

La valutazione funzionale in quadri anatomici particolari:

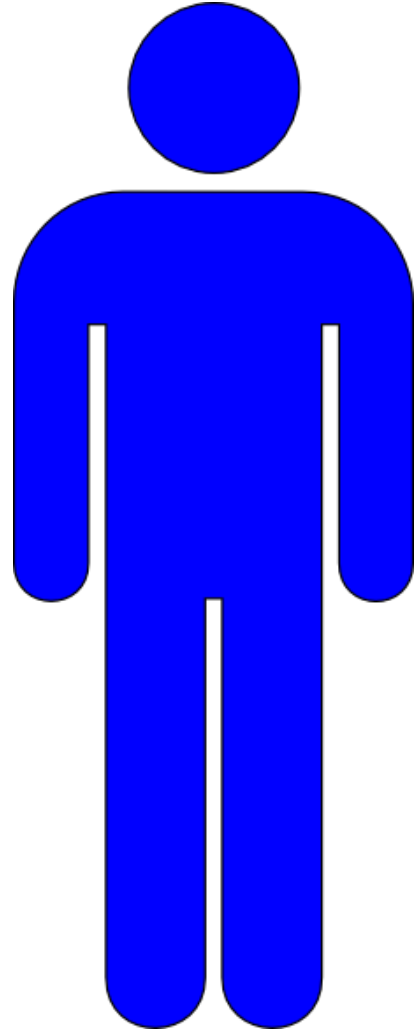
“Il paziente con stenosi Aortica severa”

Gabriele Pesarini, MD, PhD
University of Verona



UNIVERSITÀ
di **VERONA**





NO CORONARY DISEASE



AORTIC STENOSIS



CORONARY DISEASE



Pressione Aortica (Pa)



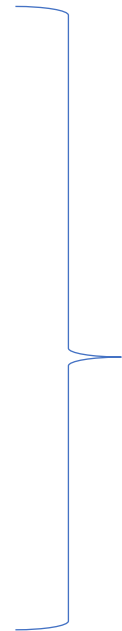
Capacità Vasodilatante



Disfunzione Microcircolatoria

Ipertrofia Miocardica

Aumento LVEDP

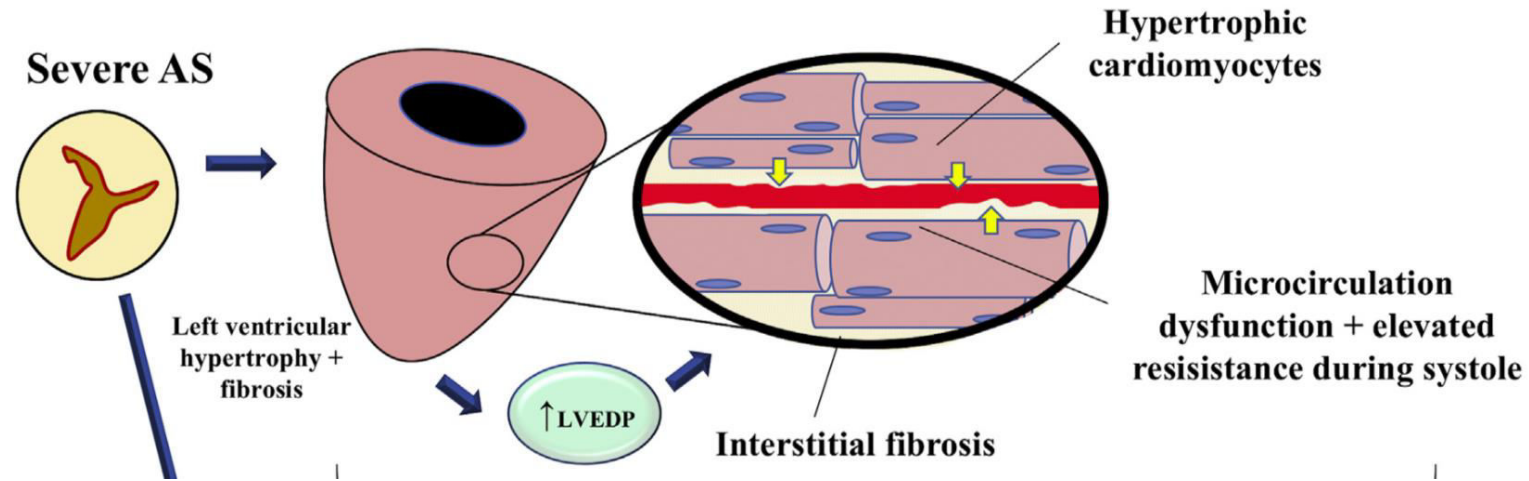


?



FFR/iFR

?



LVEDP + IPERTROFIA

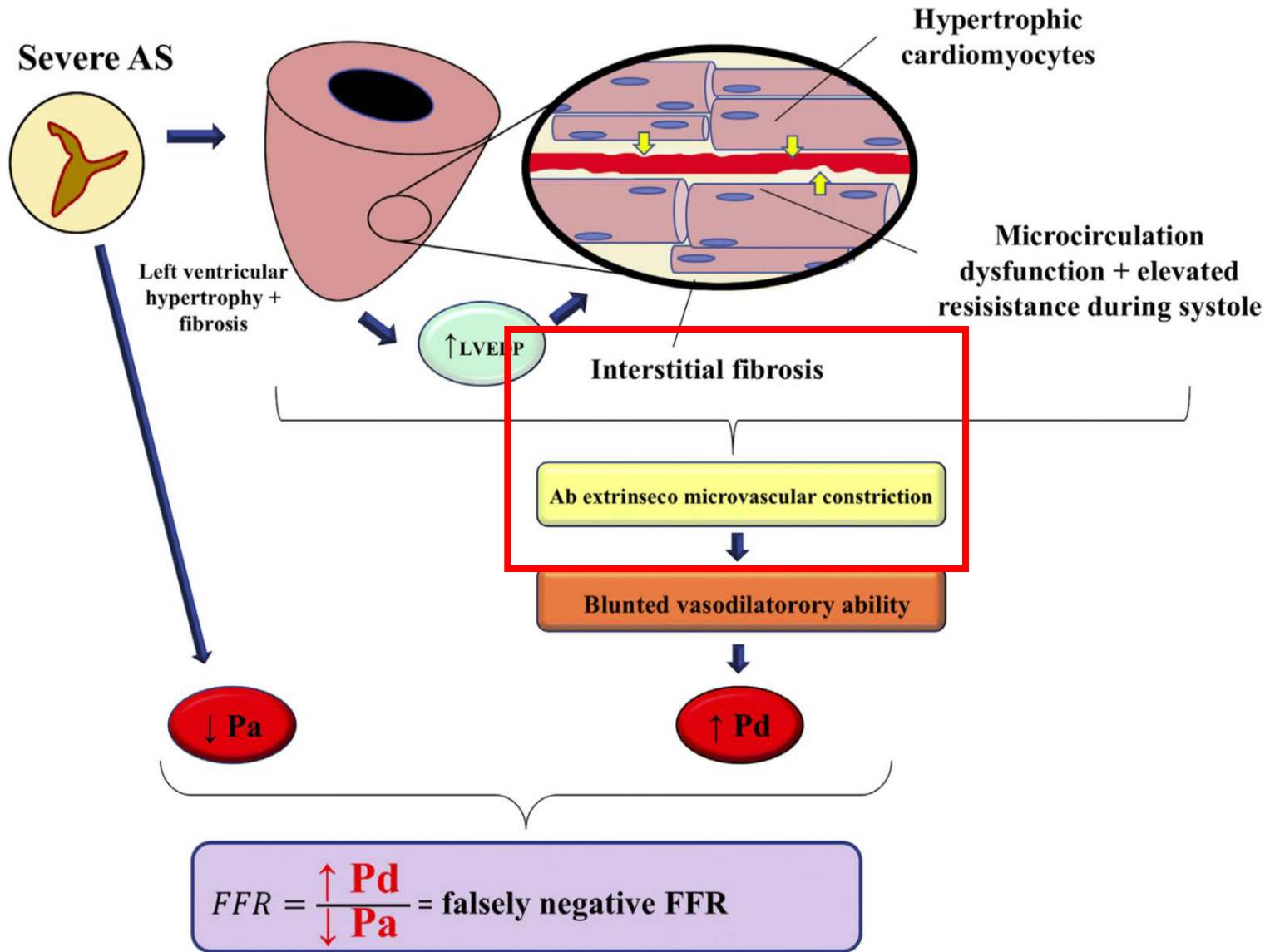


RAREFAZIONE DEI VASI

VASODILATAZIONE COMPENSATORIA



RIDOTTA RISERVA VASODILATANTE

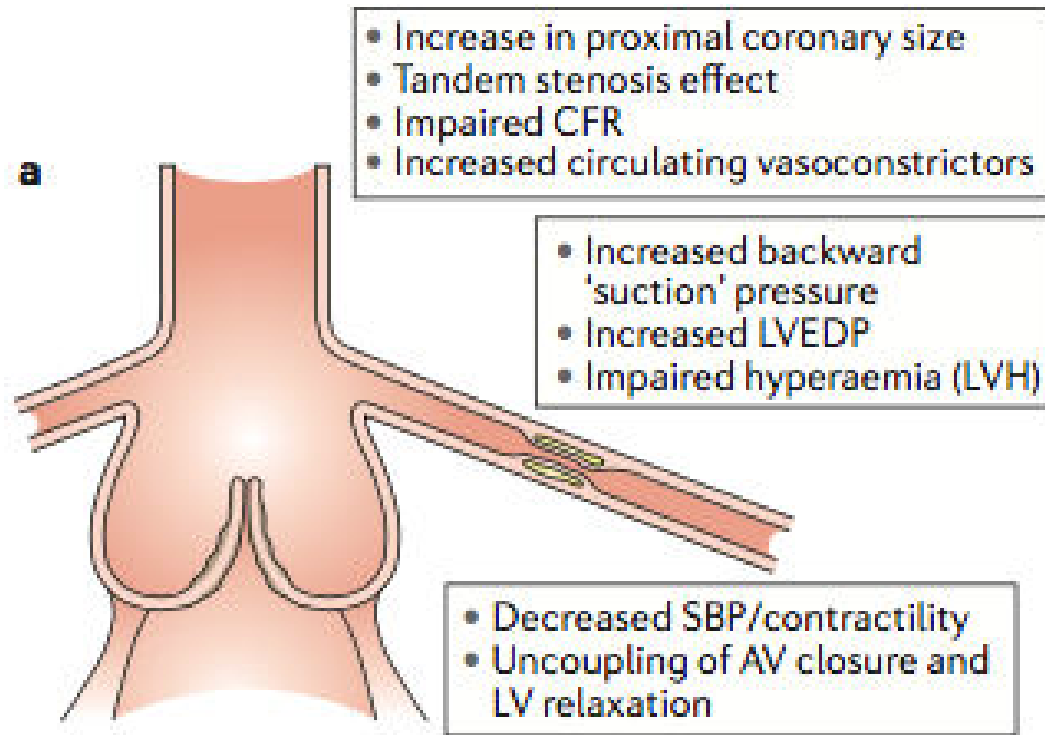


LVH is associated with a lower ischemic threshold as a result of:

