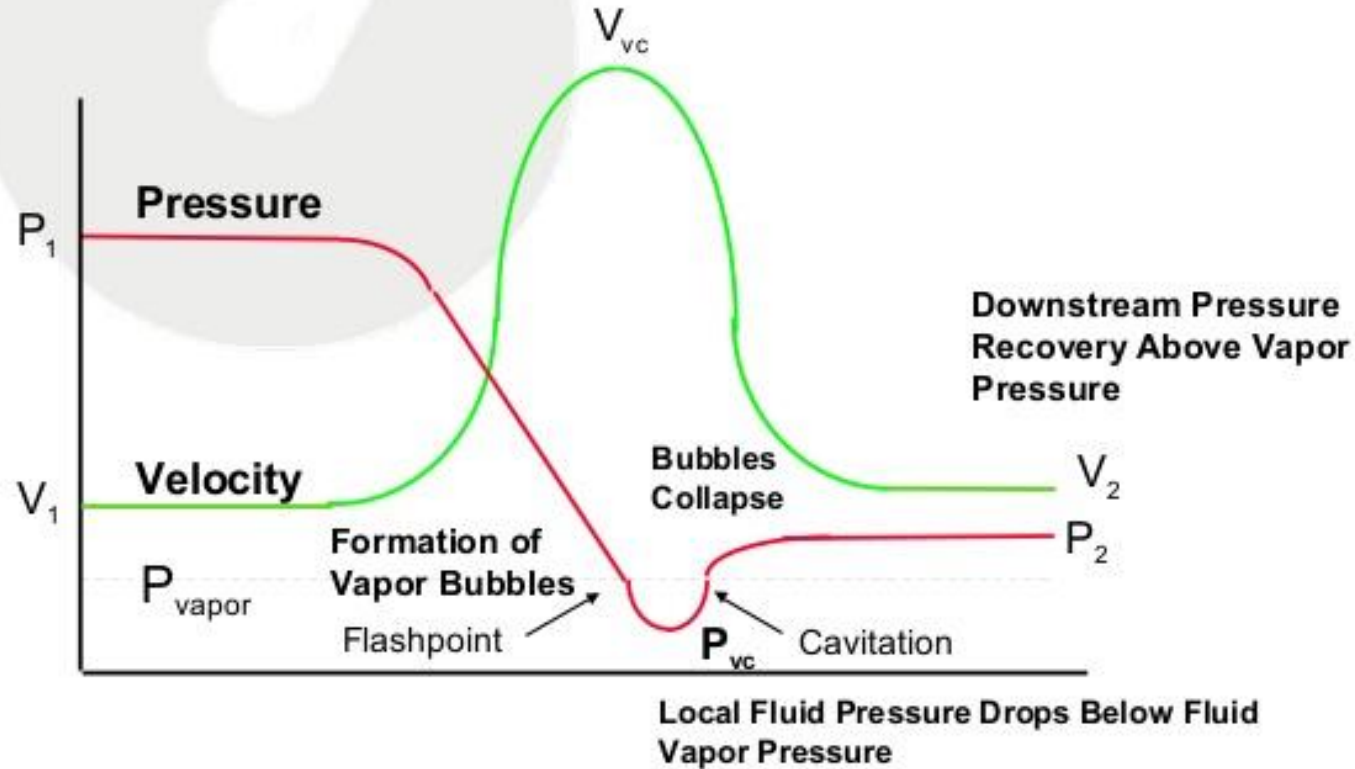


**Engineering and re-engineering the  
cardiovascular system in order to prevent  
platelet aggregation triggering acute  
myocardial infarction and stroke**

**Thach Nguyen MD FACC FSCAI  
Methodist Hospital, Merrillville IN  
Joint Coronary Revascularization  
December 8<sup>th</sup> 2018, Busan Korea**

- **Engineering** is the creative application of science, mathematical methods etc, to the **understanding** of the design, construction, operation of structures, machines, materials, devices, systems etc.
- **Re-engineering** is the application of technology and management science to the modification of existing systems, organizations, processes and products in order to make them more effective, efficient and responsive.

