

Assessment of microvascular dysfunction by bolus thermodilution



Madrid Microcirculation
Meeting - 4th Edition -

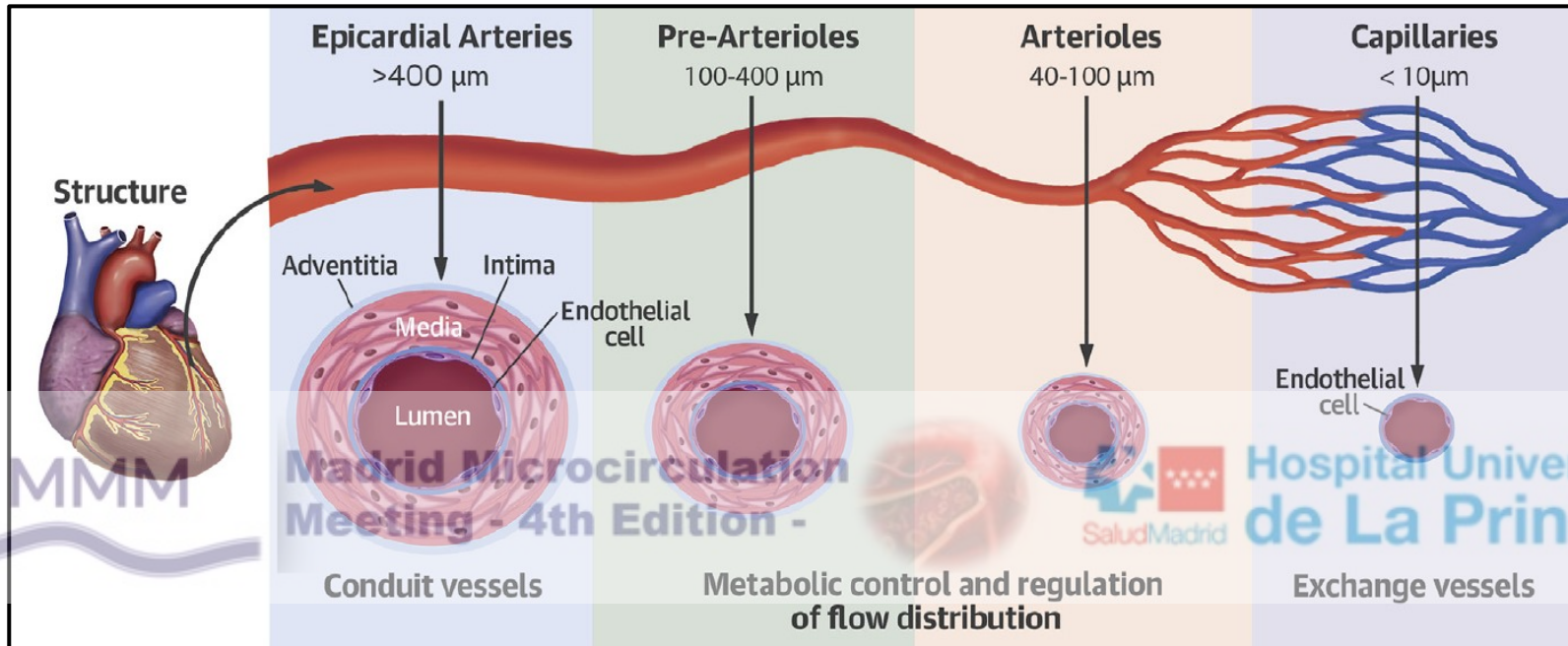


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29-30 de Noviembre 2023

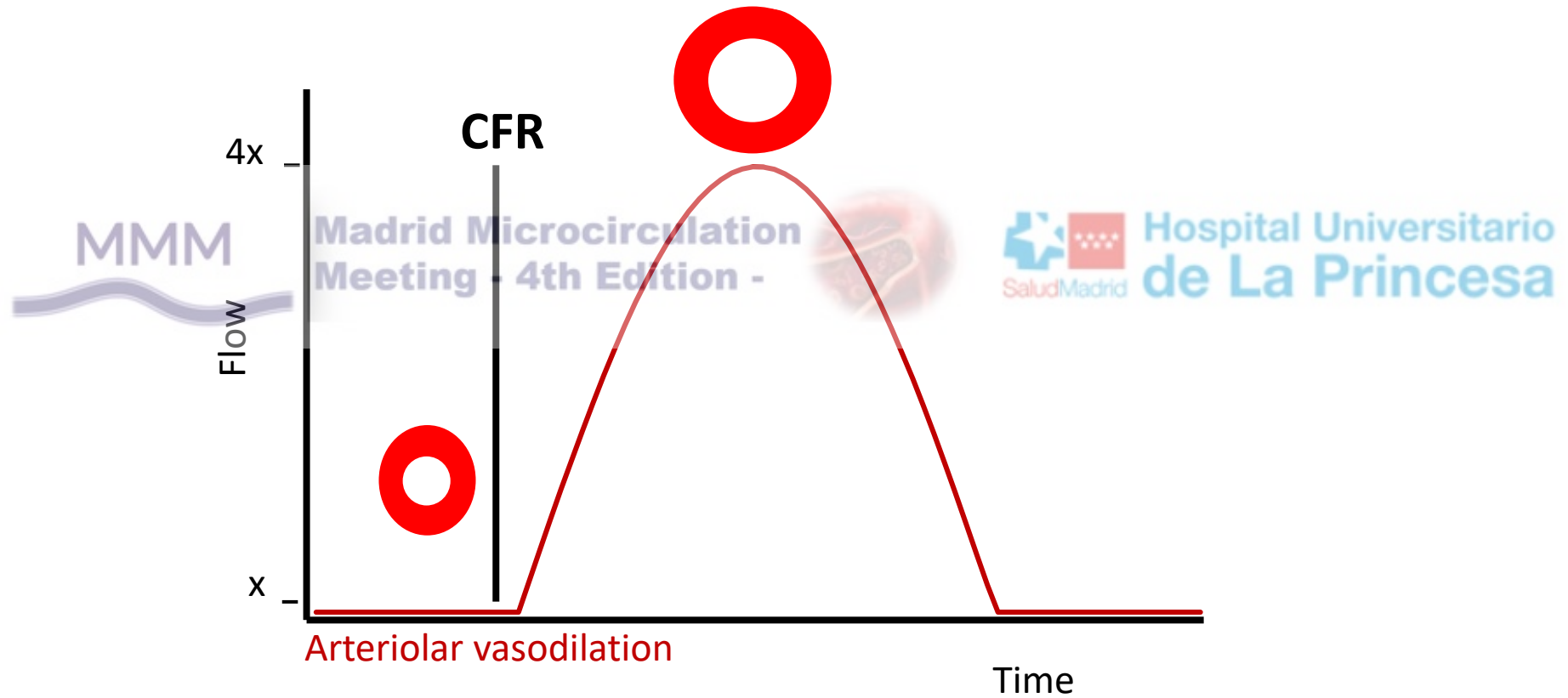


FFR-IFR

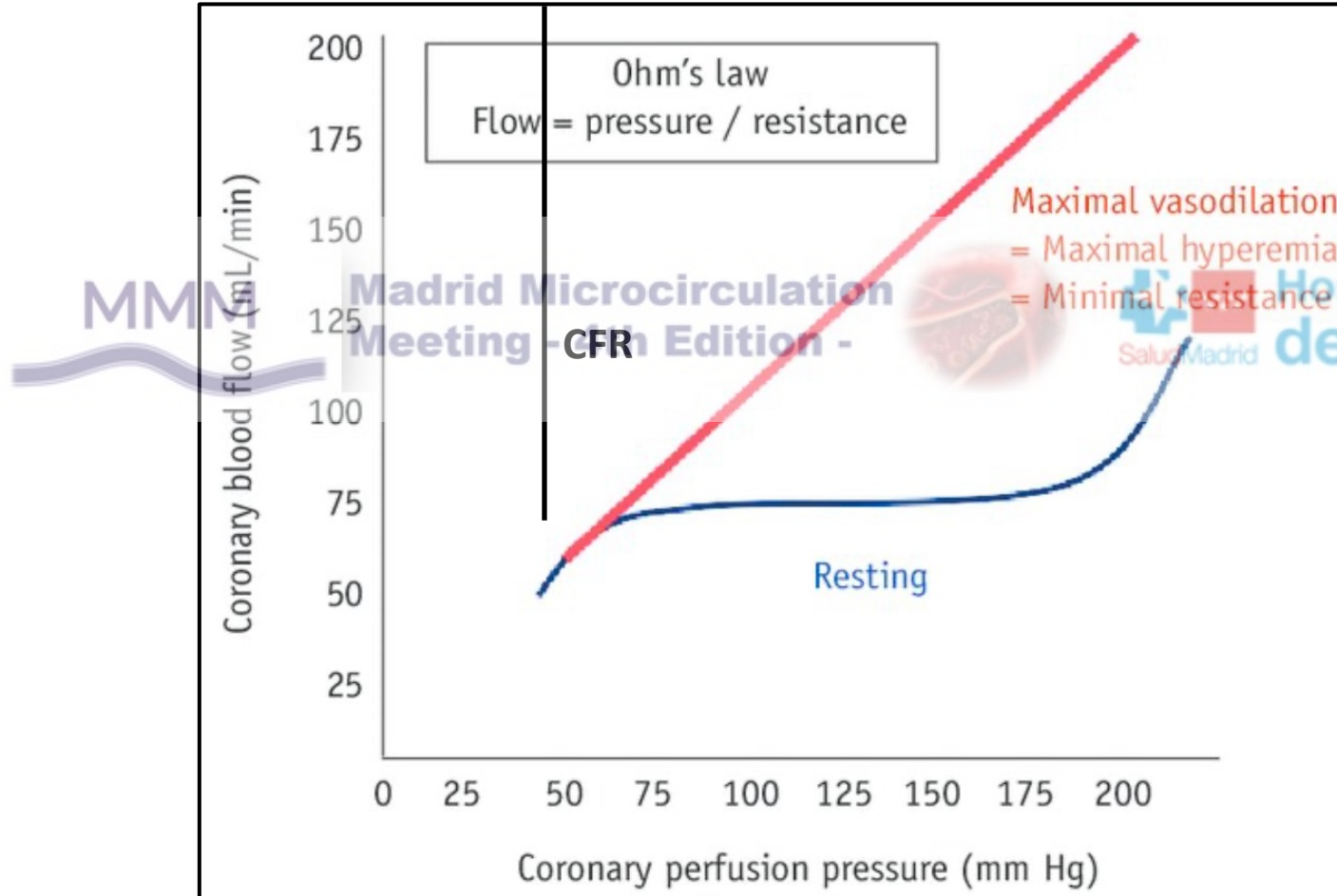
CFR

IMR, HMR

Coronary Flow Reserve



