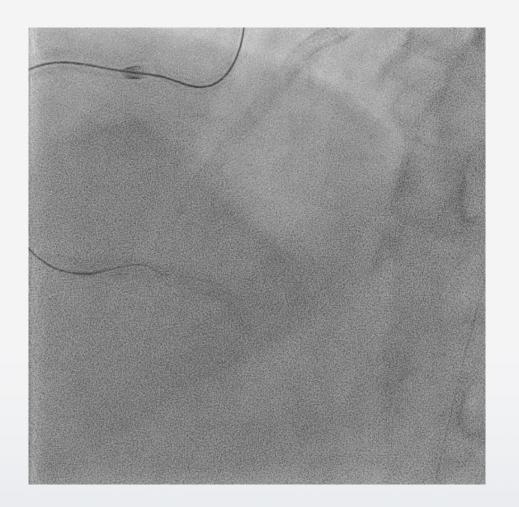
Gaia Next 2nd







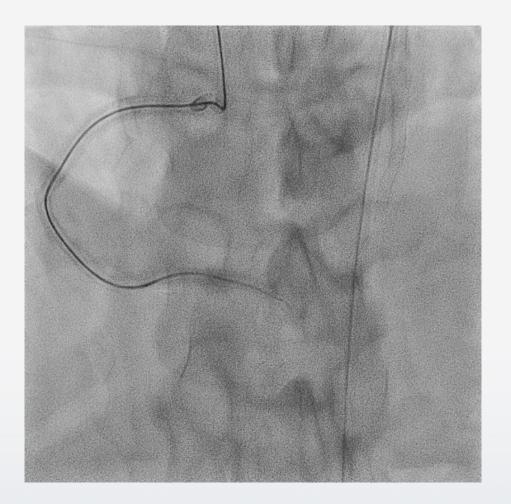
Conquest Pro







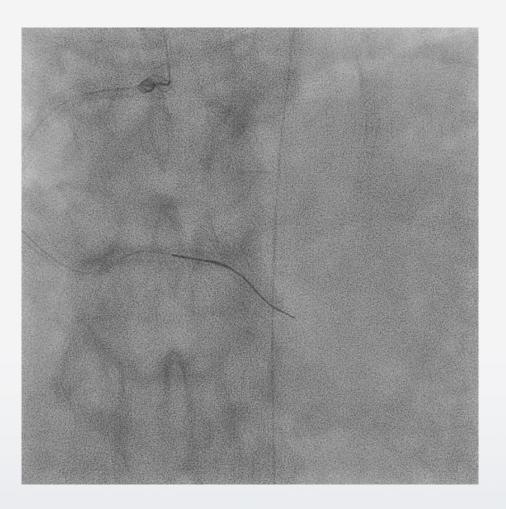
CP was reached at near the distal end of CTO