# Cavitation Phenomena



**SETPPOINT**  
INTEGRATED SOLUTIONS

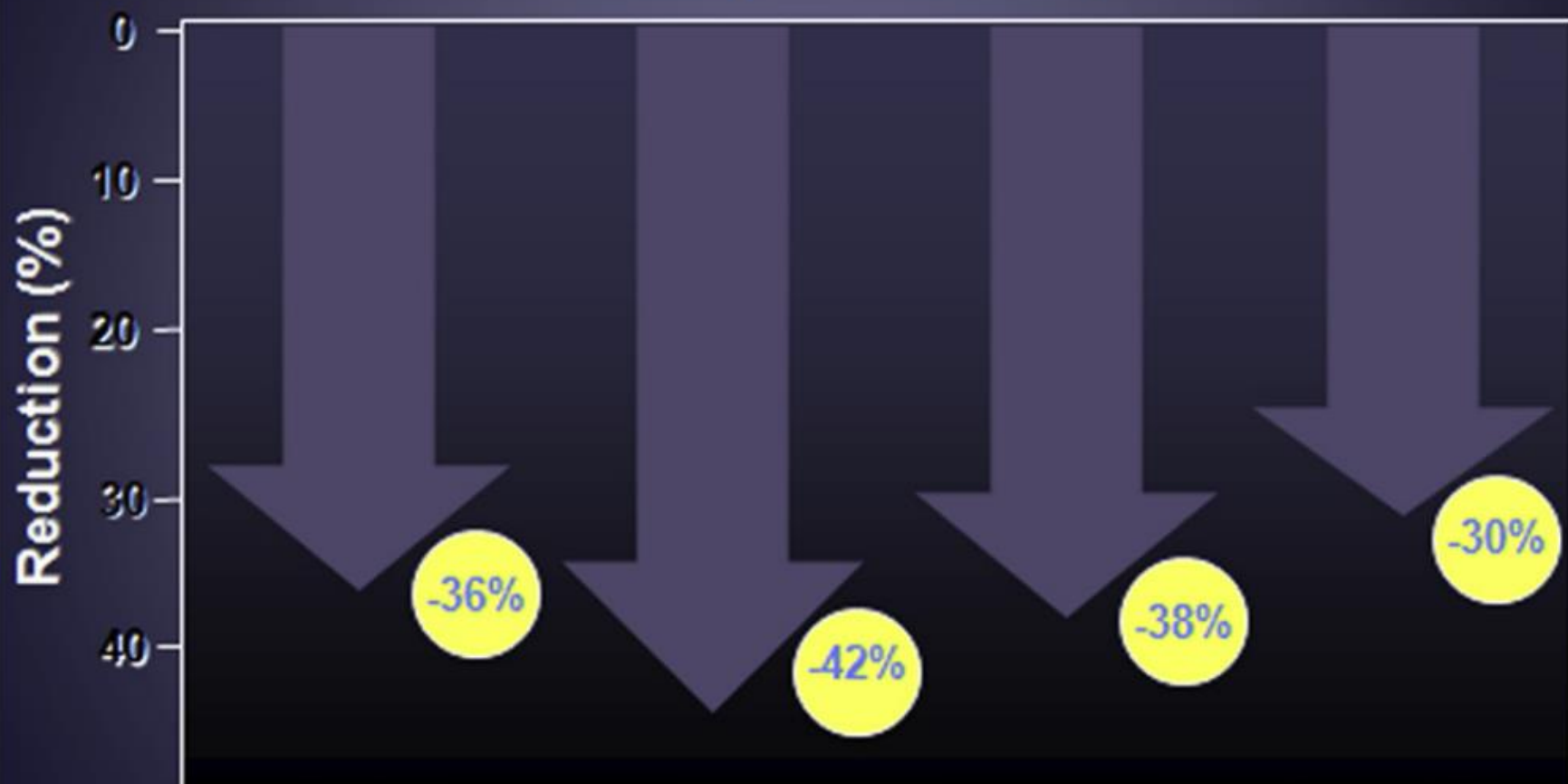
WHEN ACCURACY MATTERS

*Credit: Basic Fluid Dynamics - Control Valves, Setpoint Integrate Solutions*