Coronary Flow Reserve



$$CFR = \frac{\text{Hyperemic Flow}}{\text{Resting Flow}}$$

- Coronary thermodilution



Invasive Assessment
CFR/IMR

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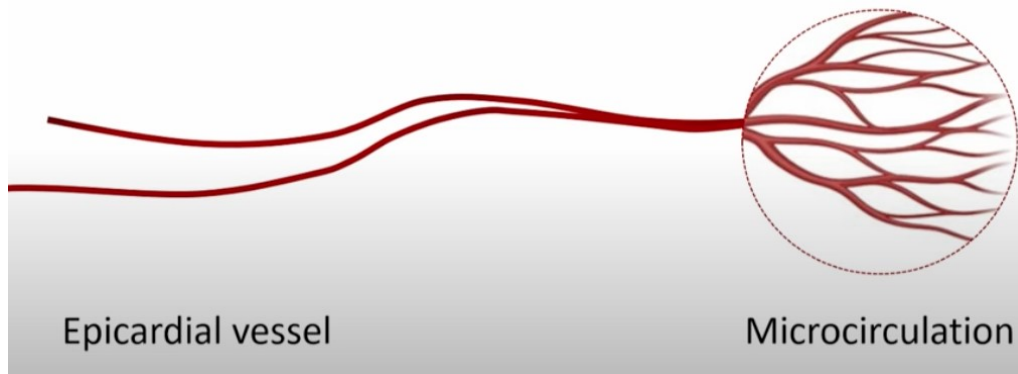
- Coronary Doppler



Thermodilution theory

$$\text{Flow} = \cancel{\text{Volume}} / \text{Mean Transit Time}$$

