

# How to treat long CTO

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# Problem of long CTO

- **Unknown vessel course**  
increase risk of perforation, dissection
- **Unknown tissue characteristics**  
distribution of calcium
- **Unknown vessel size**  
small , tapered
- **Unknown branch vessel information**  
RCA distal bifurcation

# How to do for long CTO

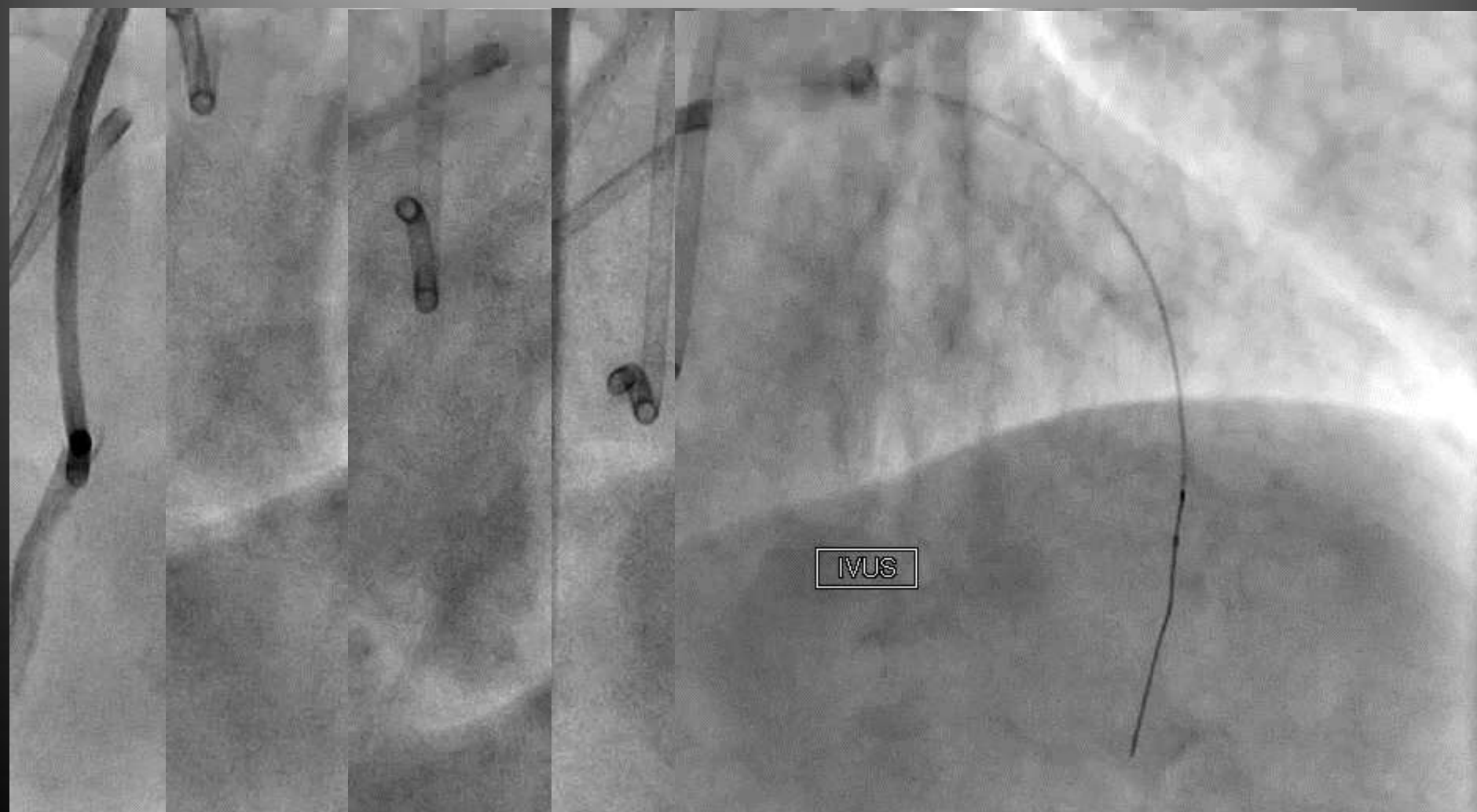
- **Vessel information**  
**MSCT**
- **Antegrade approach**  
**Side branch technique**  
**IVUS guided**
- **Retrograde approach**  
**Knuckle wire+r-CART**  
**Stepped Treatment**