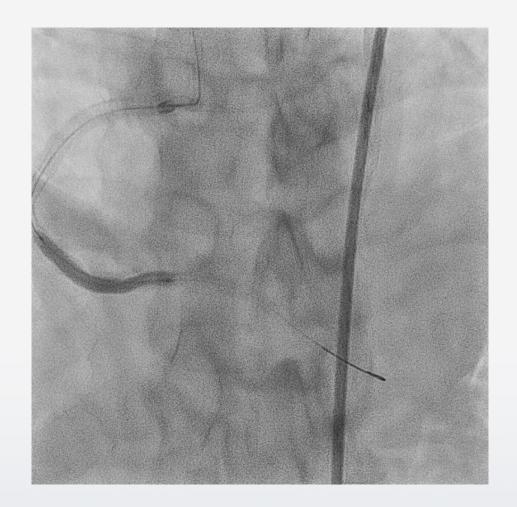
Conventional wire crossed the lesion







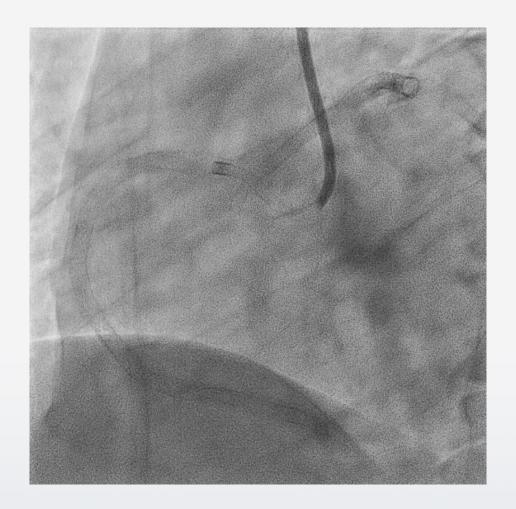
DCB was done







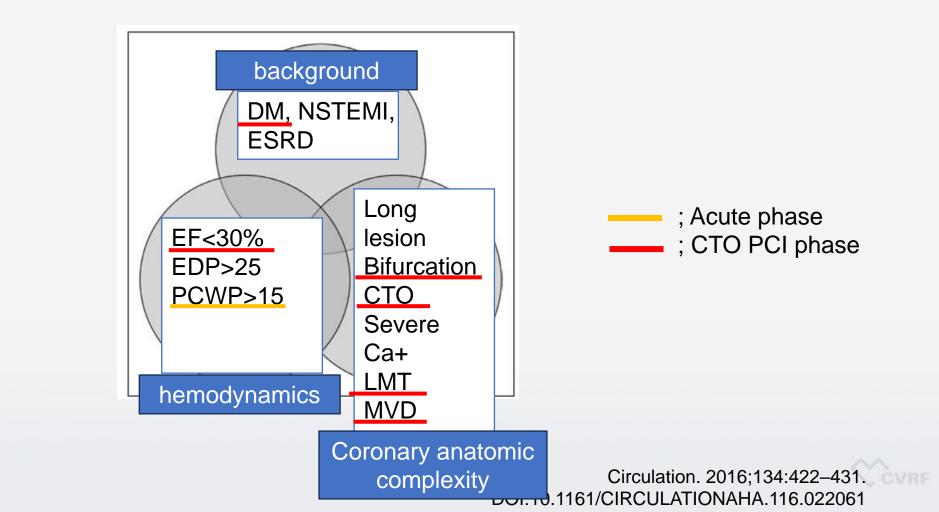
Final angiography



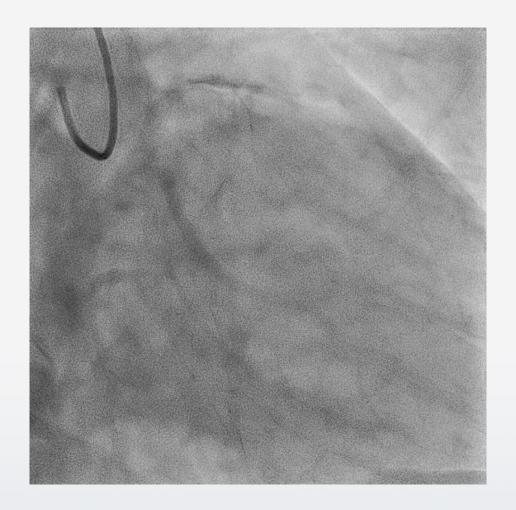




Case3 CHIP population



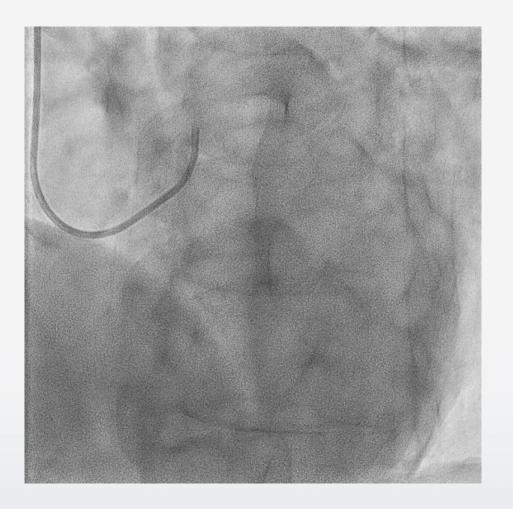
Case3; CHF(HFrEF) low EF, prox LAD CTO, moderate stenosis at LCX







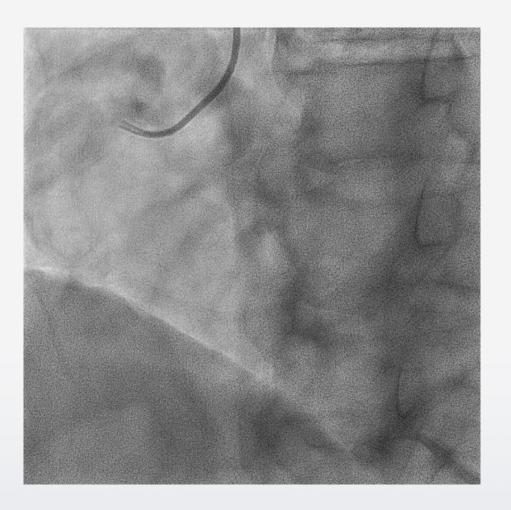
CHF(HFrEF) low EF, prox LAD CTO, moderate stenosis at LCX







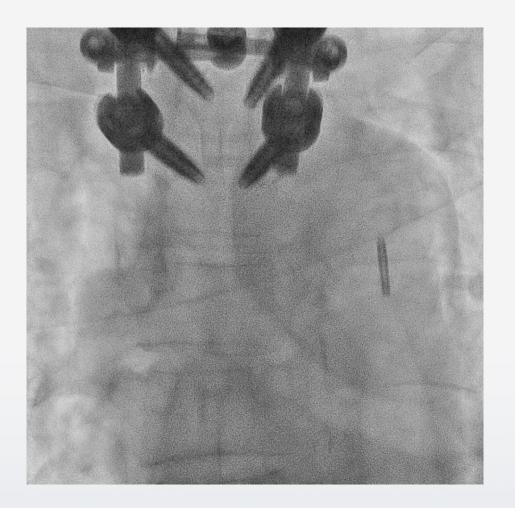
Severe stenosis at mid RCA, provided jeopardized collateral for LAD