$$\text{CFR} = \frac{\text{Hyperemic Flow (1/Mean Transit Time)}}{\text{Resting Flow (1/Mean Transit Time)}} = \frac{\text{Mean Transit Time}}{\text{Mean Transit Time}} = \text{CFR}$$



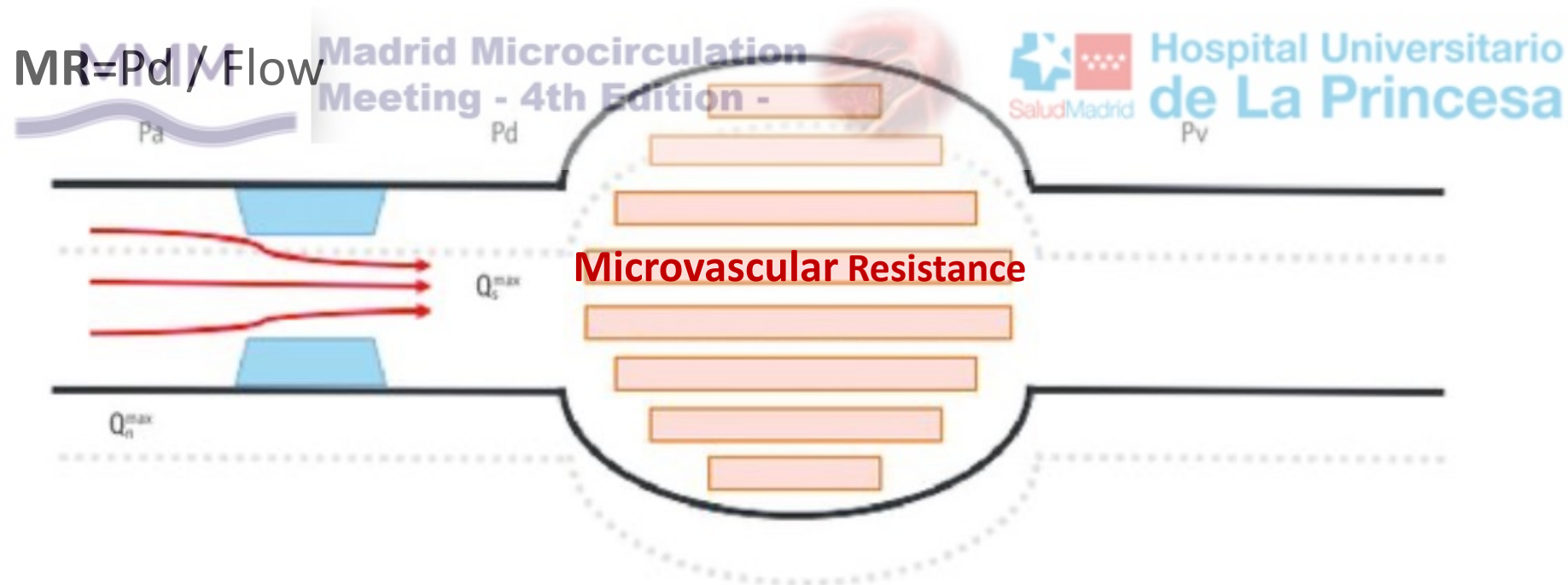
Microvascular Resistance

Ohm's law: $R = \text{Pressure} / \text{Flow}$

$MR = Pd - Pv / \text{Flow}$; $Pd \uparrow \uparrow \uparrow \approx Pv$

Thermodilution:

$IMR = Pd \times Tmn_{\text{Hyperemia}}$



Normal Values

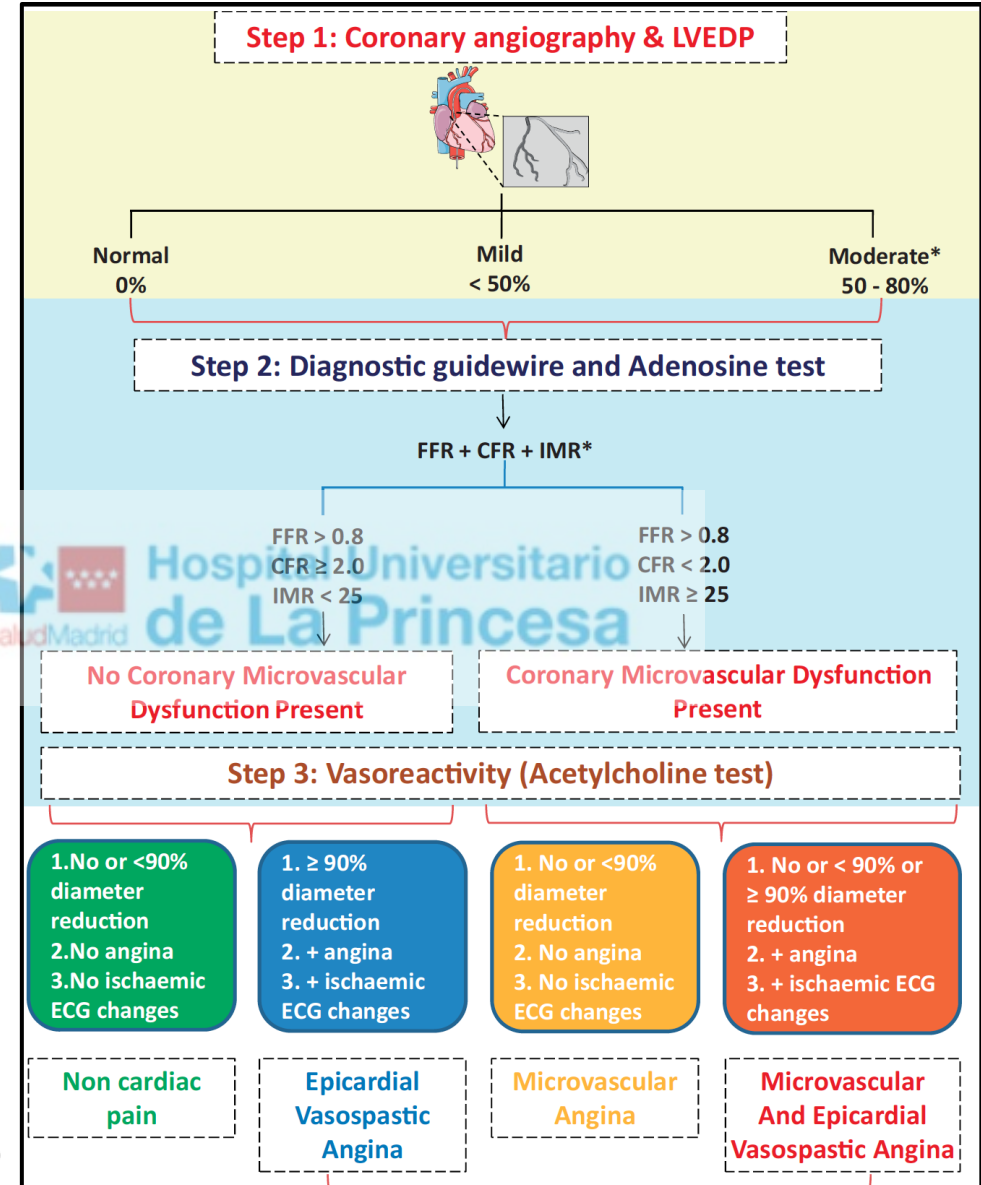
$CFR_{thermo} \geq 2$

$CFR_{Doppler} \geq 2,5$

and/or $IMR: < 25$

MVD

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Lee et al, J Am Coll Cardiol 2016;67:1158-69
Rahman et al. Circ Cardiovasc Interv 2020;13: e009019

Kunadian V, et al.Eur Heart J 2020; 41: 3504–3520

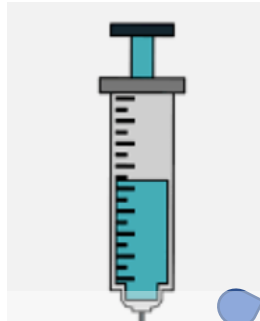
What is needed?



Hyperaemic agent

- IV Adenosine 140mcg/Kg/min.
- IC Papaverine 8-12 mg in RCA and 12-16 mg in the left coronary artery.
- IV Bolus Regadenoson 400 µg.