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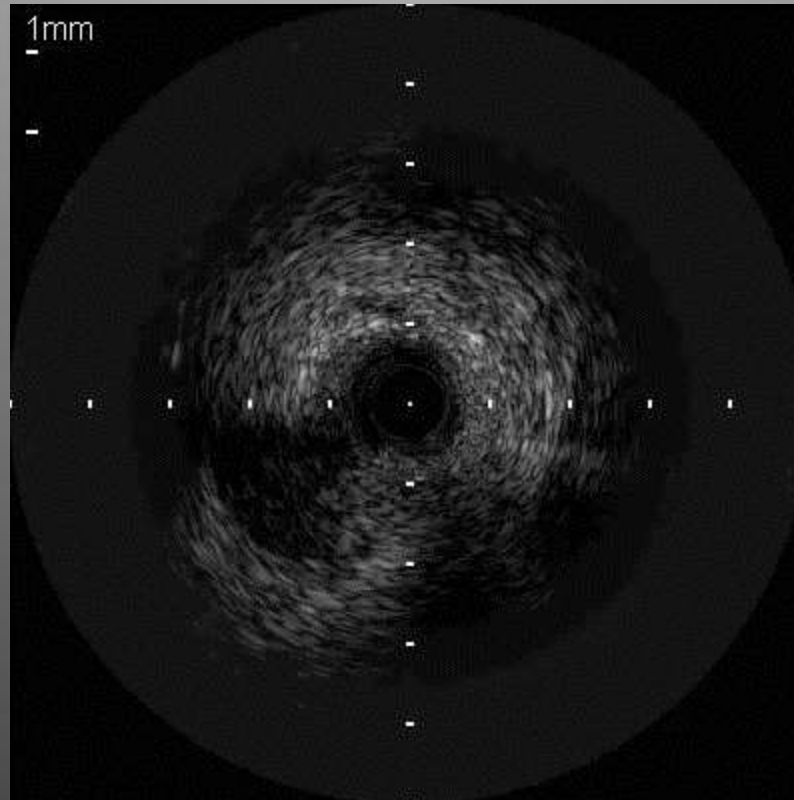
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**Side branch technique**  
**-Antegrade dissection**  
**reentry technique-**