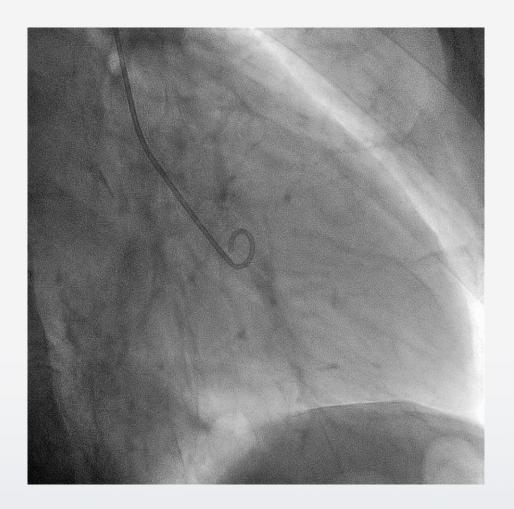
IABP was equiped



TCTAP2024



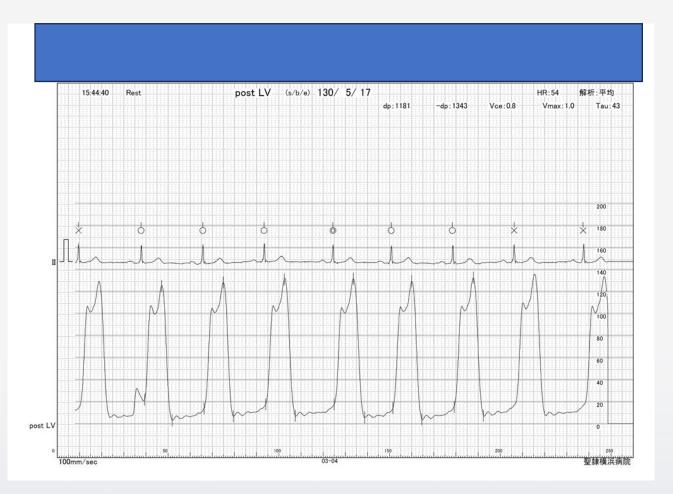
Low LV function







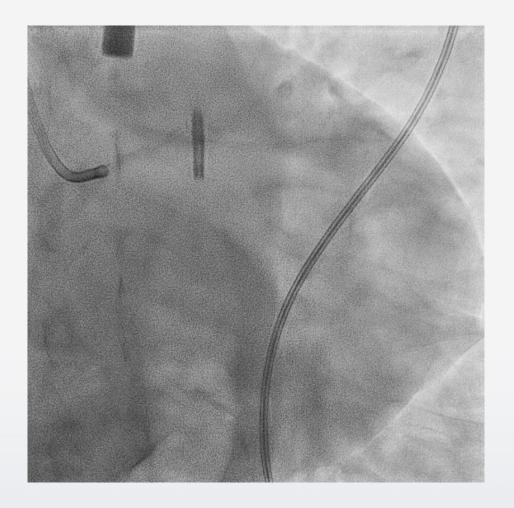
LVEDP 17 with IABP support



TCTAP2024



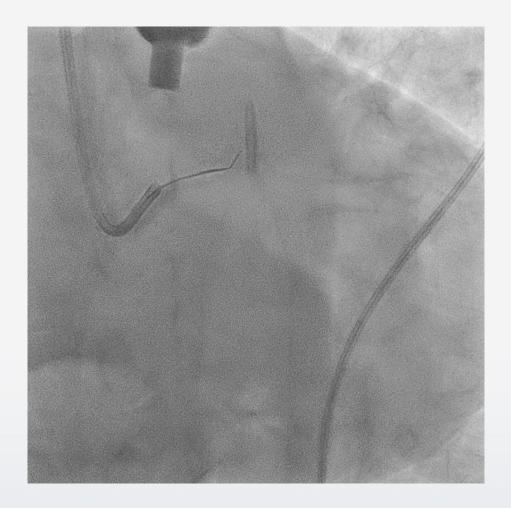
A few days later, CTO PCI was done with IABP supported