3cc Saline



T^a proximal



T^a distal

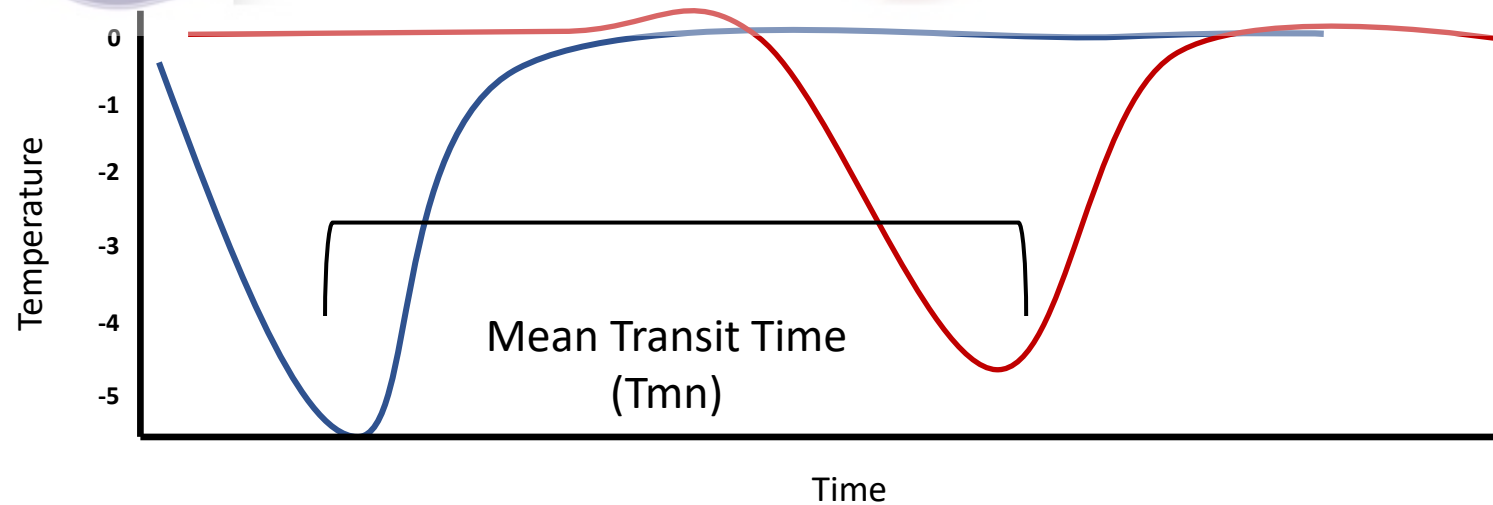


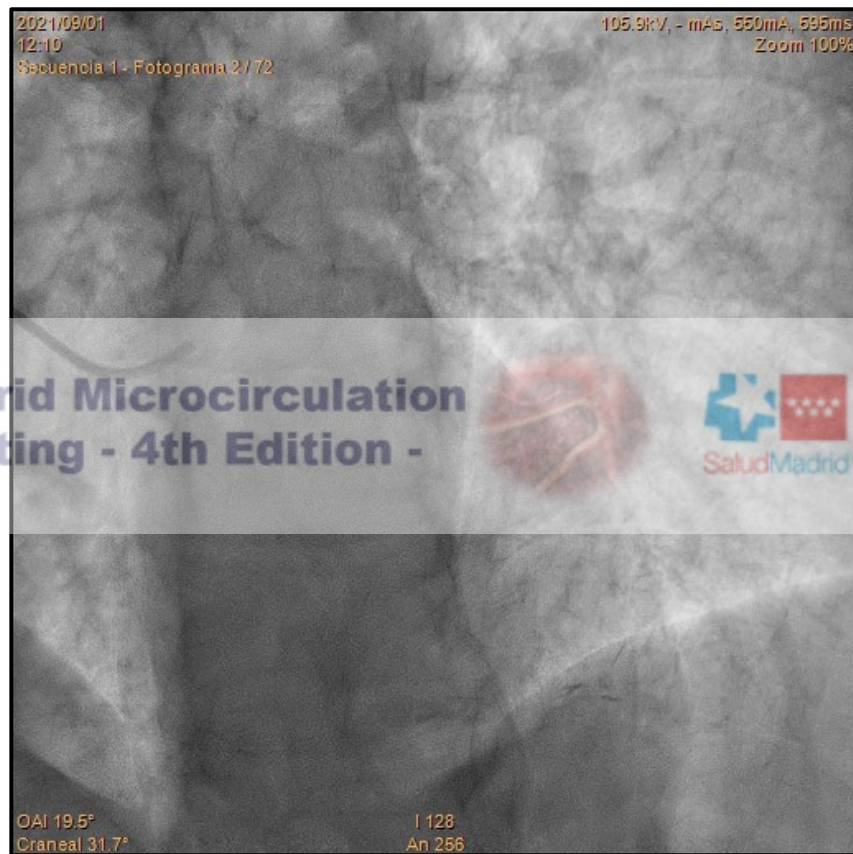
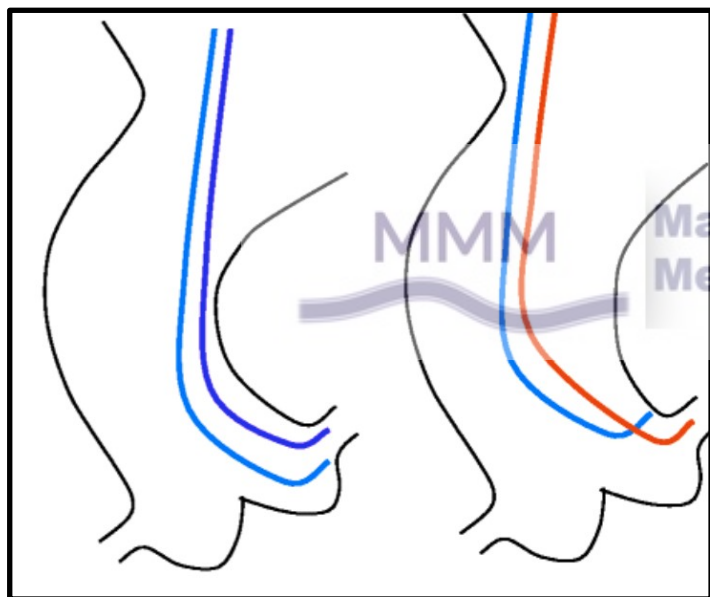
MMI