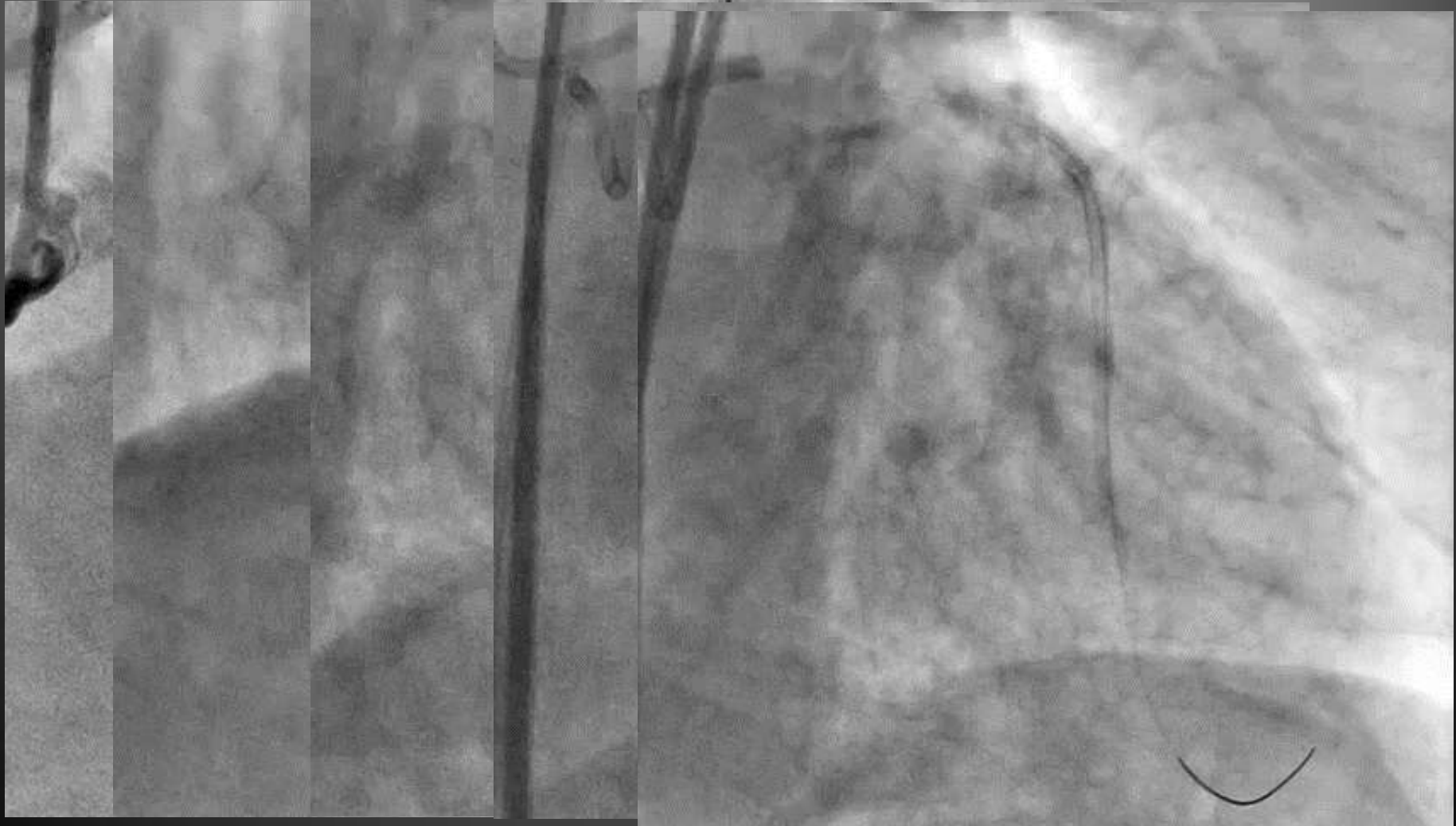
# *Side branch antegrade reentry case*



# *Antegrade reentry case*

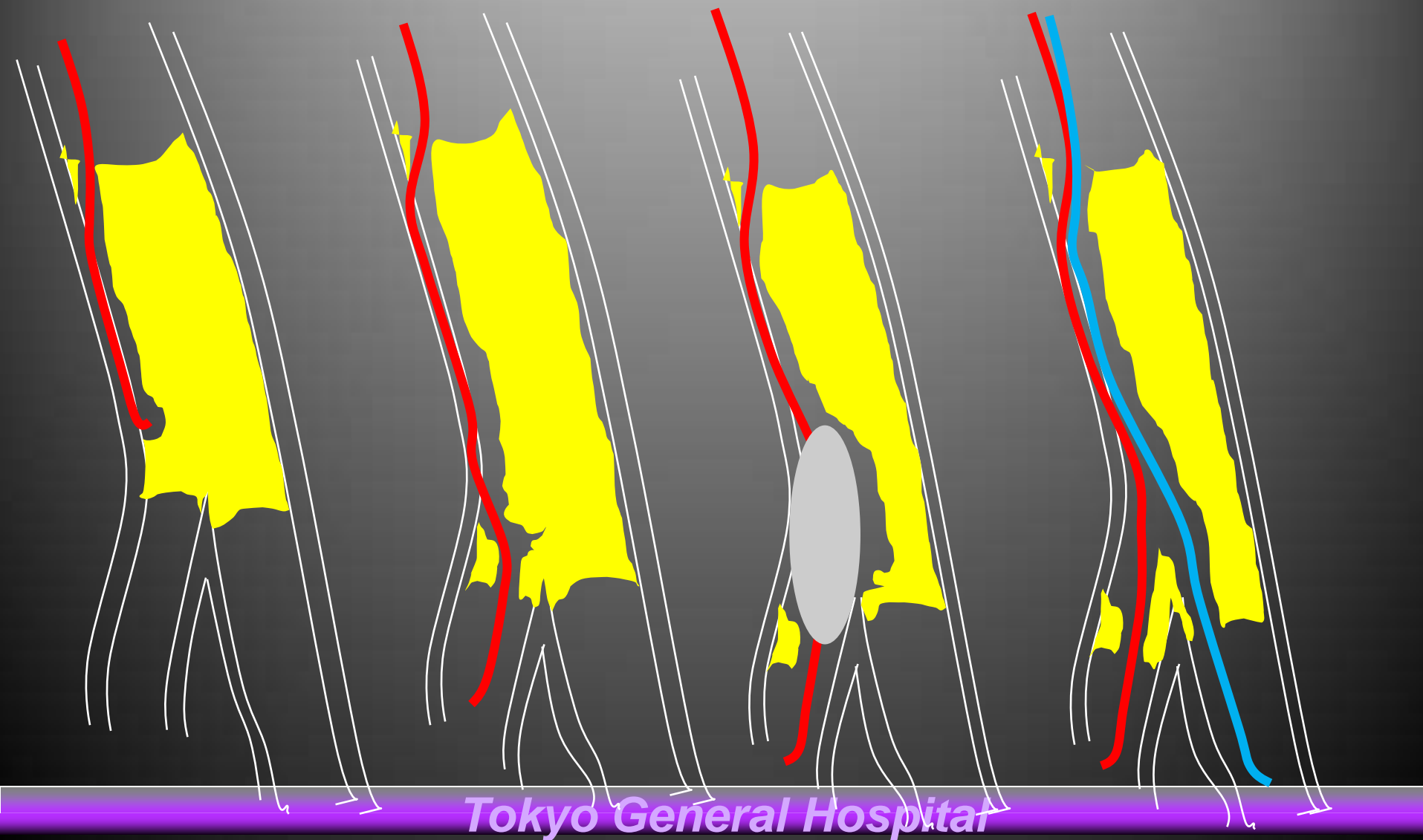