- Capillary rarefaction
- Transmural steal (subendocardial ischemia)

Coronary physiology, in presence of aortic stenosis is complex...

Several factors might influence coronary pressure or flow measurements in the presence of severe aortic valve stenosis.



Influenze neuro-ormonali:

Per preservare la pressione arteriosa il paziente con stenosi aortica ha livelli aumentati di alfa-adrenergici, angiotensina e vasopressina → **Aumento Resistenze**

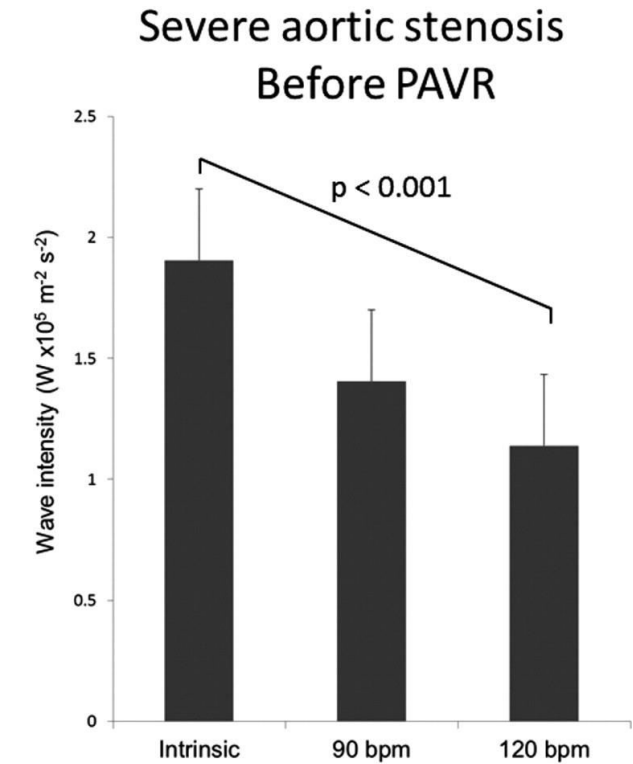
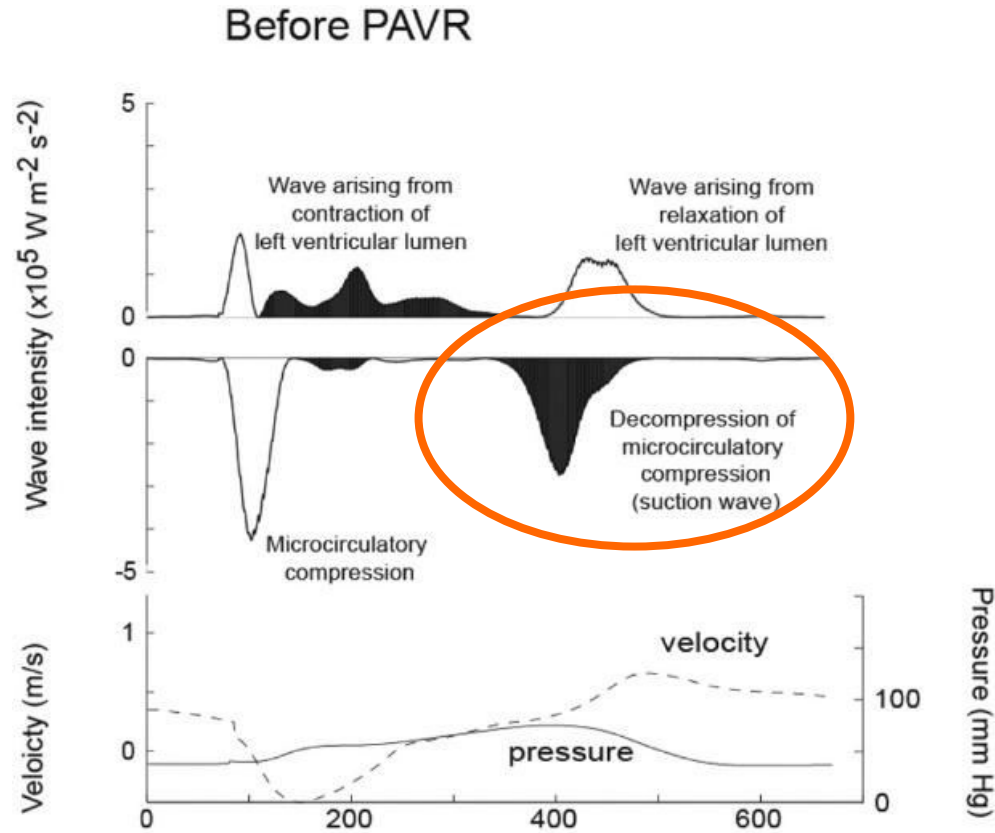
Disaccoppiamento Chiusura Aorta-LV relaxation:

Alterazione del fisiologico rapporto tra la chiusura della valvola aortica e la caduta di pressione di LV e la sua tensione di parete.

«Suction wave» microcircolatoria:

Un'onda sfigmica acceleratoria di aspirazione proporzionale al gradiente valvolare e non chiaramente correlata all'ipertrofia di LV.

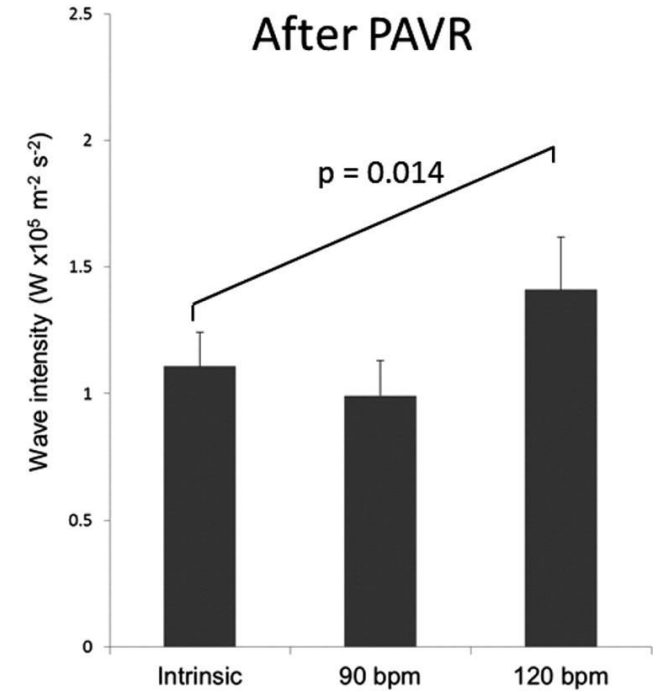
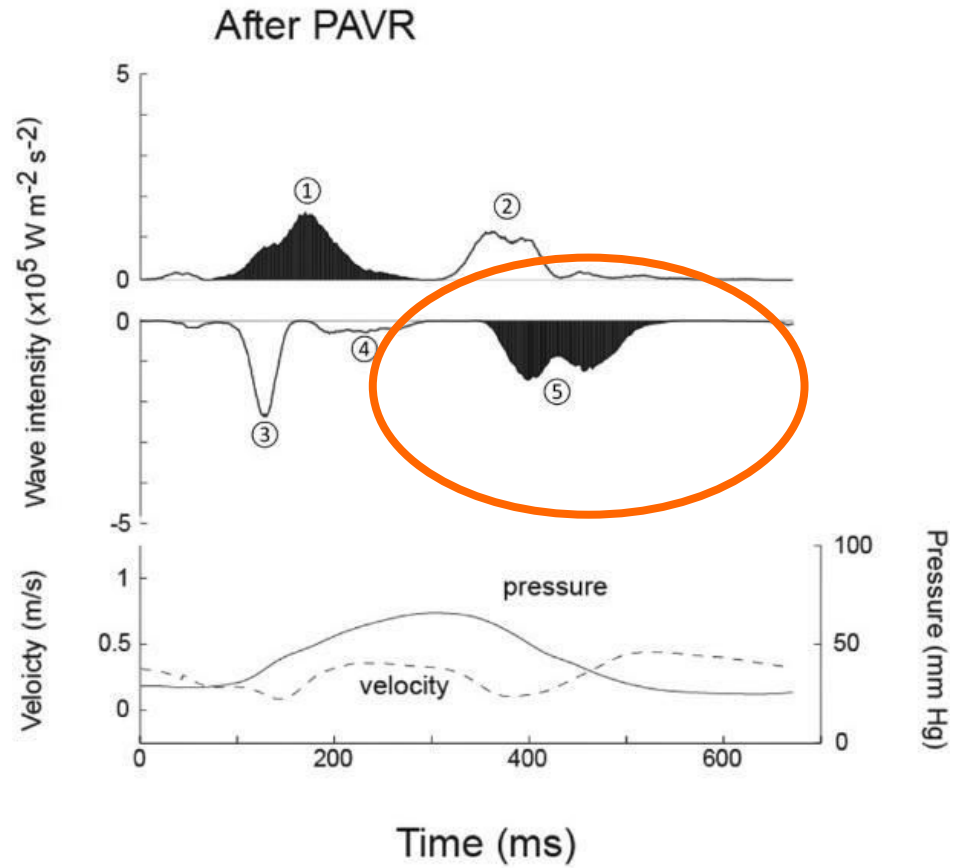
Arterial pulse wave dynamics in aortic stenosis