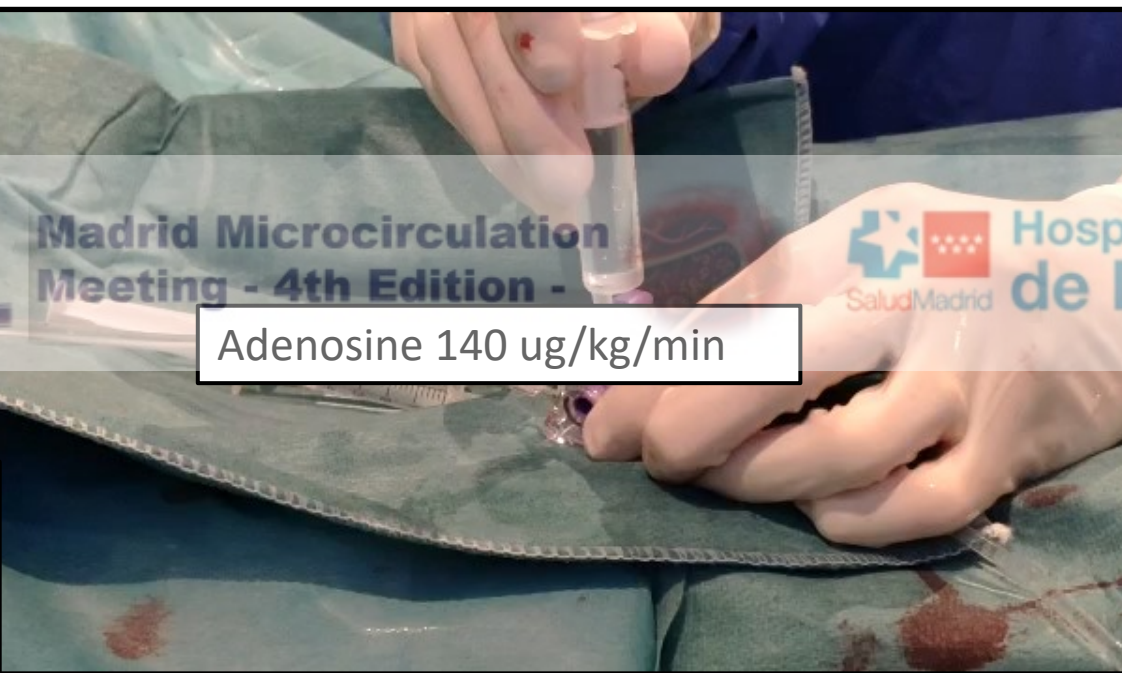
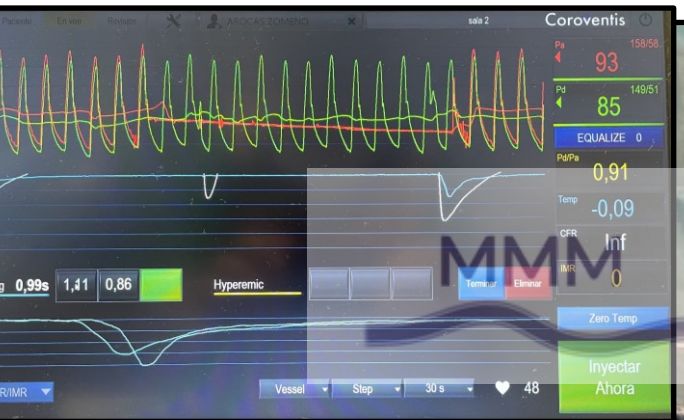
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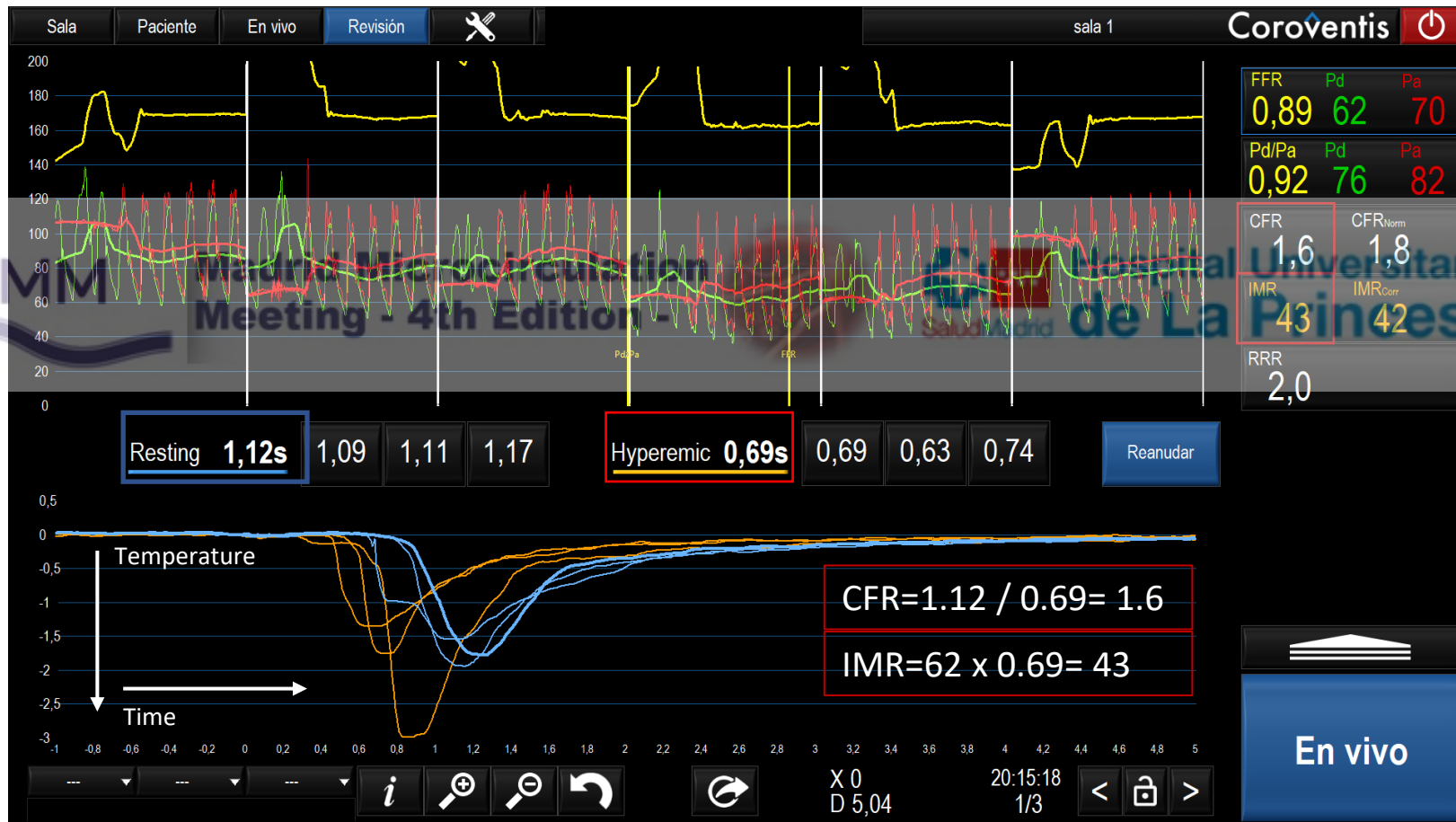