# *Side branch antegrade reentry case*





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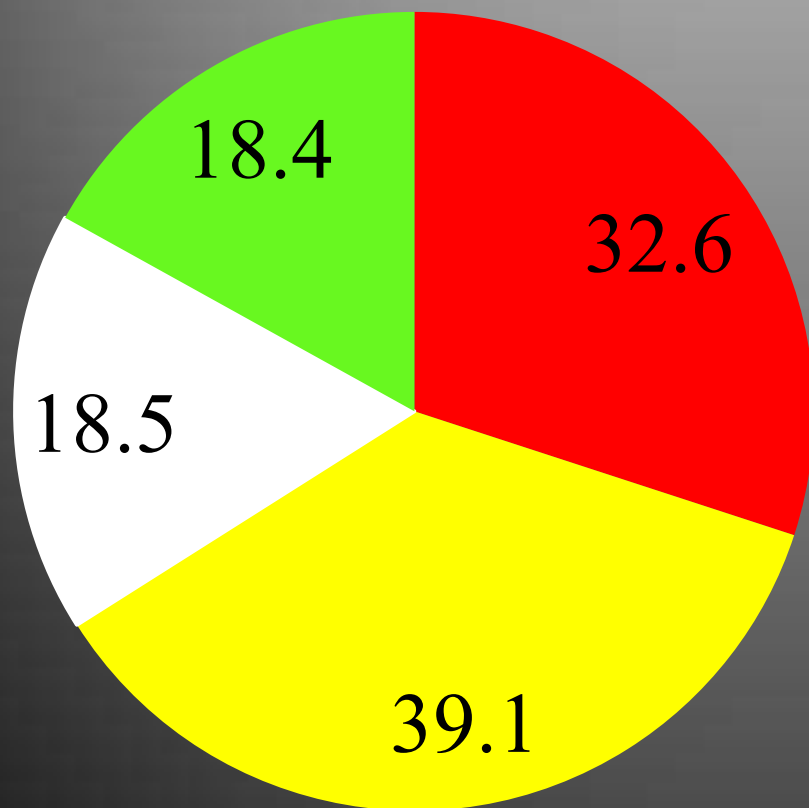