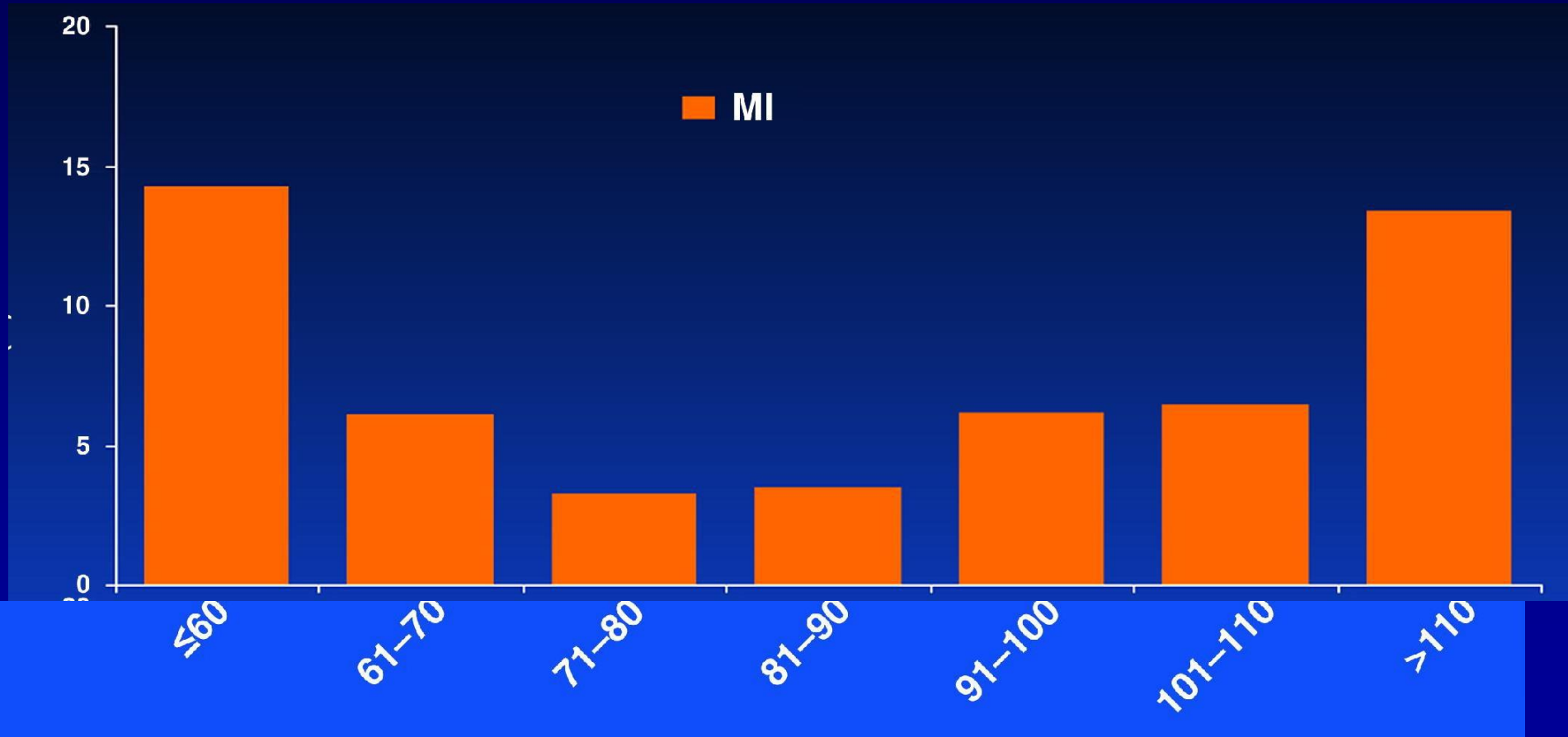


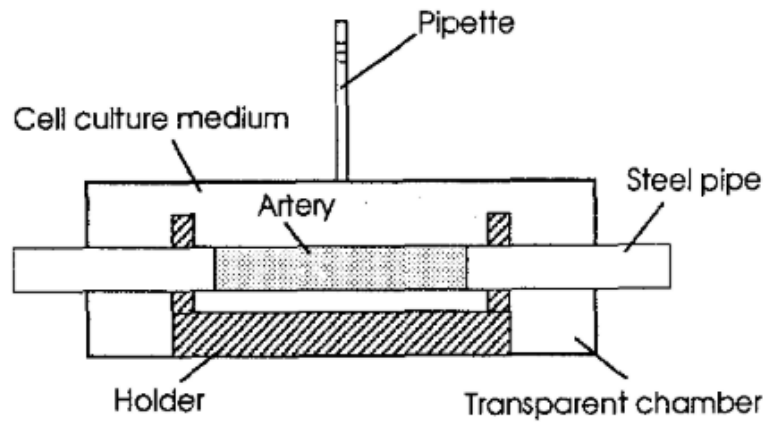
# Reduction of Stroke in ISH

SHEP, 1991    Syst-EUR, 1997    Syst-China, 1998    HYVET, 2008  
Chlothaldione    Nitrendipine    Nitrendipine    Indapamide