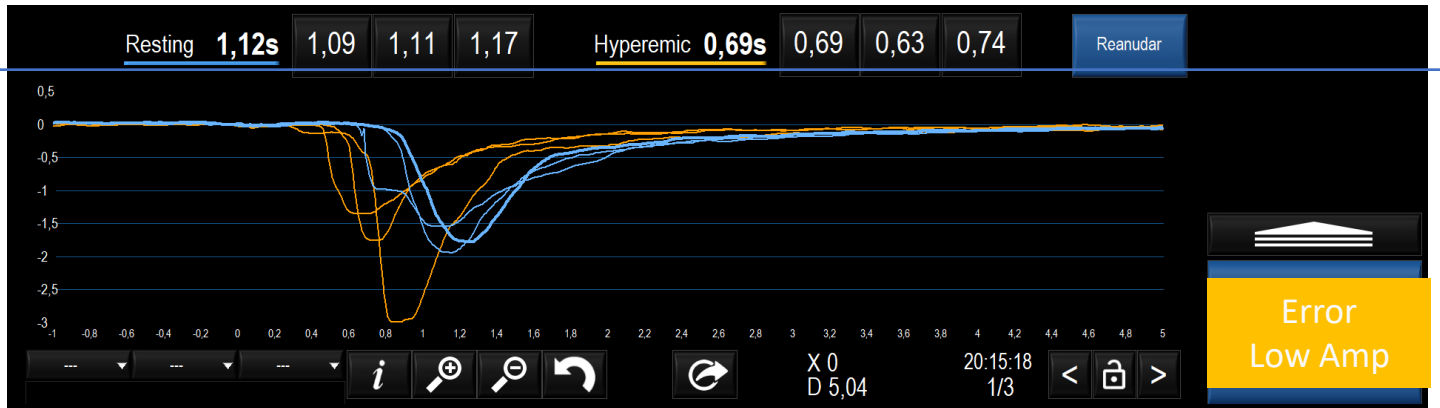
$$\text{CFR} = \frac{\text{Mean Transit Time}}{\text{Mean Transit Time}}$$

$$\text{IMR} = \text{Distal Pressure} \times \text{Mean Transit Time}$$



Temperature did not reach the lower limit (-1°).

- Flush the guidewire with saline solution
- Increase bolus or use colder solution



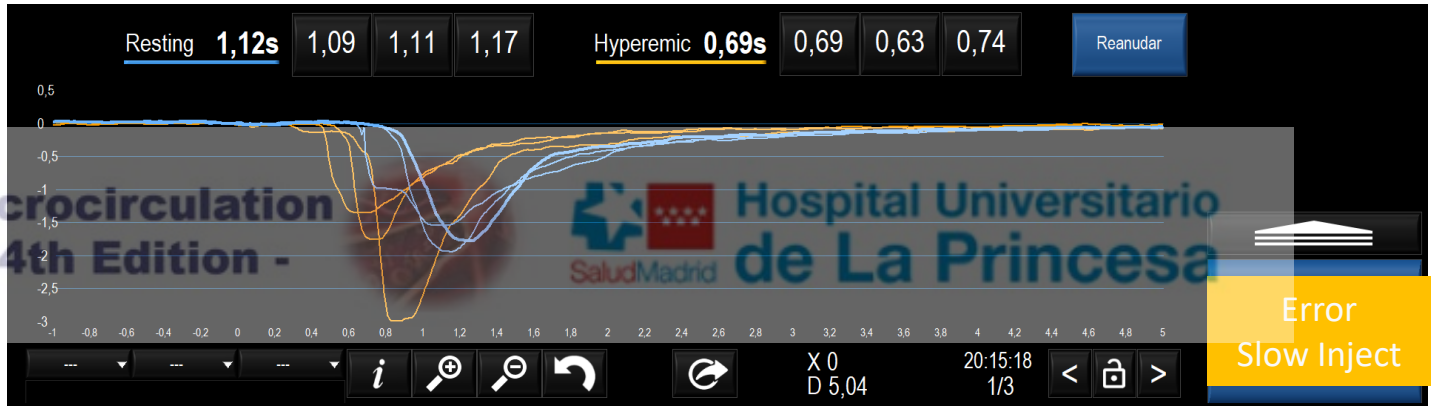
Too slow injection (>0.6s)

- Use a small syringe (3-5cc) and bolus injection of 3cc max.
- Inject faster.