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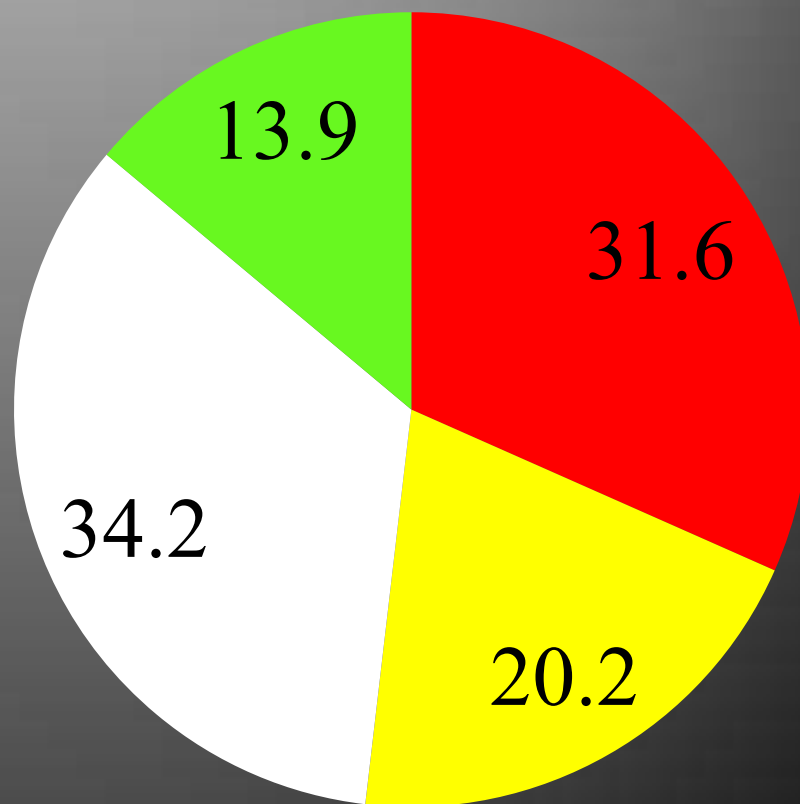
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# Strategies of retro CTO crossing