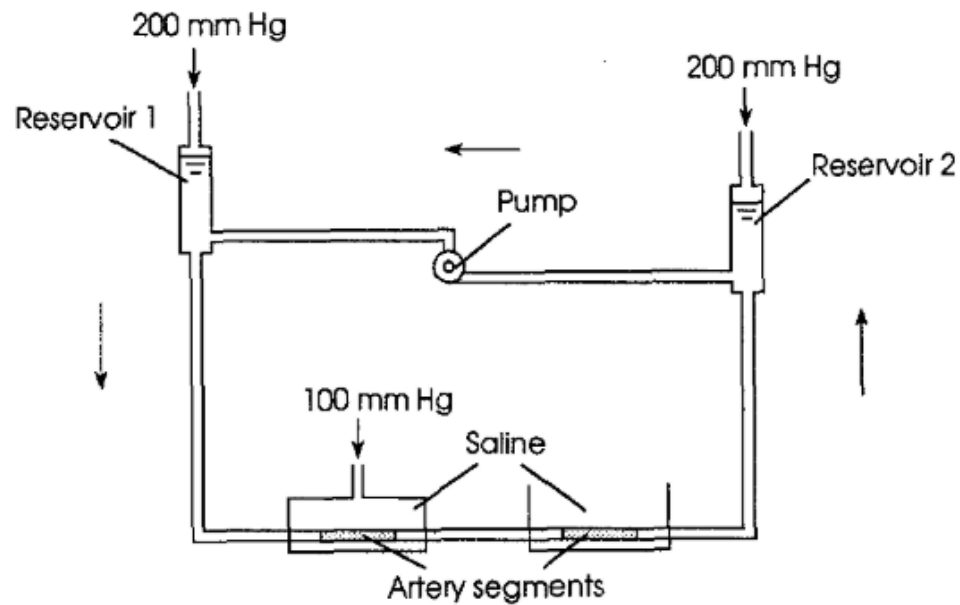


# Incidence of MI Stratified by Diastolic Blood