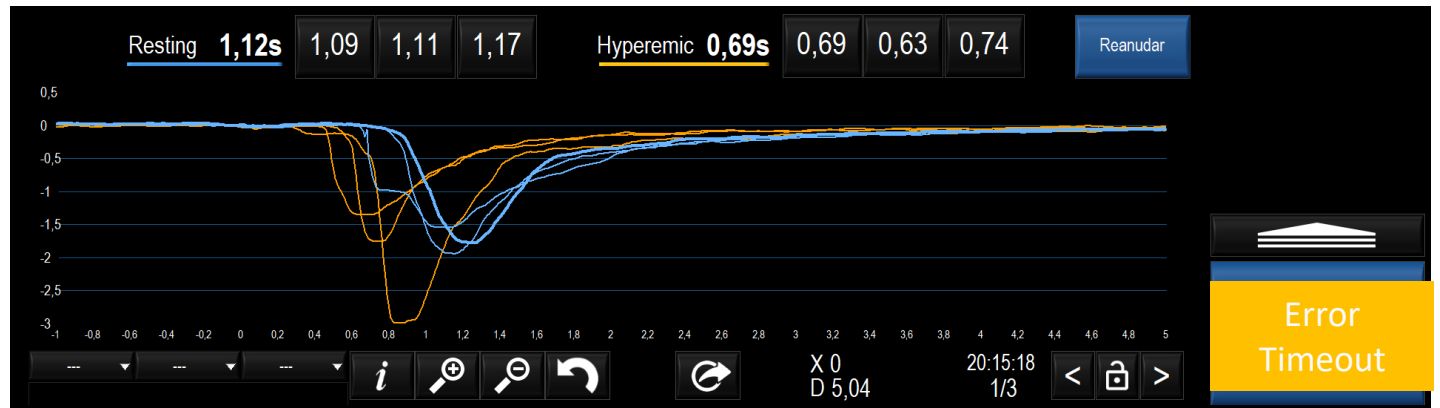
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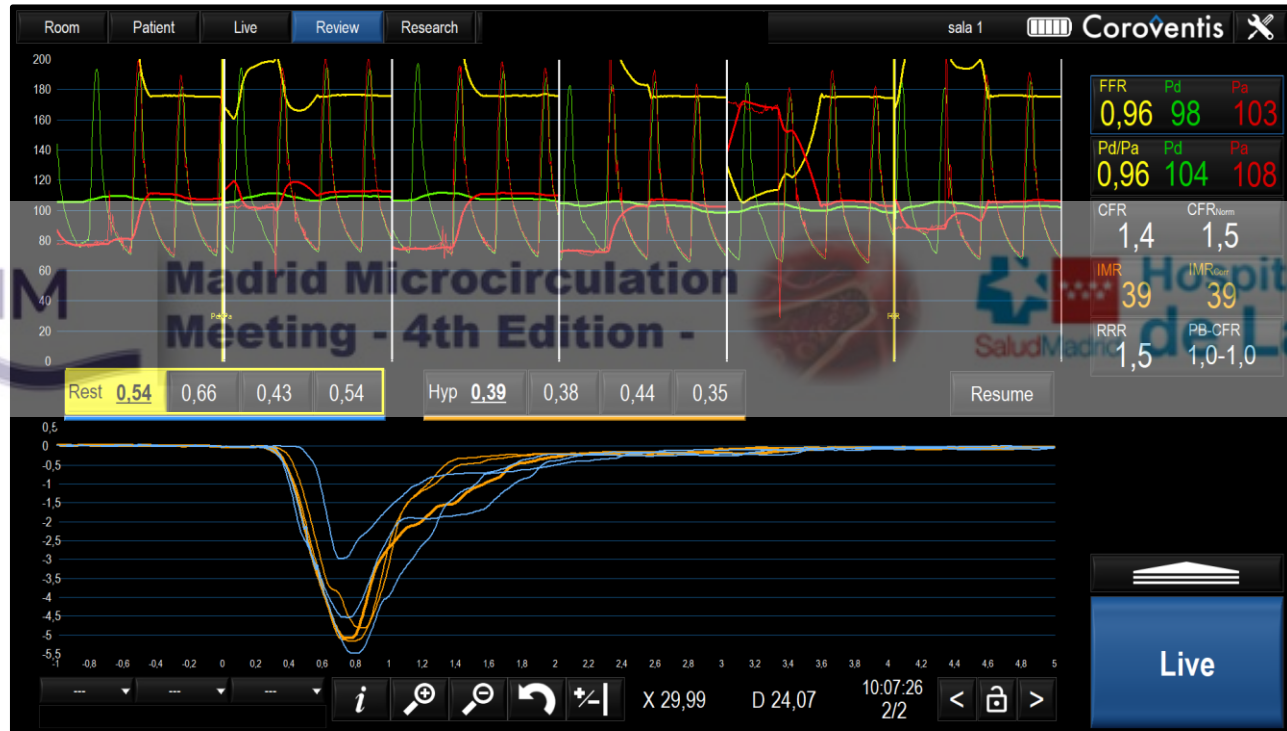
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Temperature did not return to baseline in time (8 seconds)

- Check that the guide is not too far advanced.
- If the baseline temperature is not zero, do zero temperature and redo the injection.





MMM

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Right Patient

Optimal time of
implementation

Doppler/Thermodilución

MMM

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Invasive Assessment
Microcirculation

Coronary artery

Cut-off values

Thank you!



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