2014 n=102

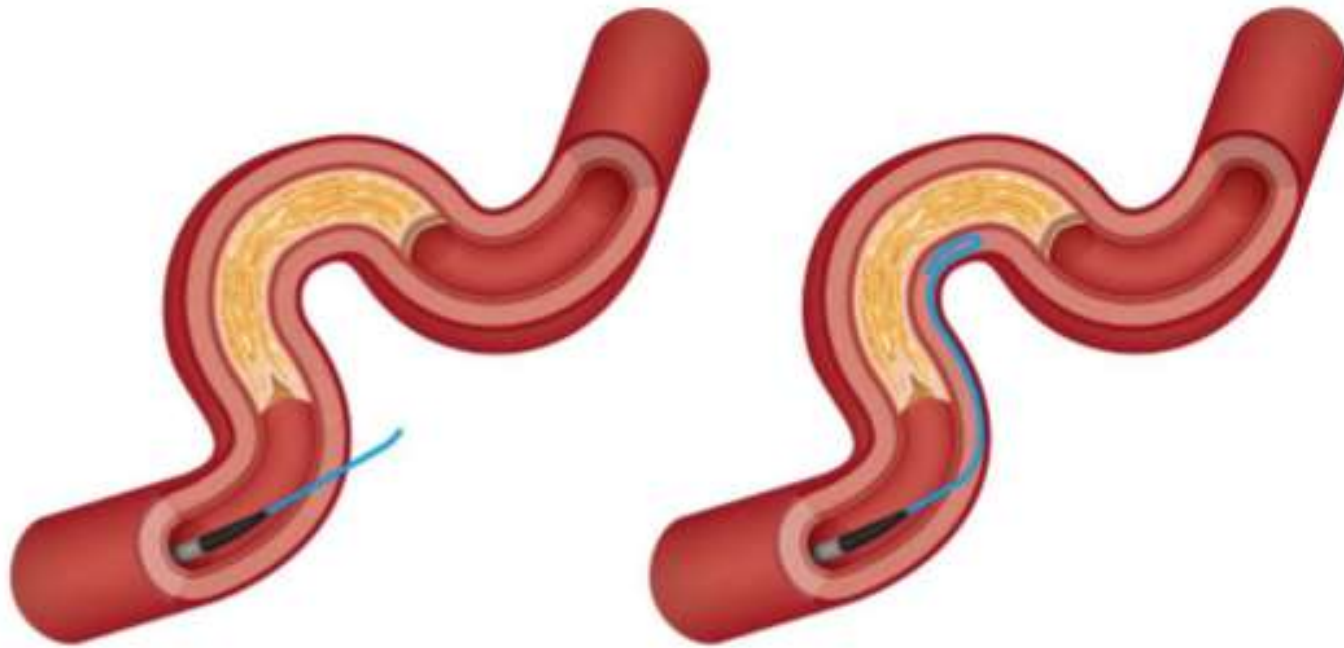


2015 n=85



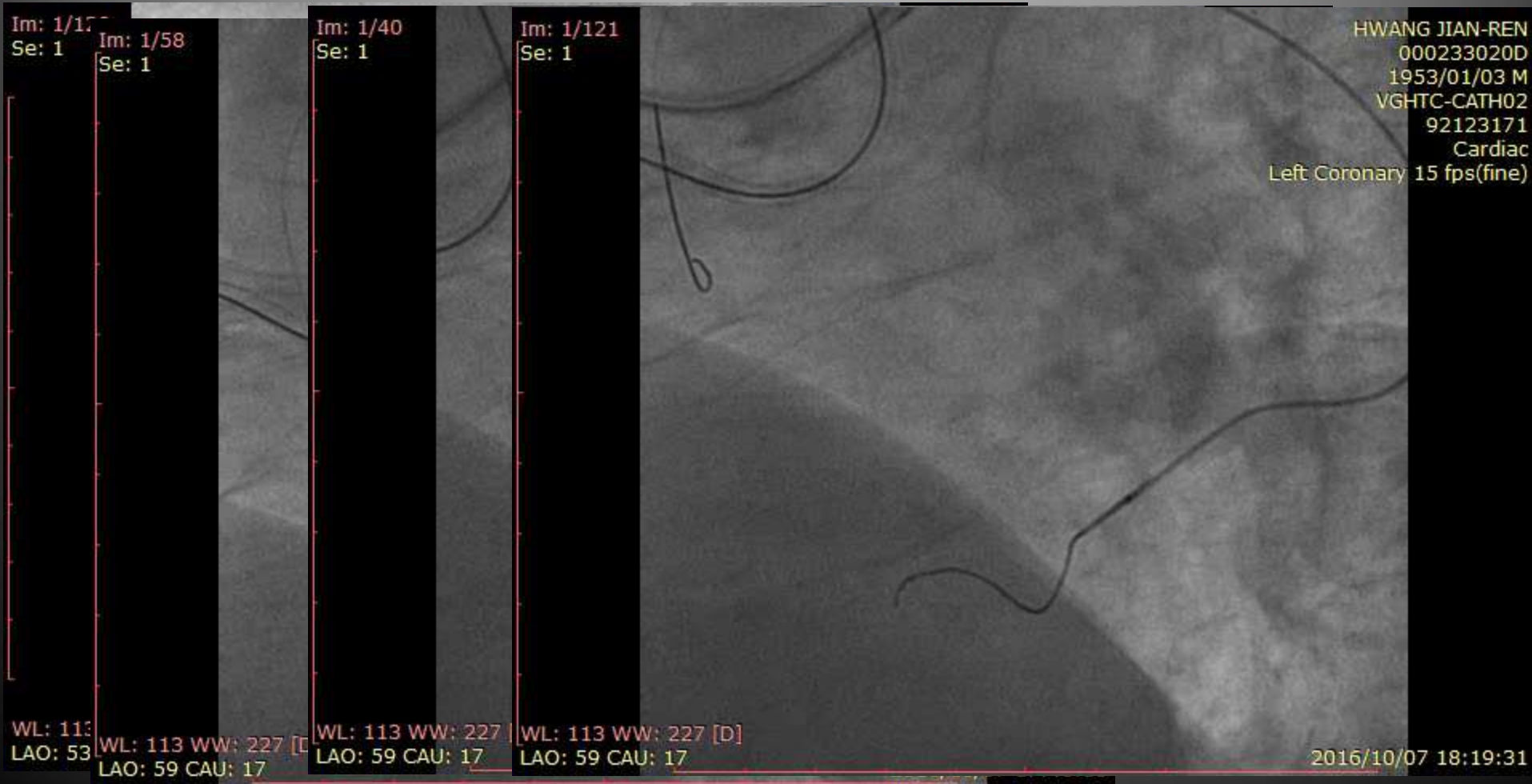
■ Retro GW ■ KWT ■ r-CART ■ Knuckle

## Straight vs. Knuckled wires



Illustrations from 'A Guide to Mastering Retrograde CTO PCI' / [www.ctoibooks.com](http://www.ctoibooks.com)