La decompressione violenta del microcircolo non lascia ulteriore spazio alla modulazione della suzione microcircolatoria con riduzione della riserva

Riduzione dell'onda anterograda del flusso a genesi microcircolatoria nel paziente con AS severa: ipotesi fisiopatologica dell'angor con riduzione della riserva fisiologica coronarica

Arterial pulse wave dynamics after percutaneous aortic valve replacement



Ridotta onda di «suzione» subito dopo la TAVI:
 ripristino della riserva coronarica con potenzialità
 di aumento della suzione microcircolatoria
 durante stress fisiologico

Ripristino della riserva di flusso coronarico
 con l'incremento di FC dopo la TAVI

Coronary vasodilatory reserve is reduced in AS

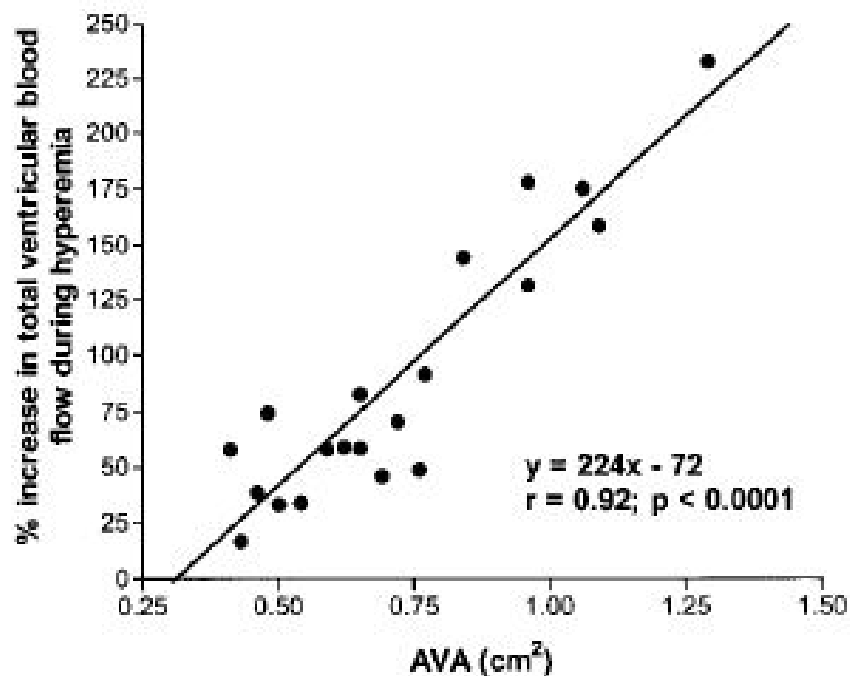


Figure 3. Relationship between percentage increase in total ventricular blood flow during hyperemia and AVA.

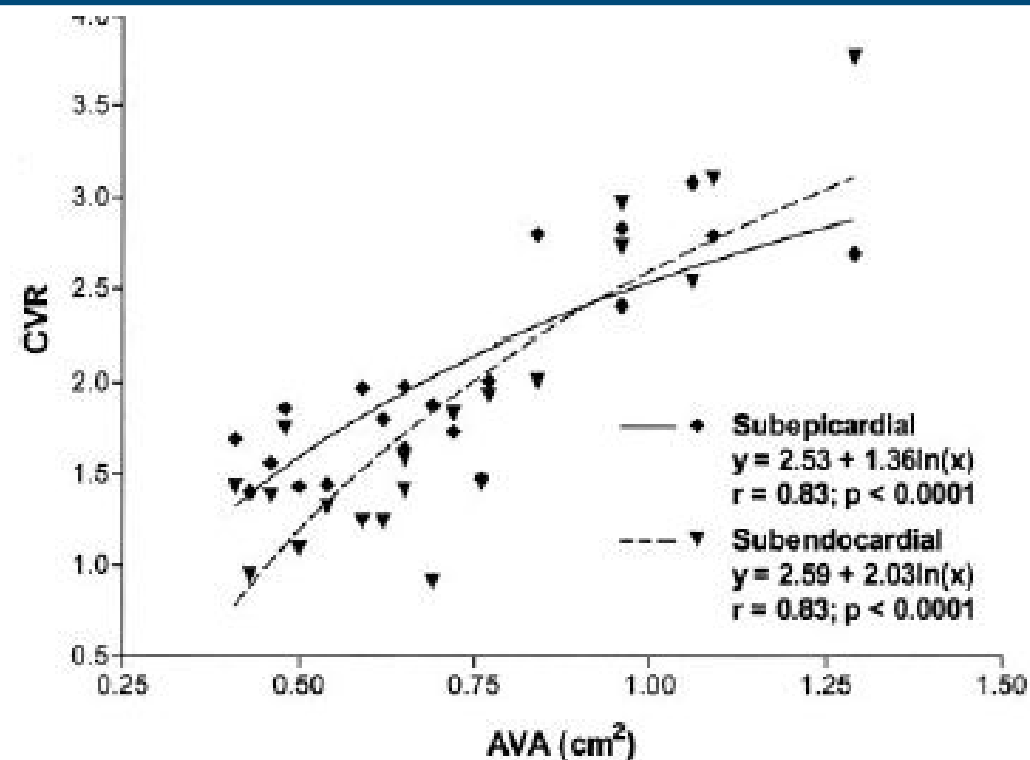


Figure 4. Relationship between CVR and AVA in the subepicardium and subendocardium. The lines intersect at 0.92 cm².

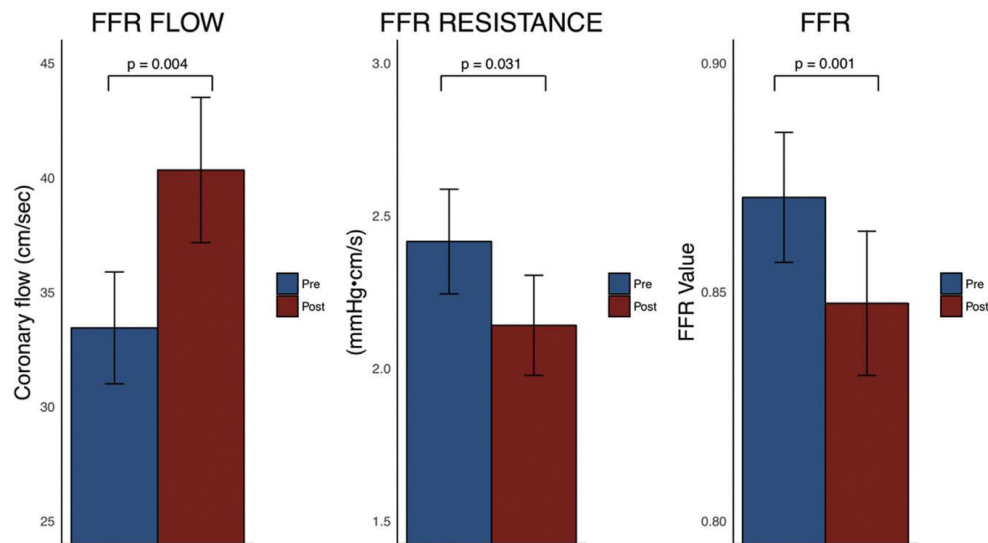
Nella stenosi aortica l'iperemia è meno efficace e la riserva di vasodilatazione coronarica è ridotta. Queste riduzioni sono direttamente **proporzionali all'area valvolare** ed il subendocardio è più affetto dalla disfunzione dell'autoregolazione.