Pressure in the INVEST Study



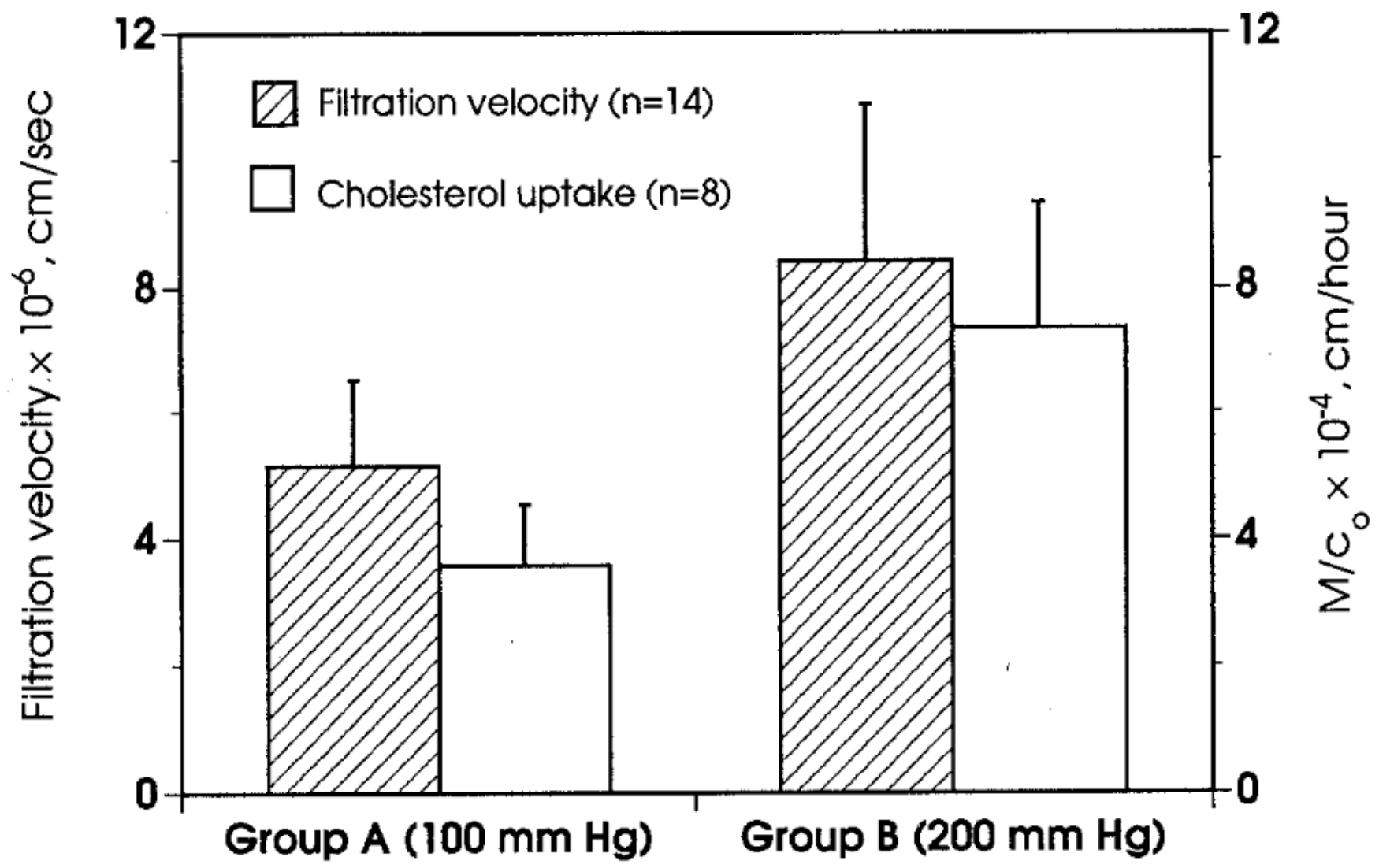


(A)



(B)