# *Retrograde long knuckle wire*

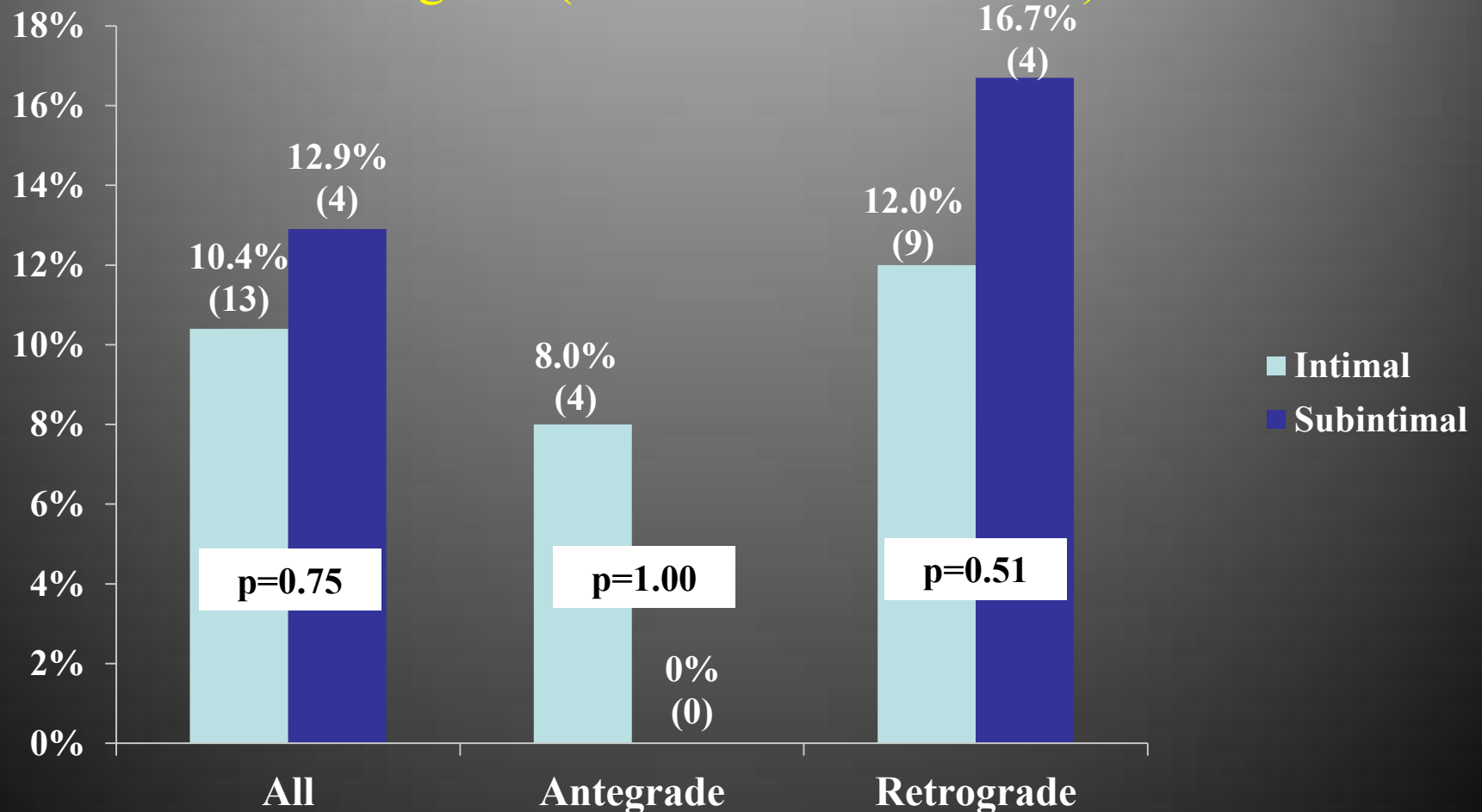


# *Retrograde long knuckle wire*



# TVR at 12 months

Antegrade (Intimal vs. Sub-intimal)  
Retrograde (Intimal vs. Sub-intimal)



## *Key point of Knuckle wiring*

- *Fielder XT or Sion black*
- *Supported by MC*
- *To make complete knuckle shape*
- *Careful to avoid insert to side branch*
- *Combined with ante knuckle wire, r-CART*
- *To find appropriate position which both knuckle wire connect into same sub-space*



# Stepped treatment for very long CTO



# Conclusion

- 1. Problems of long CTO are unknown CTO vessel course and plaque component.**
- 2. MSCT and IVUS may help to understand CTO vessel course.**
- 3. ADR has possibility to reentry from subintimal space in long CTO.**
- 4. Retrograde knuckle wire technique plus r-CART is strongest technique to overcome for long CTO.**