MASSIMA IPEREMIA per FFR INAFFIDABILE



FFR FALSAMENTE NEGATIVA

FFR



28 pts con AS + CAD

Hyperemic flow increases significantly after TAVI

No significant variations in resting flow



FFR decreases after TAVI

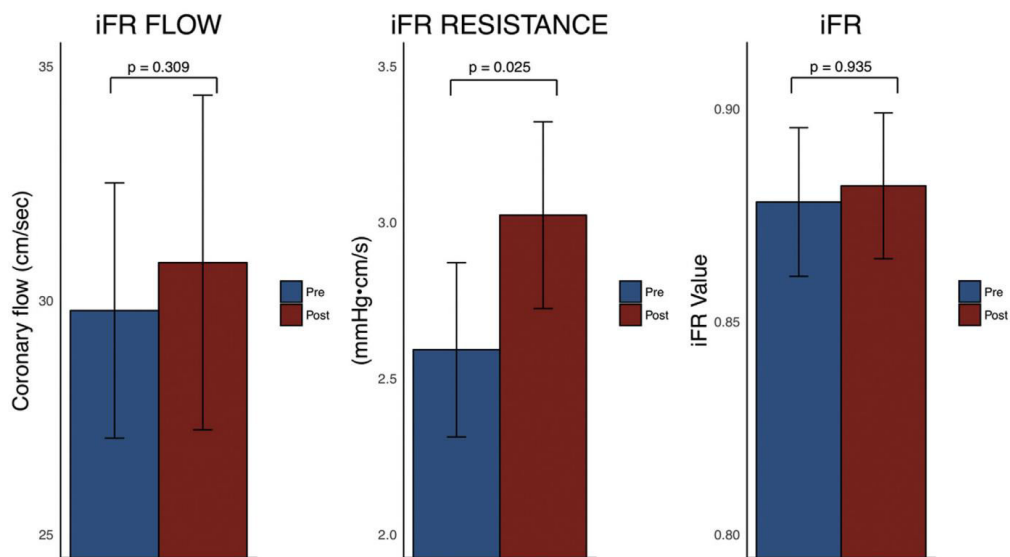
iFR does not vary after TAVI



FFR may be falsely negative

iFR should be used in assessing bystander coronary disease in TAVI

iFR





CFR by thermodilution before and after TAVI

| Data immediately before and after TAVI | CAD | No CAD | |
|--|-------------|-------------|--------|
| ΔP_{mean} aortic valve before TAVI (mmHg) | 45±17 | 58±19 | 0.0490 |
| ΔP_{mean} aortic valve after TAVI (mmHg) | 9±5 | 8±6 | 0.88 |
| LVEDP before TAVI (mmHg) | 17±6 | 18±7 | 0.61 |
| LVEDP after TAVI (mmHg) | 14±5 | 16±9 | 0.37 |
| AR after TAVI: no/mild/moderate/severe | 16/10/0/0 | 5/9/0/0 | 0.25 |
| CFR before TAVI | 1.8±0.9 | 2.1±0.9 | 0.48 |
| CFR after TAVI | 2.0±0.9 | 2.0±1.2 | 0.94 |
| Hyperaemic coronary transit time before TAVI (s) | 0.50±0.41 | 0.32±0.16 | 0.15 |
| Hyperaemic coronary transit time after TAVI (s) | 0.52±0.35 | 0.41±0.18 | 0.34 |
| FFR before TAVI | 0.89±0.09 | 0.93±0.08 | 0.29 |
| FFR after TAVI | 0.91±0.09 | 0.95±0.06 | 0.13 |
| Mean aortic pressure for FFR before TAVI (mmHg) | 74±16 | 65±14 | 0.0832 |
| Mean aortic pressure for FFR after TAVI (mmHg) | 70±15 | 61±11 | 0.0545 |
| Resting CFI before TAVI | 0.136±0.080 | 0.177±0.077 | 0.21 |
| Resting CFI after TAVI | 0.123±0.076 | 0.143±0.084 | 0.53 |
| Hyperaemic CFI before TAVI | 0.131±0.081 | 0.123±0.078 | 0.80 |
| Hyperaemic CFI after TAVI | 0.153±0.092 | 0.155±0.106 | 0.97 |
| Hyperaemic IMR_{true} before TAVI (mmHg s) | 29.0±21.0 | 20.8±8.4 | 0.29 |
| Hyperaemic IMR_{true} after TAVI (mmHg s) | 32.1±24.2 | 26.6±12.4 | 0.60 |

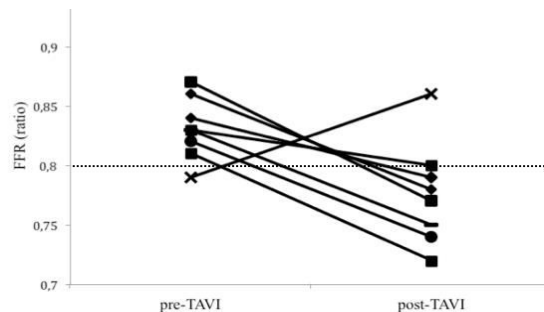
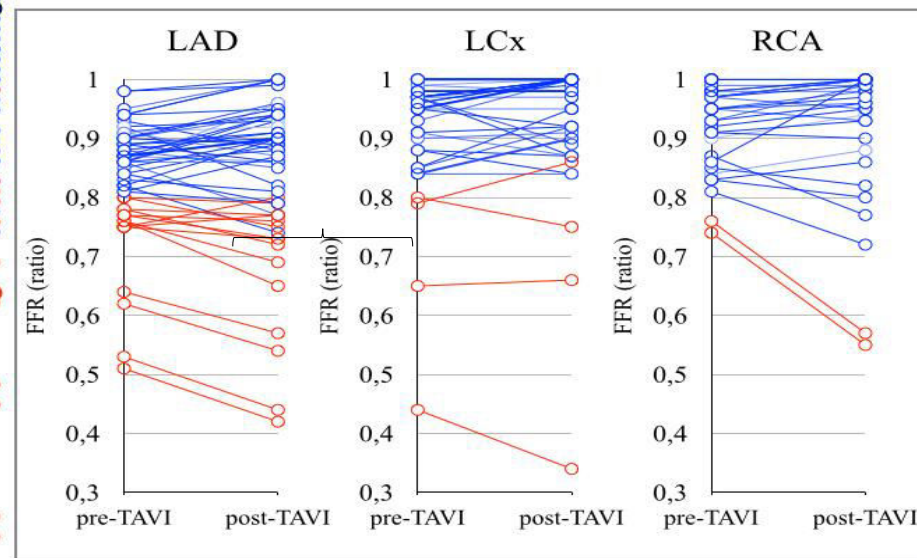
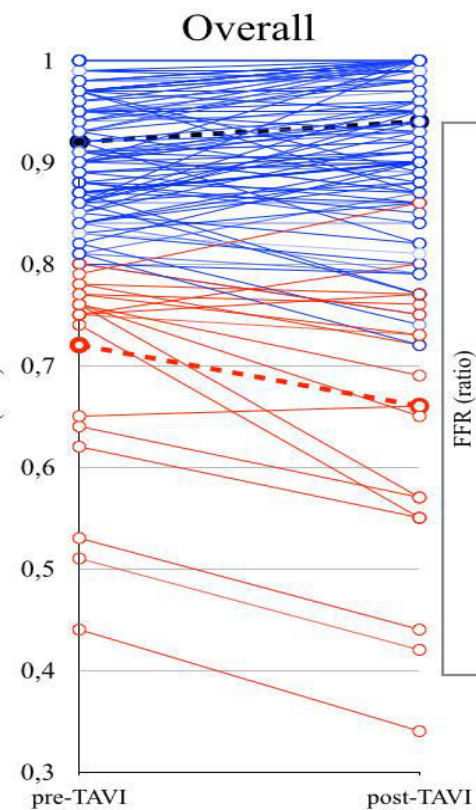
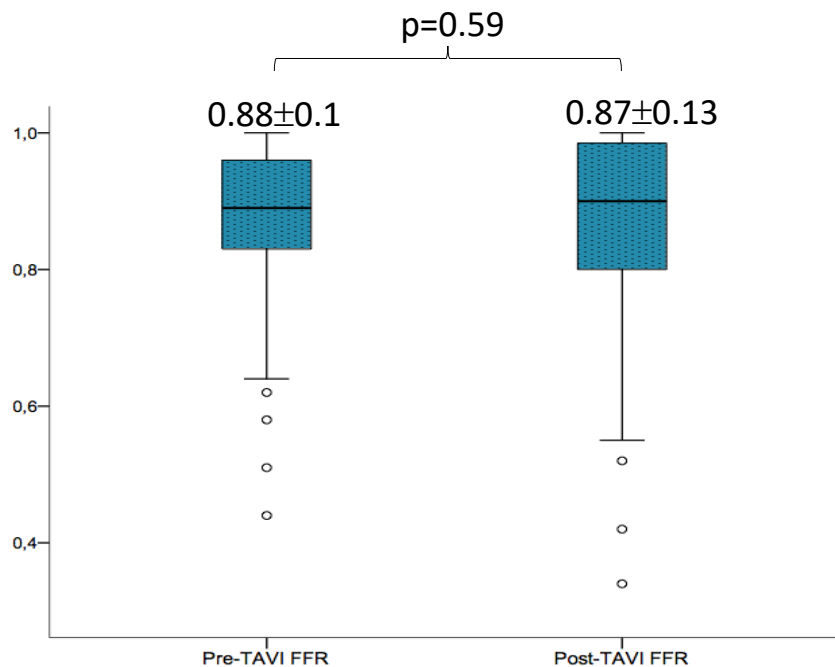
AR: aortic valve regurgitation; CFI: collateral flow index; CFR: coronary flow reserve; FFR: fractional flow reserve; IMR_{true} : true index of microcirculatory resistance (see text for calculation); LAD: left anterior descending artery; LCX: left circumflex artery; LVEDP: left ventricular end-diastolic pressure; ΔP_{mean} : mean pressure gradient; RCA: right coronary artery; TAVI: transcatheter aortic valve implantation