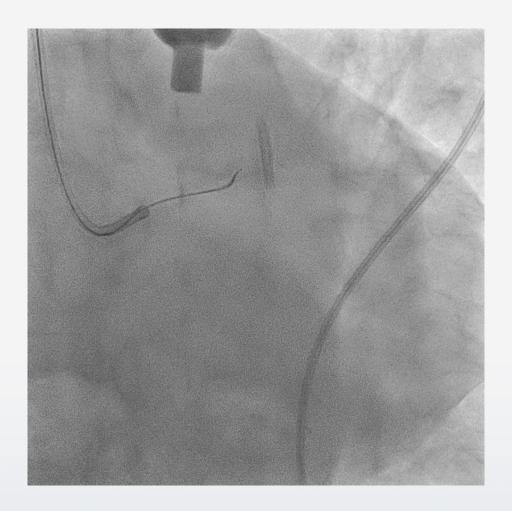


Antegrade wire got the entry point





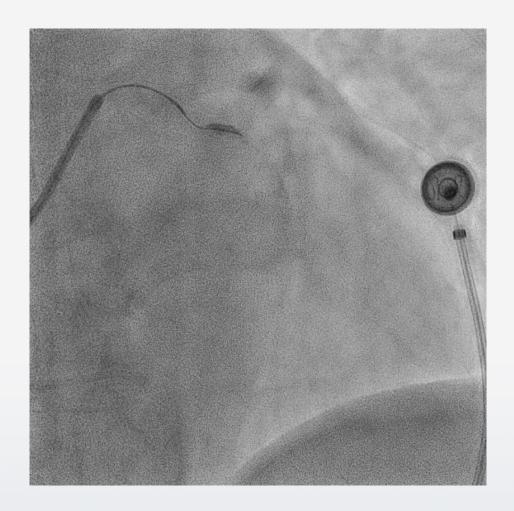








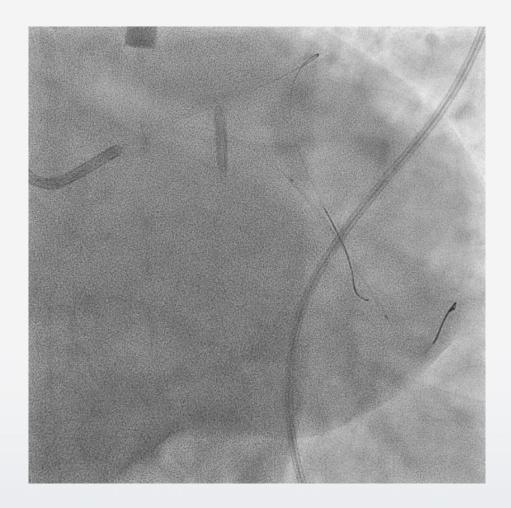
Wire reached at distal end of CTO







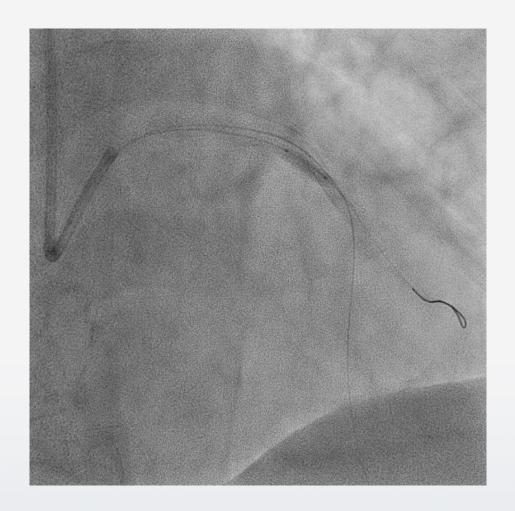
LCX stenting before LMT-LAD treatment







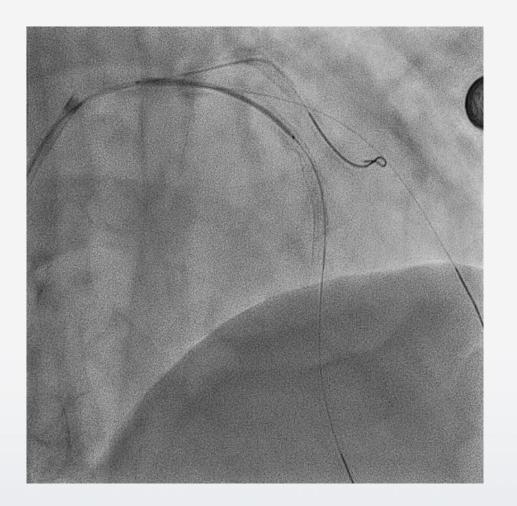
Pre balloon dilation at LAD







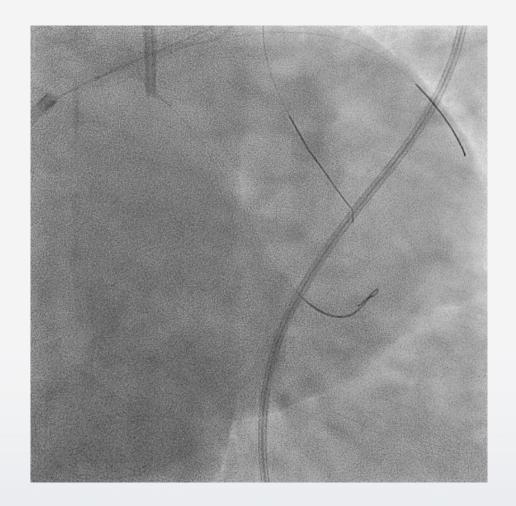
Stenting at LAD







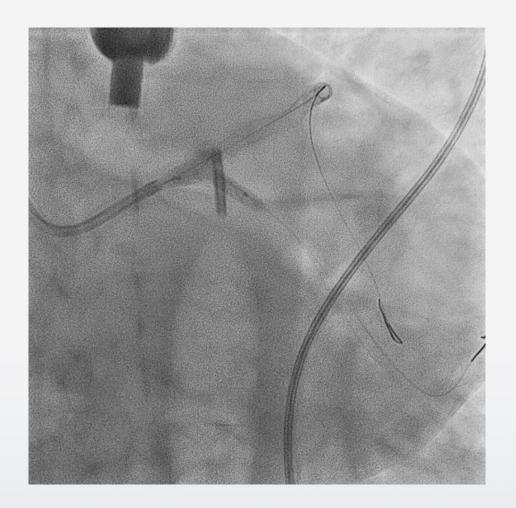
Stenting at LMT-LAD