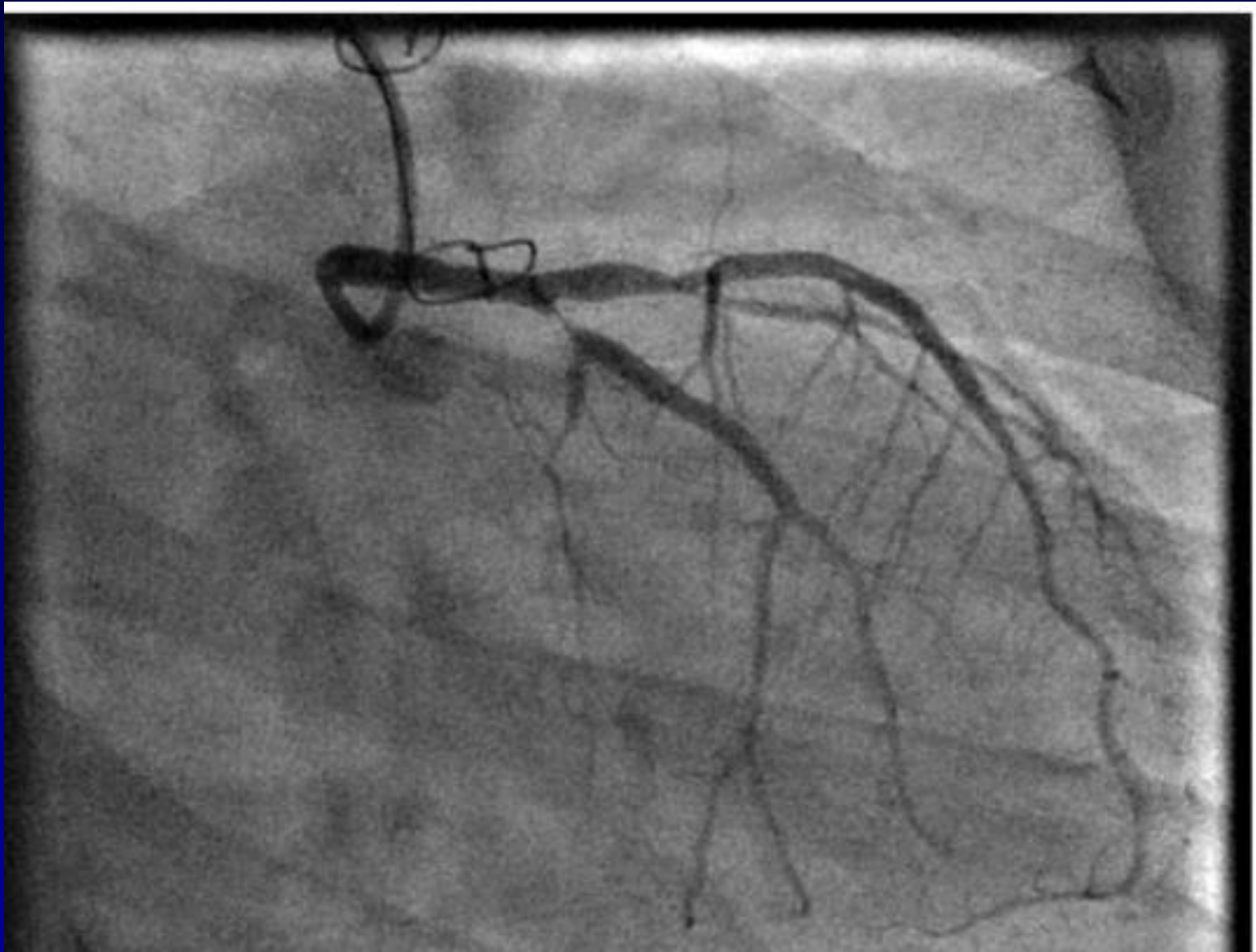
J Vasc SURG 1995;21:135-45





# First Question in Re-engineering

- Between HTN and Hyperlipidemia, which one is the **stronger risk factor** for CAD?
  - a. HTN and no hyperlipidemia
  - b. Hyperlipidemia and no HTN