Riduzione Pa



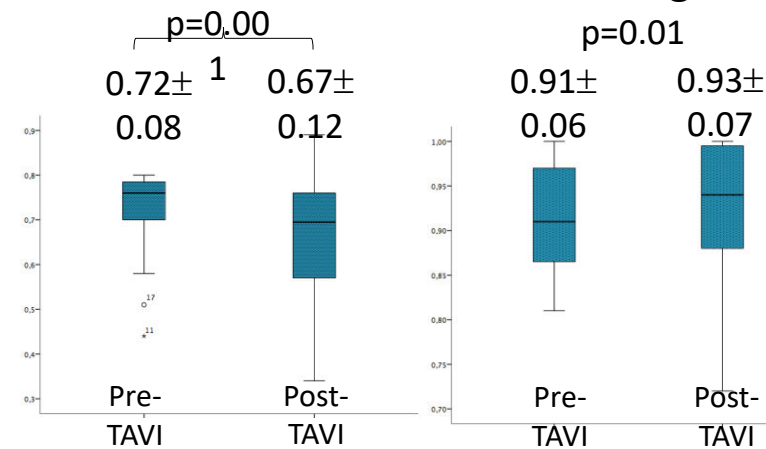
Post-TAVI

Variation of FFR before and after TAVI

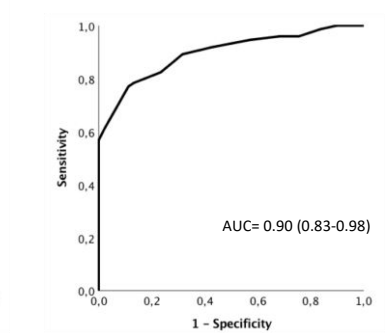
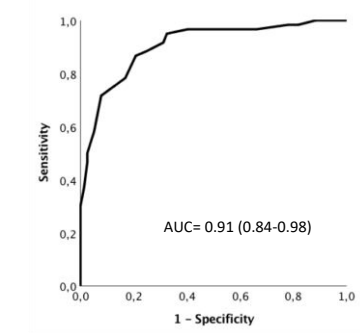
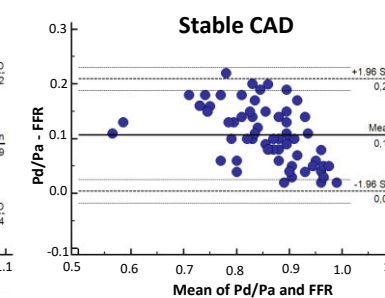
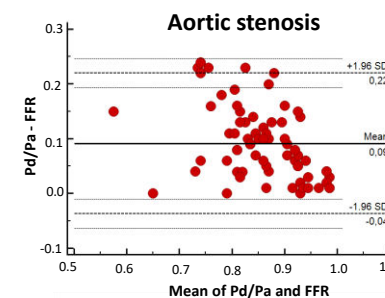
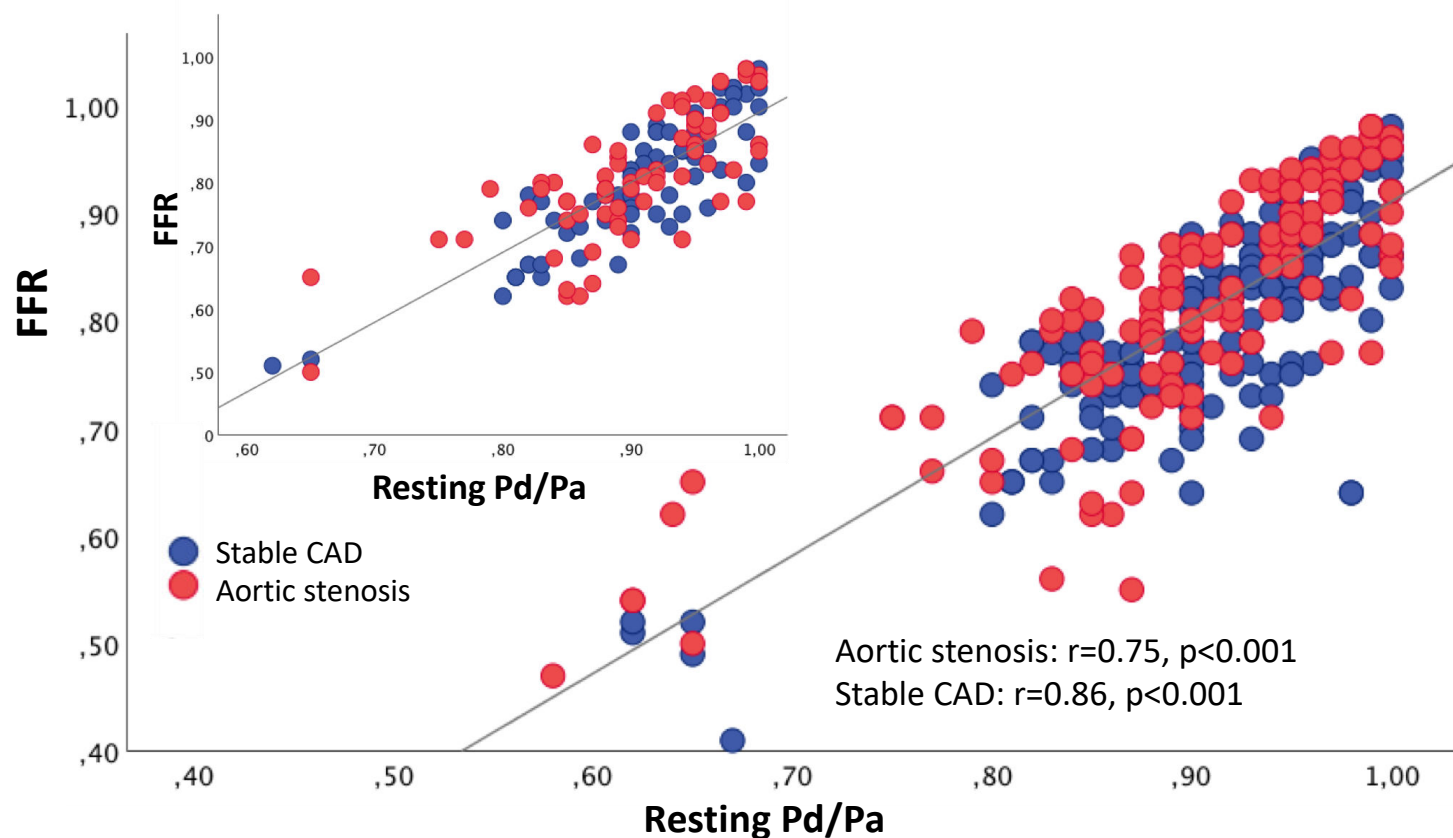


8/133 (6%) coronary lesions crossed the 0.8 cut-off after TAVI

Tendenzie confermata della diagnosi

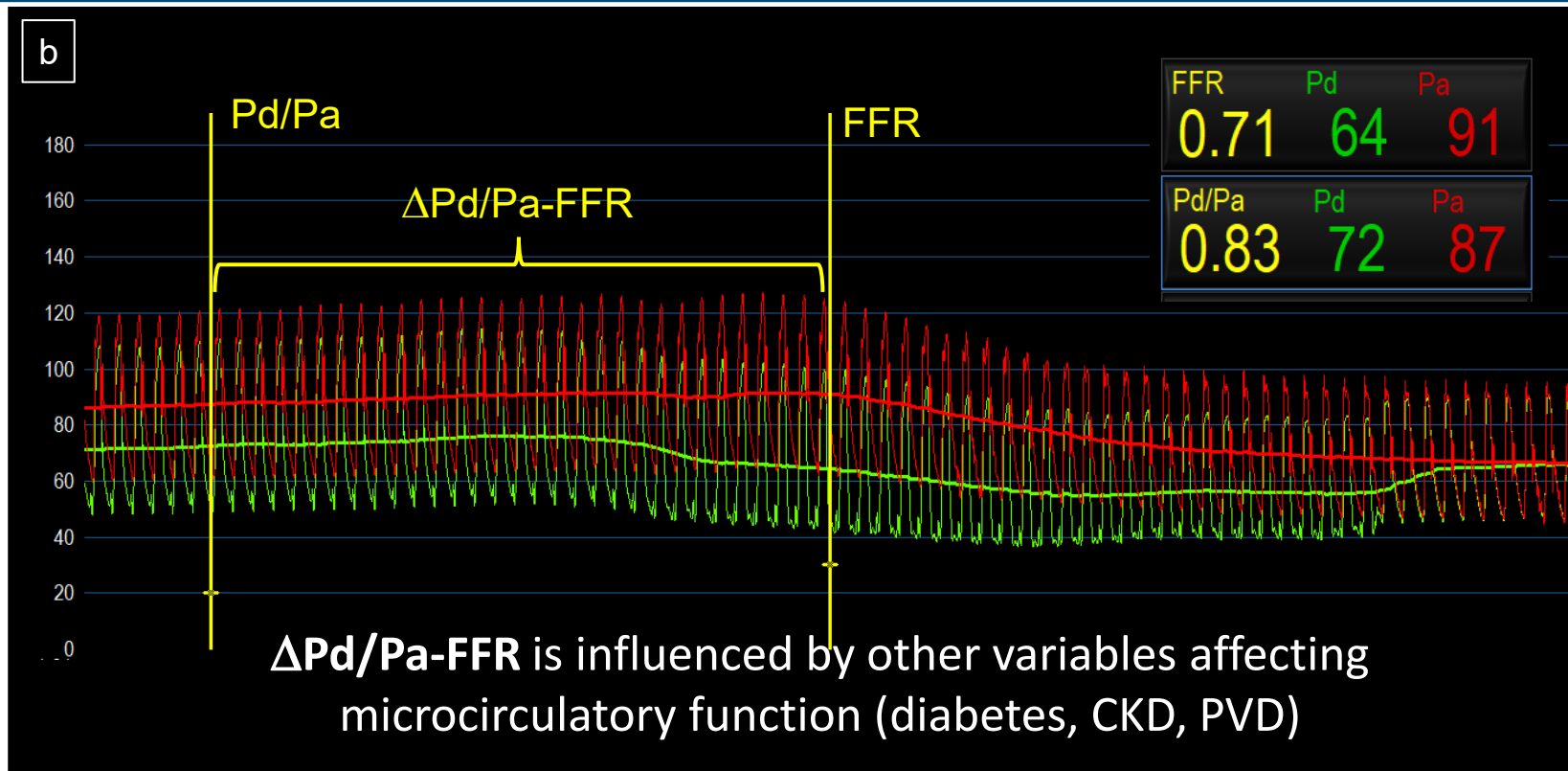
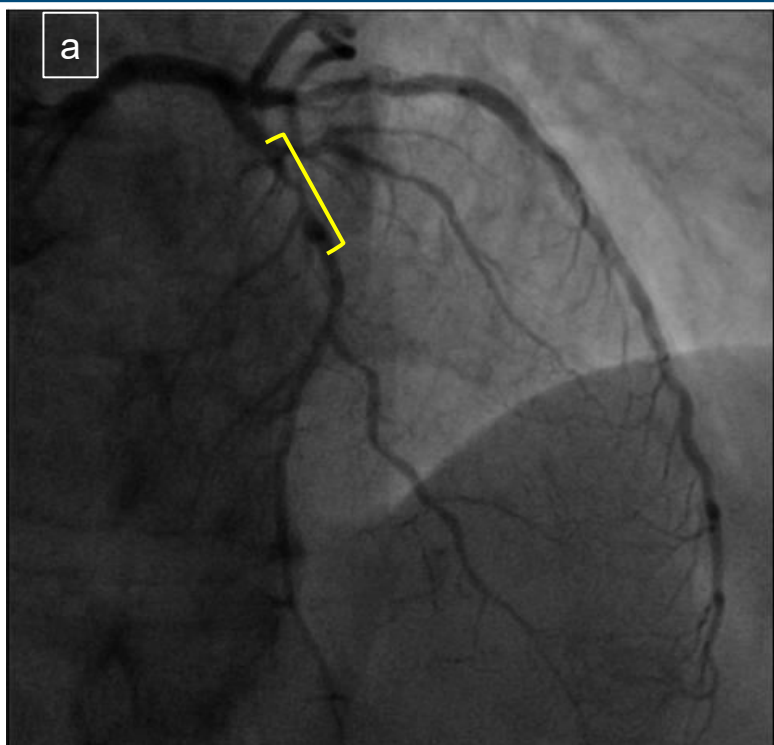