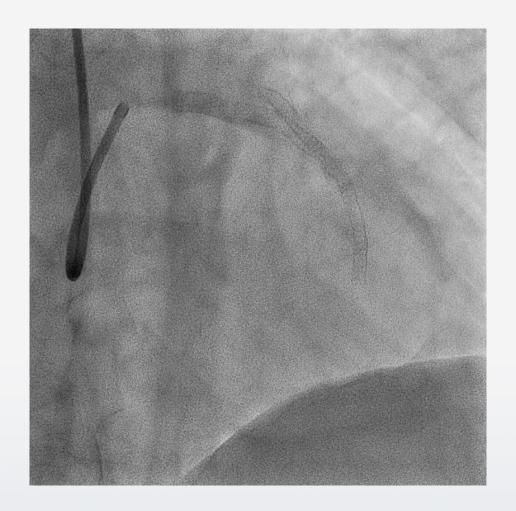
KBI to LMT



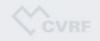




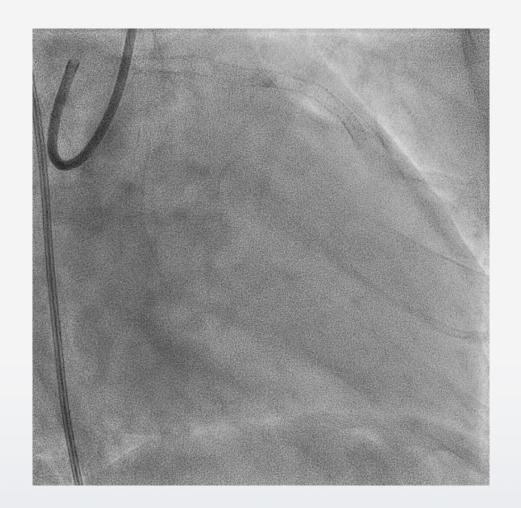
Final angiography







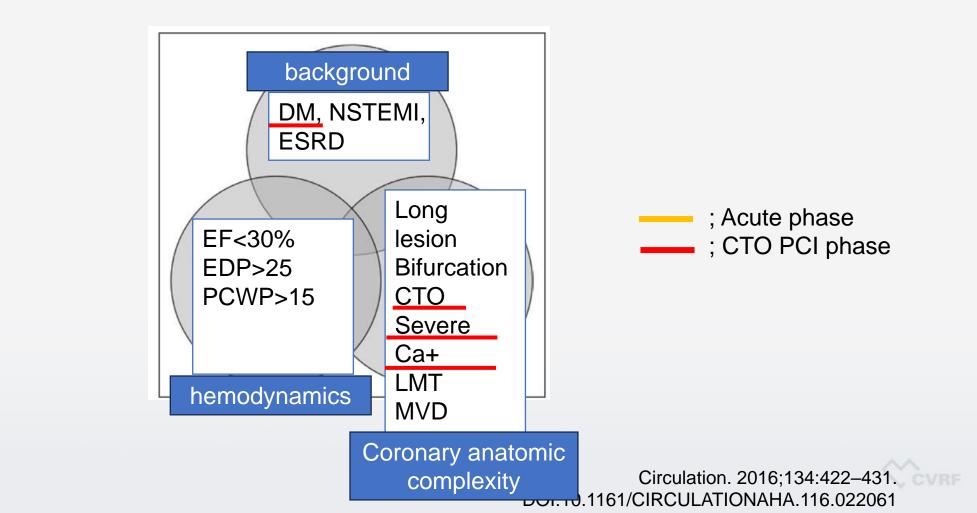
Final angiography



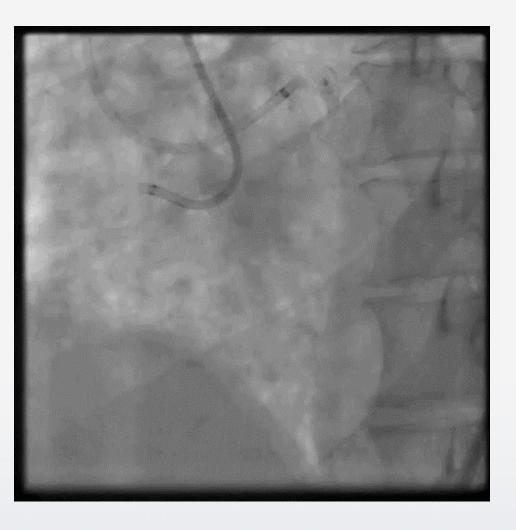




Case4 CHIP population



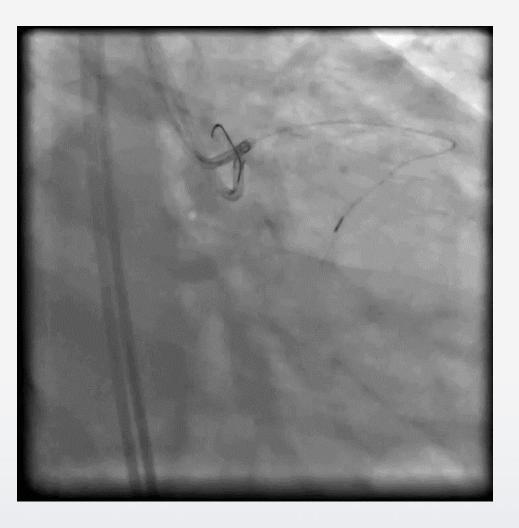
Case4; RCA CTO with severe calcification







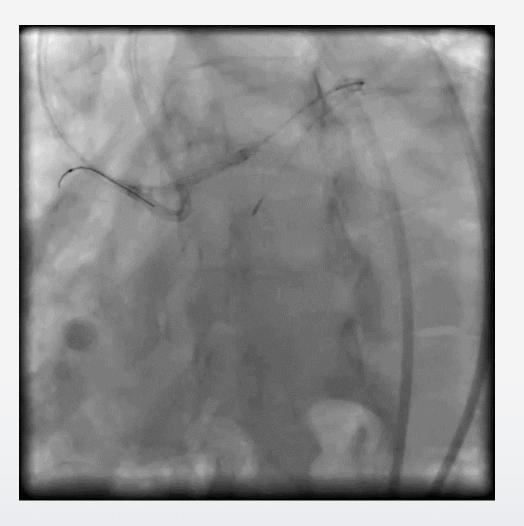
Tip injection from septal branch; relatively misty channel