Hyperemic response to Adenosine in AS

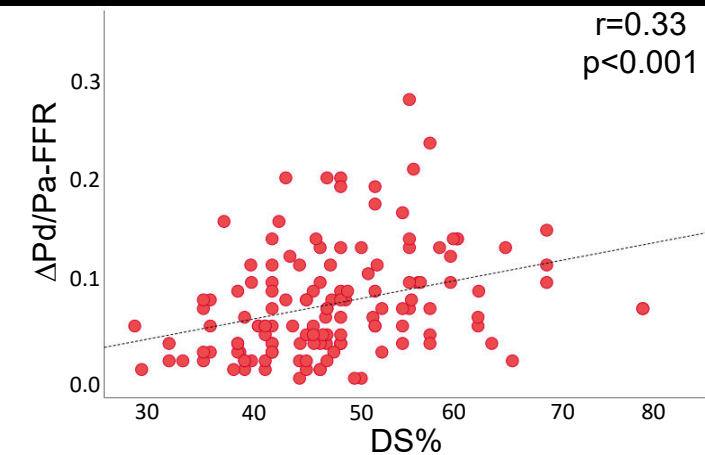
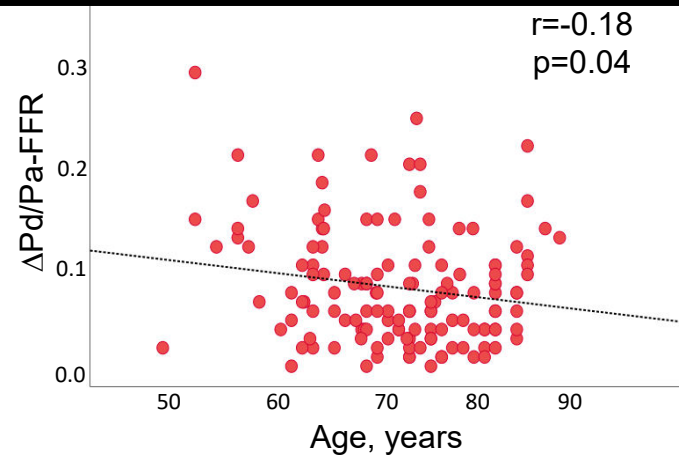
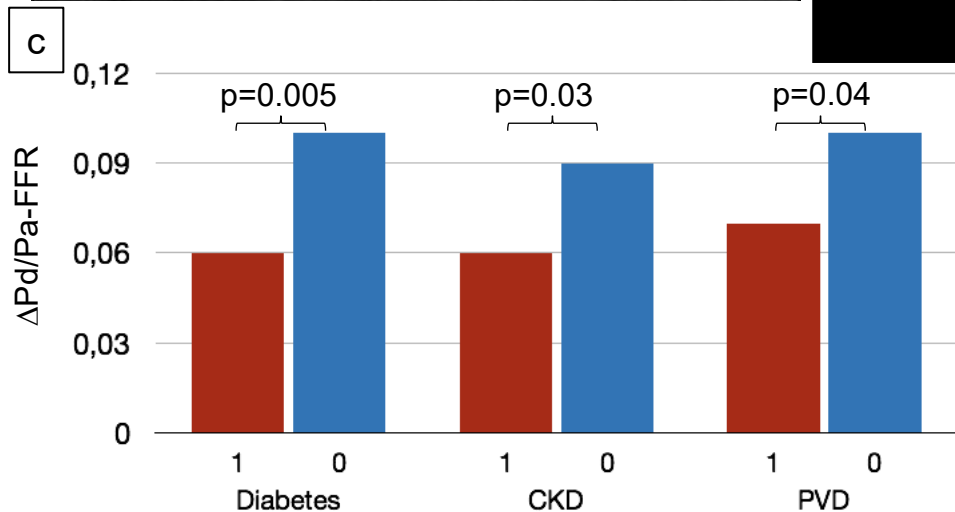


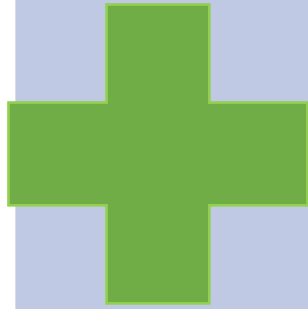
No difference in Pd/Pa – FFR correlation compared with a matched cohort of stable coronary disease patients (propensity 114 AS v 154 controls)

Hyperemic response to Adenosine in AS



$\Delta Pd/Pa-FFR$ is influenced by other variables affecting microcirculatory function (diabetes, CKD, PVD)





- Avoid vasodilators
- Theoretical advantage based on the stability of «resting» coronary flow before and after TAVI



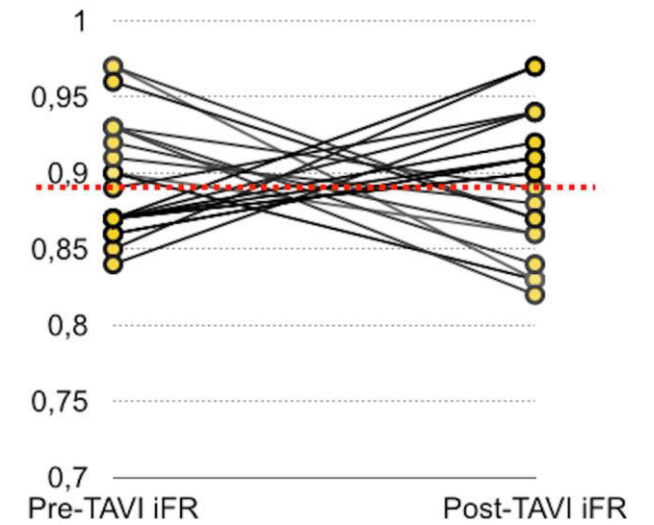
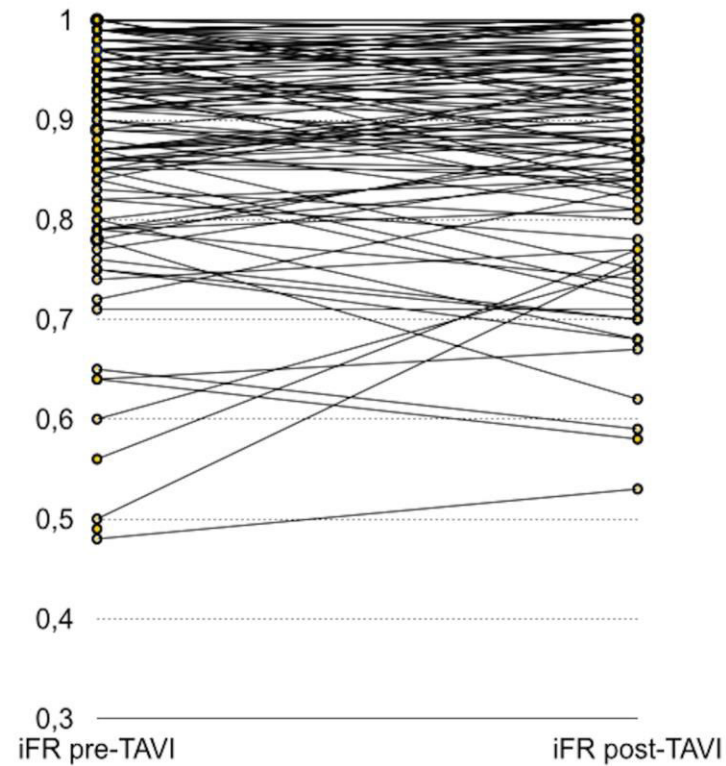
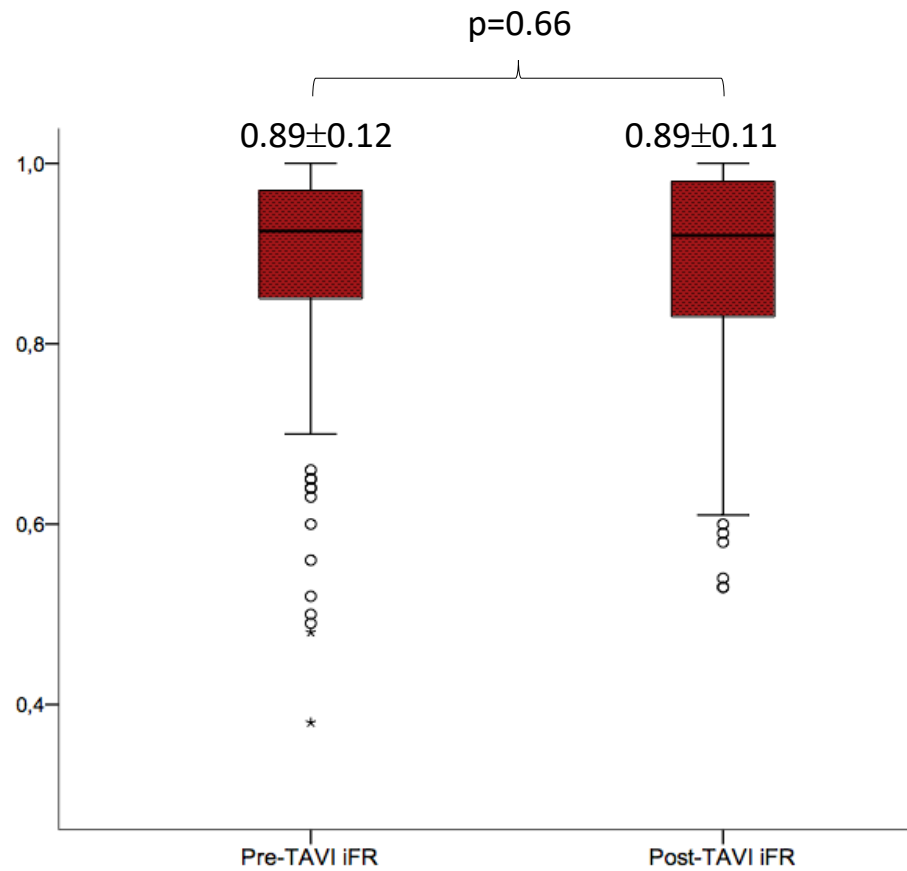
- Difficulties in achieving true resting conditions due to:
 1. Baseline coronary microvascular vasodilatation
 2. Augmented baseline resistances (due to extra-vascular compression)
 - ✓ 3. Uncoupling of the time of diastolic coronary flow
- The combination of these conditions leads to an **increased resting flow, to the CFR exhaustion and to consequently lower NHPRs values.**