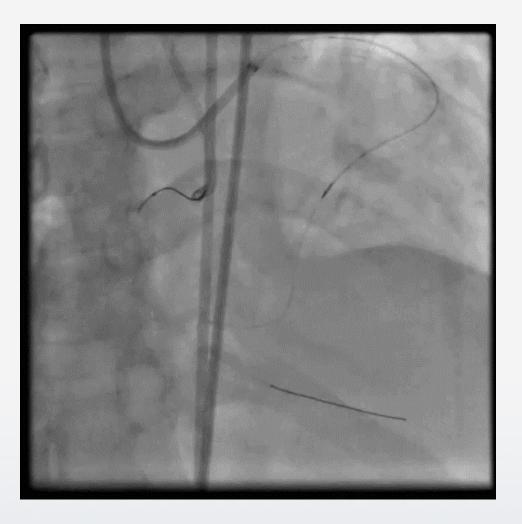
Tip injection 2







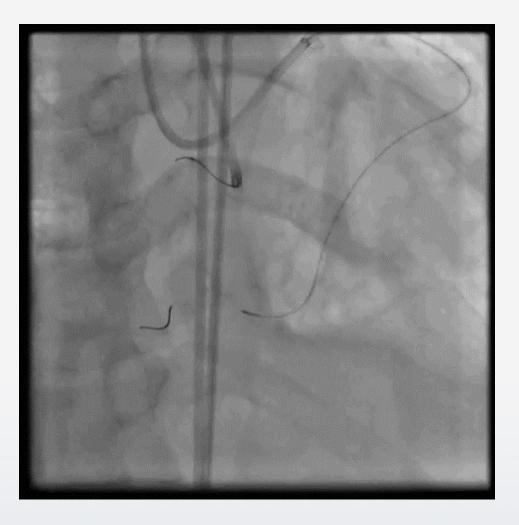
XTR-SUOH03 passed







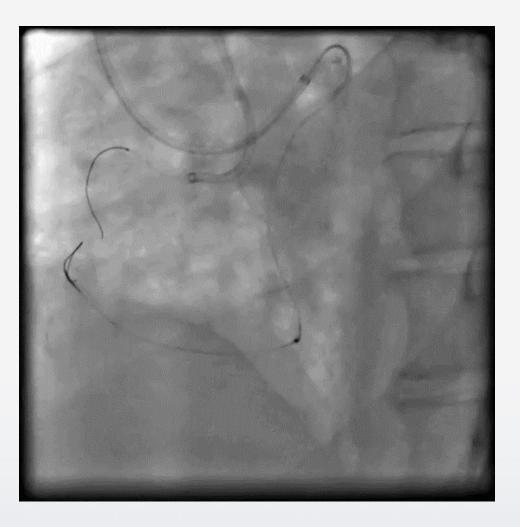
SUOH03 reached to the distal end of CTO







Knuckle wire (Sion black) technique



TCTAP2024



Reverse CART; but, failed







Algorithm for retrograde CTO crossing

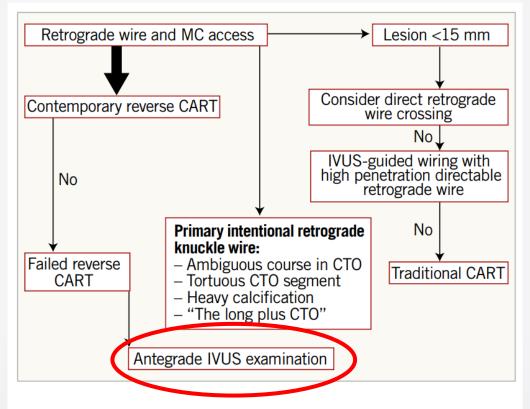
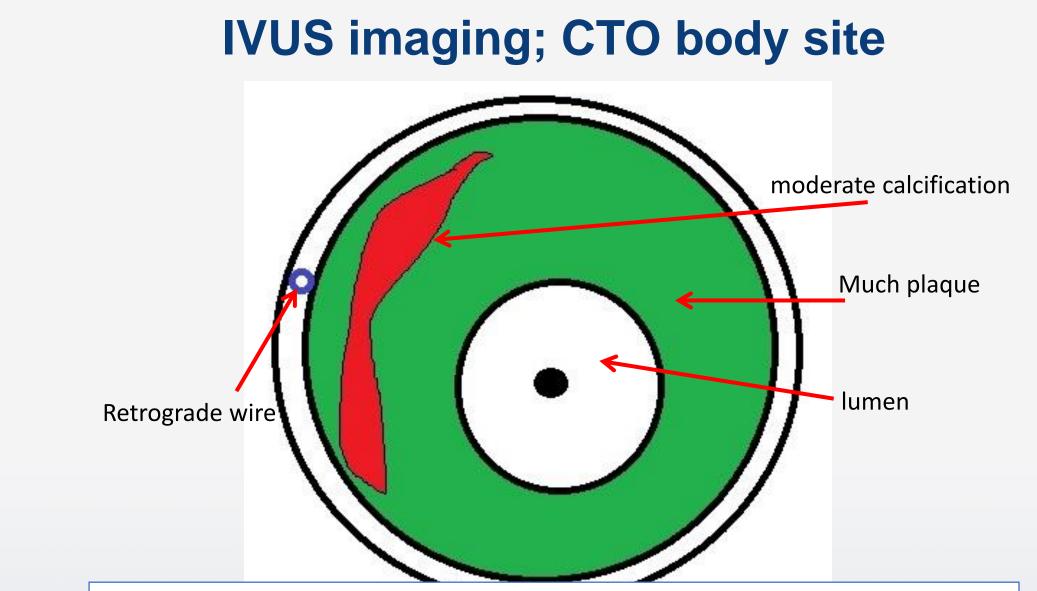


Figure 1. *Asia Pacific Chronic Total Occlusion (APCTO) club algorithm for crossing a CTO lesion via the retrograde approach.*



Wu EB, et al. AsiaIntervention. 2018;4:98-107.

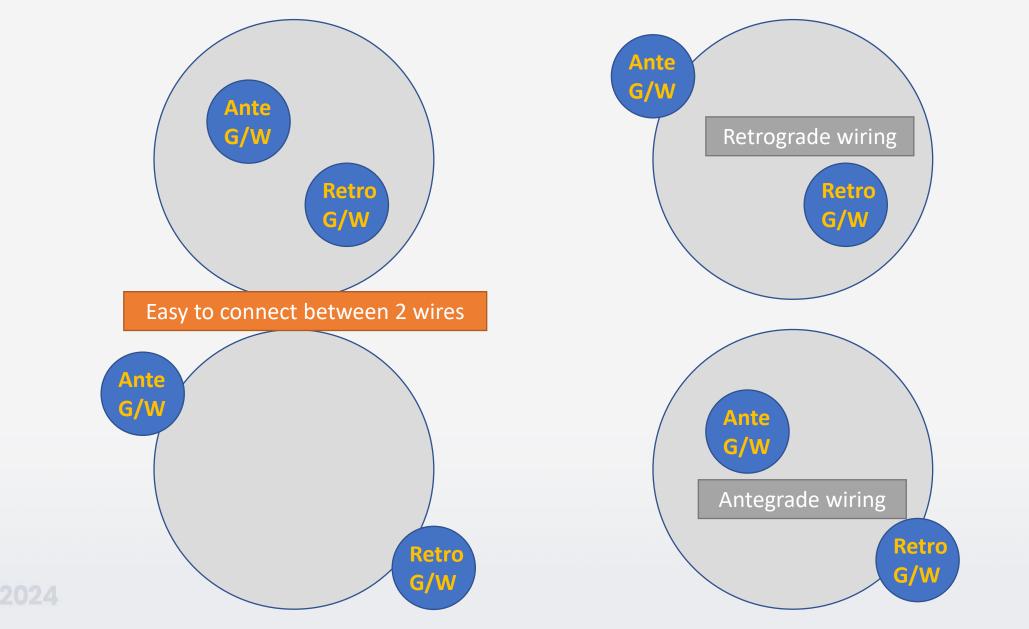


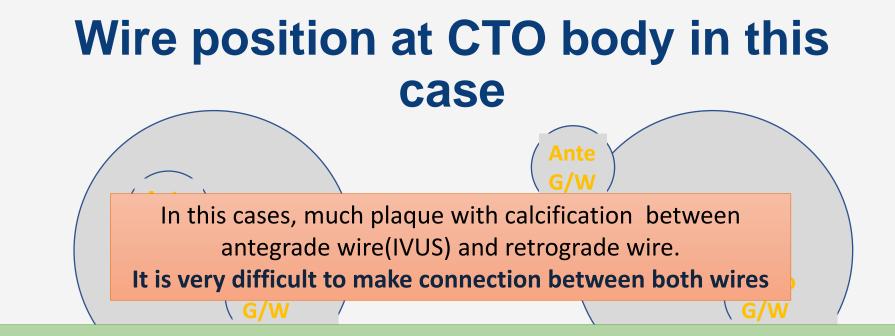


^{23*} TCTAP2024 Much plaque with calcification between antegrade wire(IVUS) and retrograde wire



Wire position at CTO body





Both antegrade wire and retrograde wire could not advance due to severe calcification, so we could not change the suitable point for reverse CART.

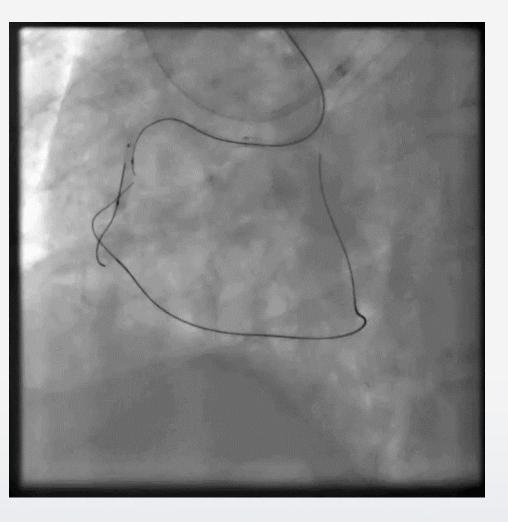


What should we do next?





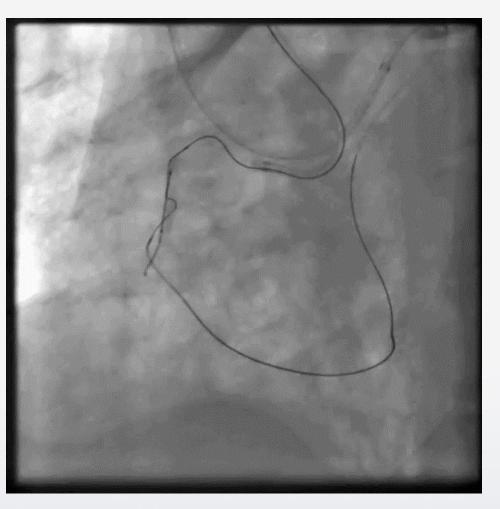
Balloon dilation on the antegrade first wire; intentionally antegrade another G/W goes to subintima