iFR Theoretically more positive in AS condition

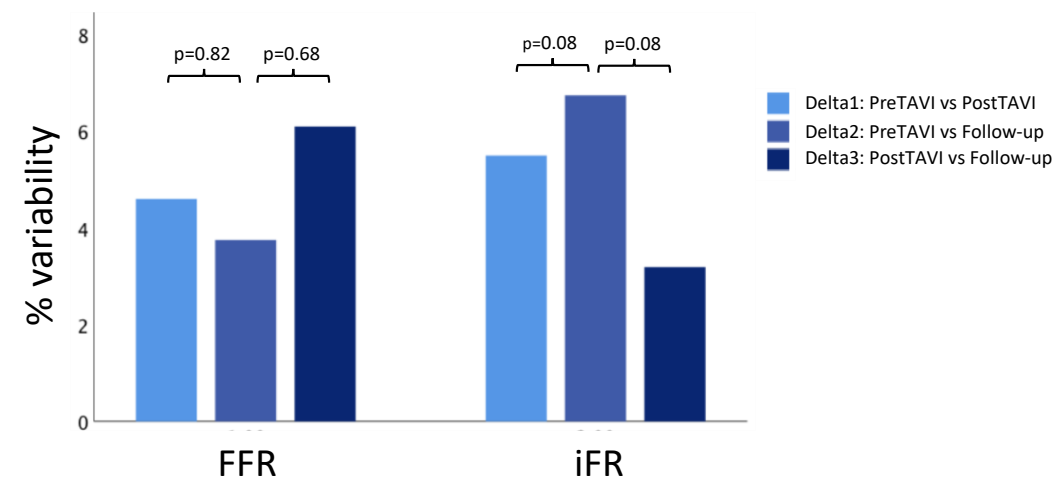
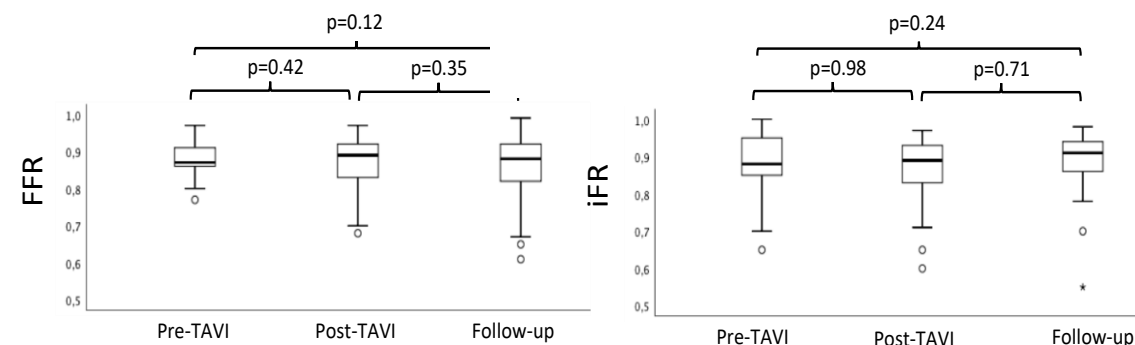
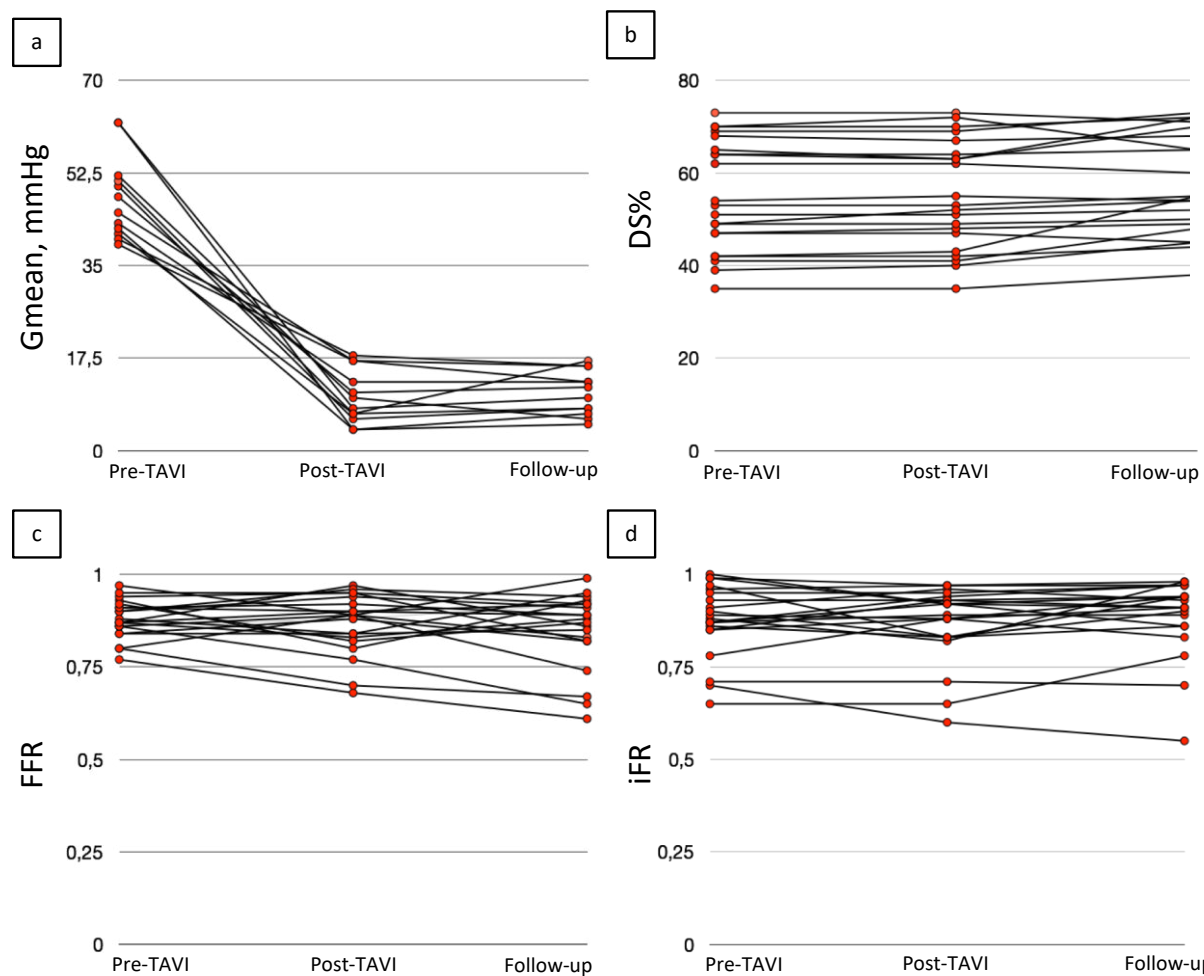


Variation of iFR before and after TAVI



21/145 (14.5%) coronary lesions in **18/66 (27.3%)** patients crossed the 0.89 threshold after TAVI.