Kissing wire with balloon support

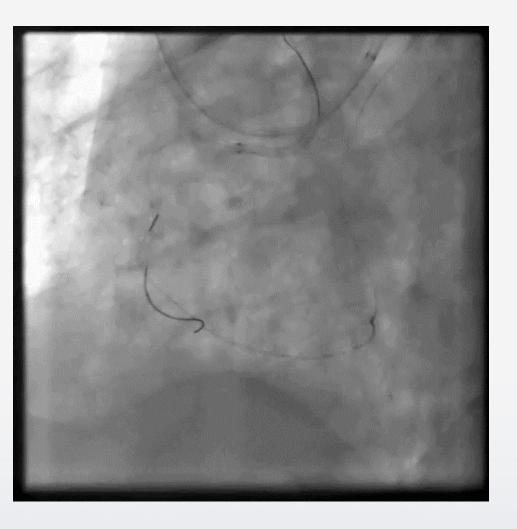




Conquest Pro12g and 8-20g



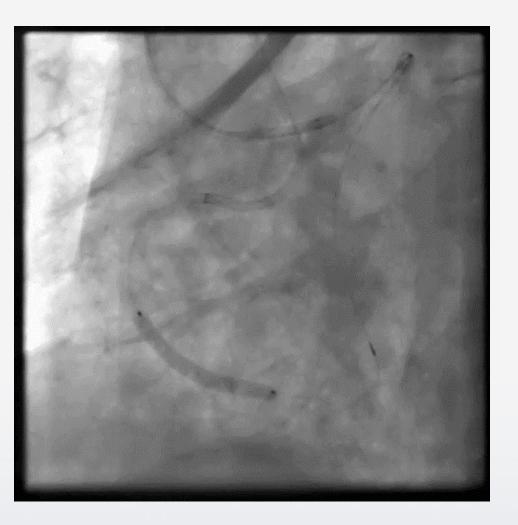
Retrograde wire crossing







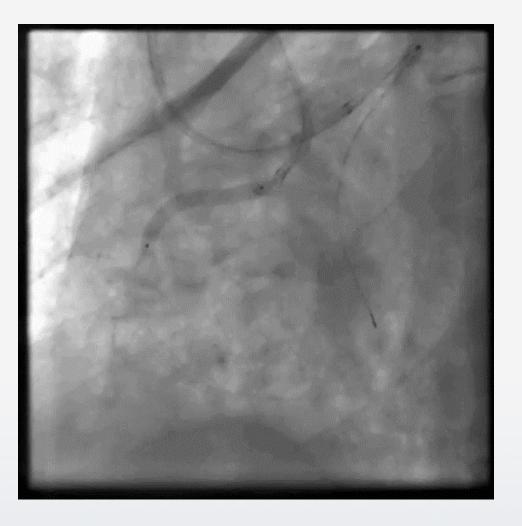
Stenting1







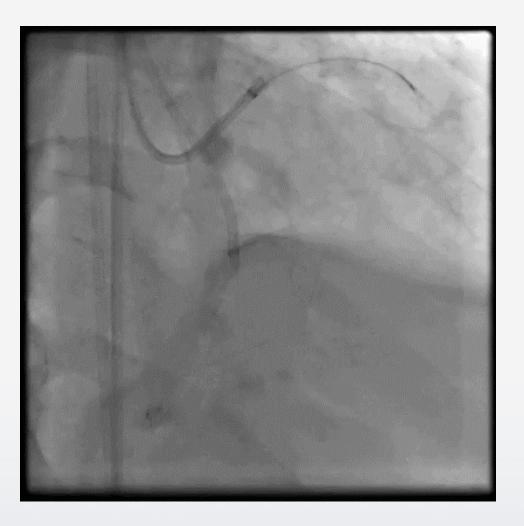
Stenting2







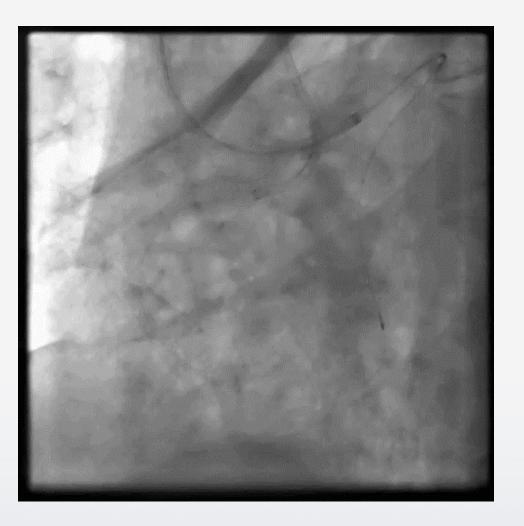
Check the channel damage







Final CAG







Conclusions

- Definition of the CHIP population were 3 patterns.
- CTO is originally one of CHIP, so CTO and other CHIP elements add up to a complex lesion with a high CHIP score.
- MCS should be selected and used as appropriate for advanced CHIP lesions, but Impella, which became available in Japan in 2017, is not approved for use only during PCI procedures.
- Except for cases of shock, in cases of CTO with CHIP, the timing of PCI should be considered by stabilizing hemodynamics as appropriate, and support with IABP using LVEDP and other indicators is realistic.
 Depending on the hemodynamics, it may be necessary to use only an antegrade approach, and it is necessary to become familiar with methods such as TD ADR.