FFR&iFR variations at long-term after TAVI (n=94; Follow-up > 6 months)



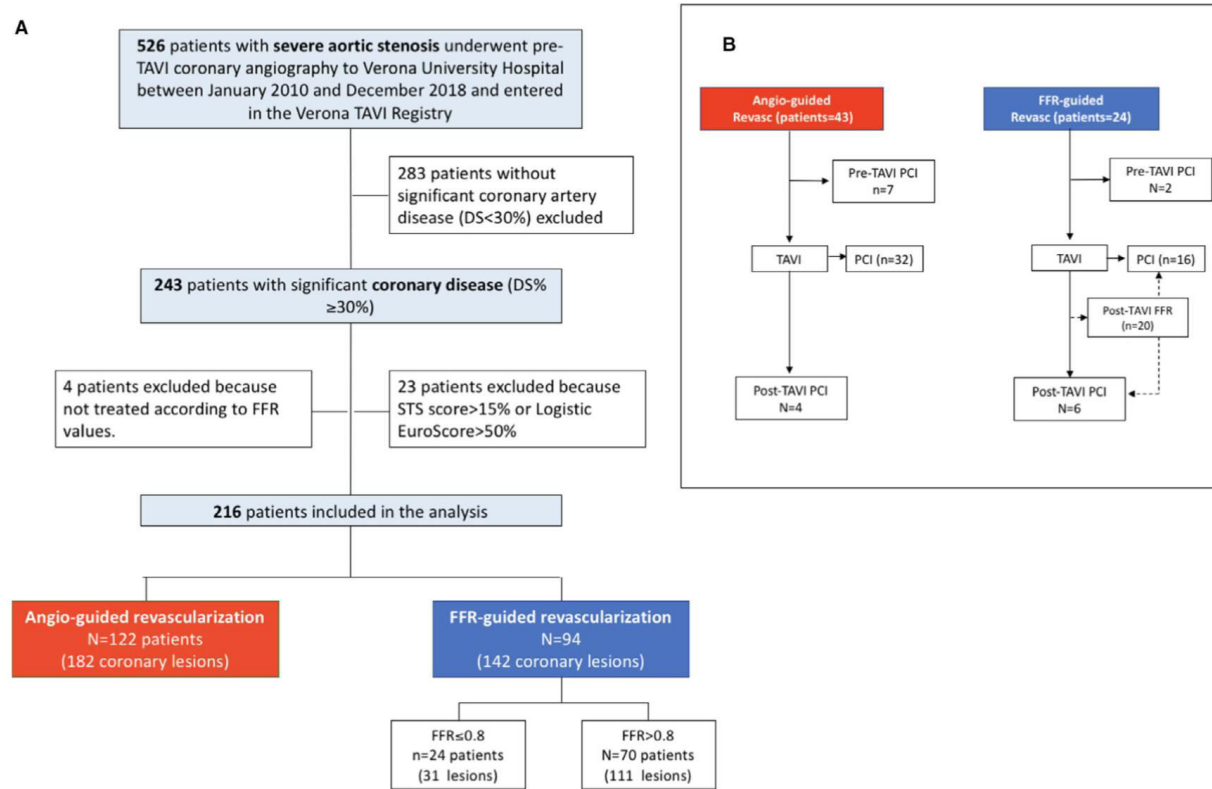


Clinical impact of physiology guided revascularization

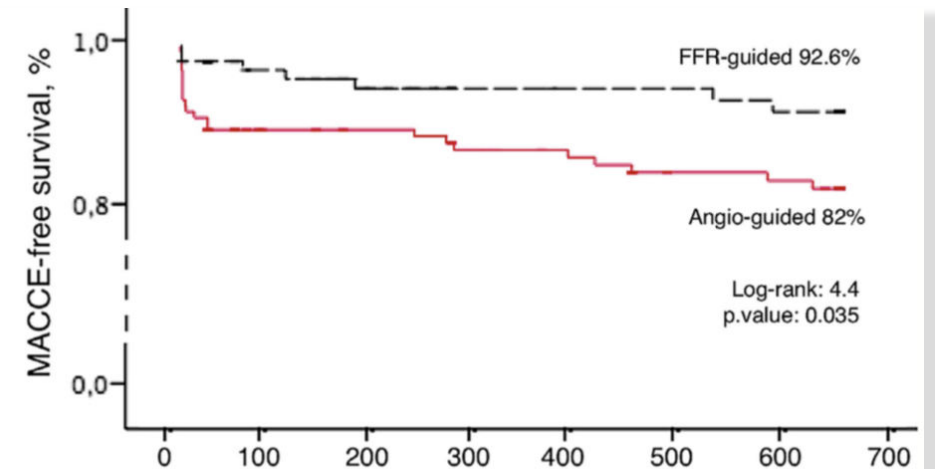
Physiological Versus Angiographic Guidance for Myocardial Revascularization in Patients Undergoing Transcatheter Aortic Valve Implantation

1 Mattia Lunardi, MD, Roberto Scarsini, MD, Gabriele Venturi, MD, Gabriele Pesarini, MD, PhD, Michele Pighi, MD, Andrea Gratta, MD;
2 Leonardo Gottin, MD; Marco Barbierato, MD Francesco Caprioglio, MD; Anna Piccoli, MD, Valeria Ferrero, MD, Flavio Ribichini, MD

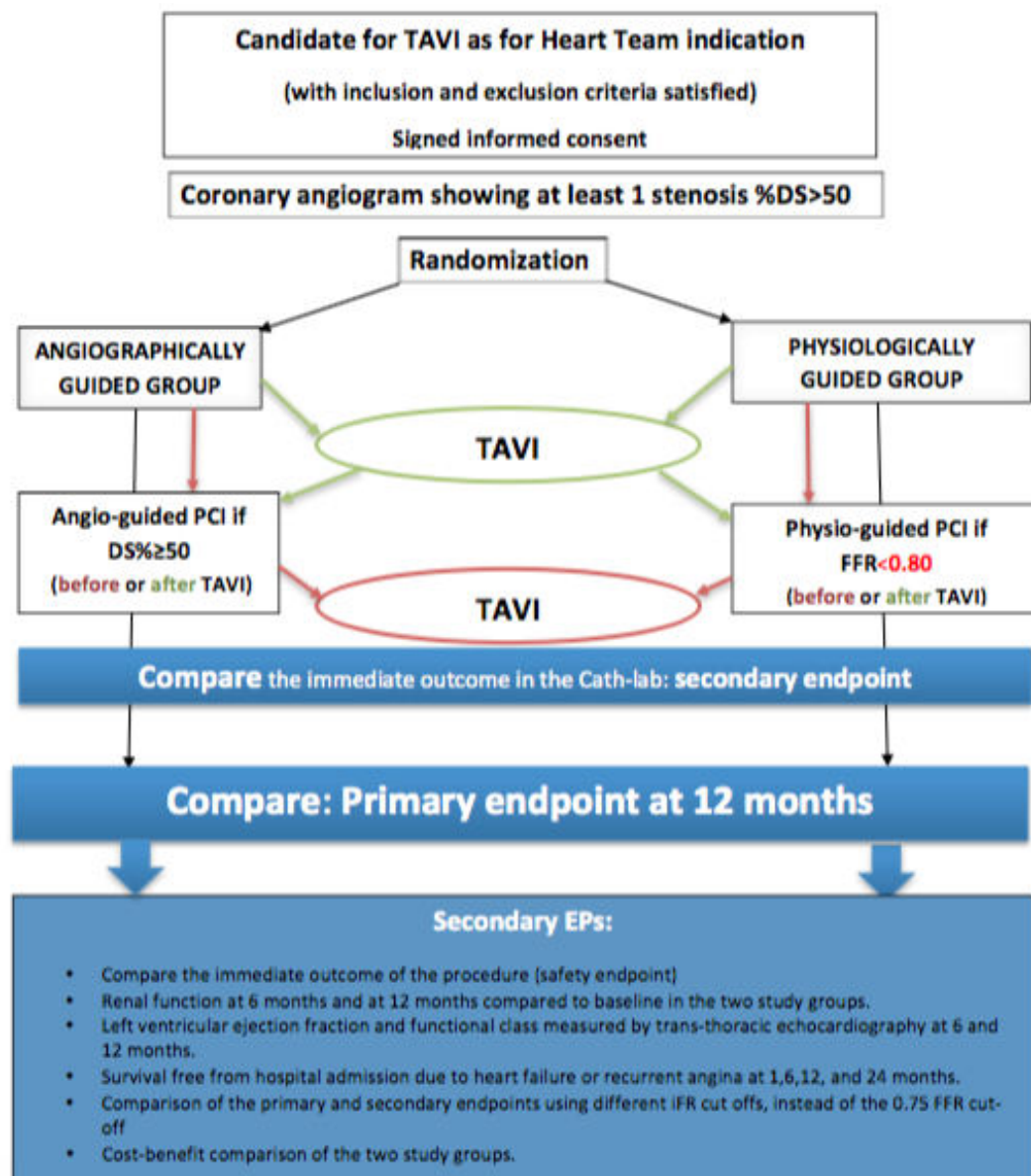
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Analisi Retrospettiva osservazionale monocentrica



| | 0 | 100 | 200 | 300 | 400 | 500 | 600 | 700 |
|----------------|-----|-----|-----|-----|-----|-----|-----|-----|
| Number at risk | | | | | | | | |
| FFR-guided | 94 | 85 | 74 | 66 | 62 | 61 | 60 | 59 |
| Angio-guided | 122 | 99 | 97 | 93 | 83 | 80 | 73 | 70 |



Ongoing FAITAVI Trial
(Enrolment almost completed!!!)

Take Home messages

- Le interazioni tra la stenosi aortica ed il flusso coronarico sono molteplici e complesse
- Sia FFR che iFR possono essere teoricamente influenzate dai meccanismi fisiopatologici della stenosi valvolare aortica
- I pazienti nella «gray zone» FFR sono i più suscettibili al cambiamento di classificazione una volta risolta la stenosi aortica
- Il flusso a riposo basale è alterato nella stenosi aortica ed è possibile che il cutoff ottimale per l'uso degli indici non iperemici sia più basso
- Dati preliminari incoraggiano sul potenziale valore clinico della FFR con il cutoff classico di 0.8



Allo stato attuale non si può che raccomandare prudenza nell'interpretazione degli indici funzionali nei pazienti con stenosi aortica e patologia coronarica

GRAZIE!



GRAZIE!