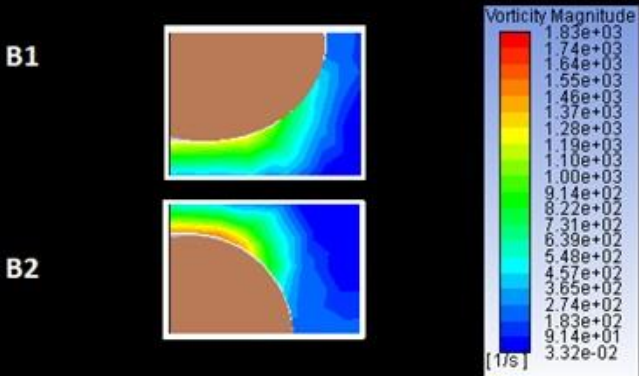
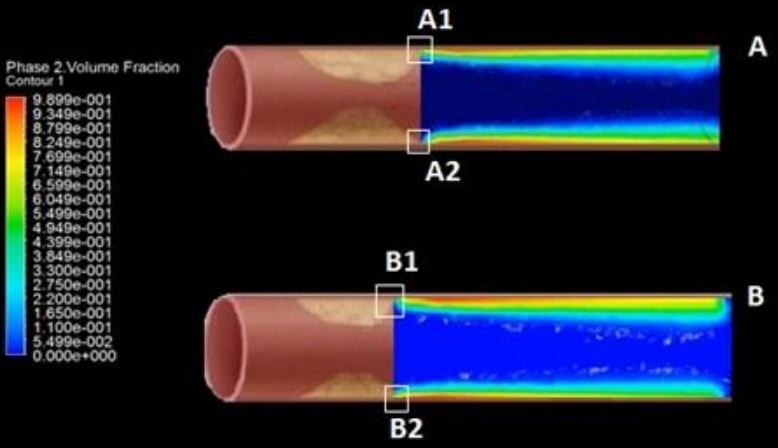
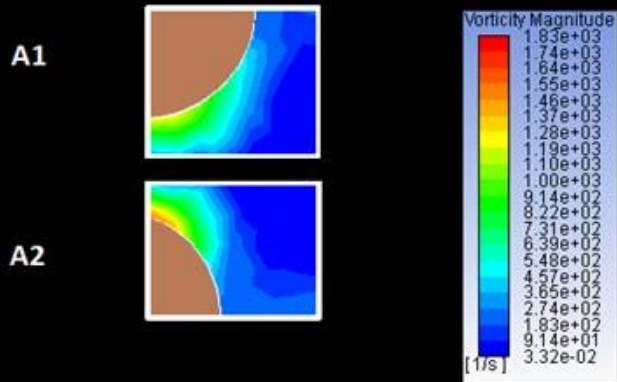
<http://www.vascular-disease-management.com/content/radial-access-pci-children-obstructive-coronary-artery-disease>



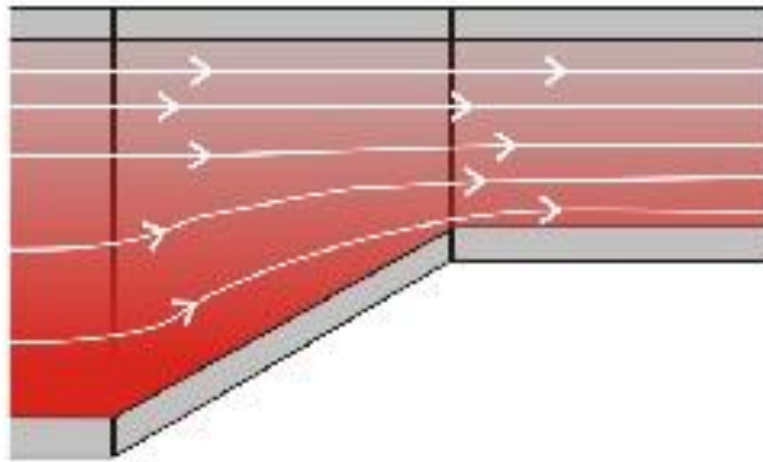
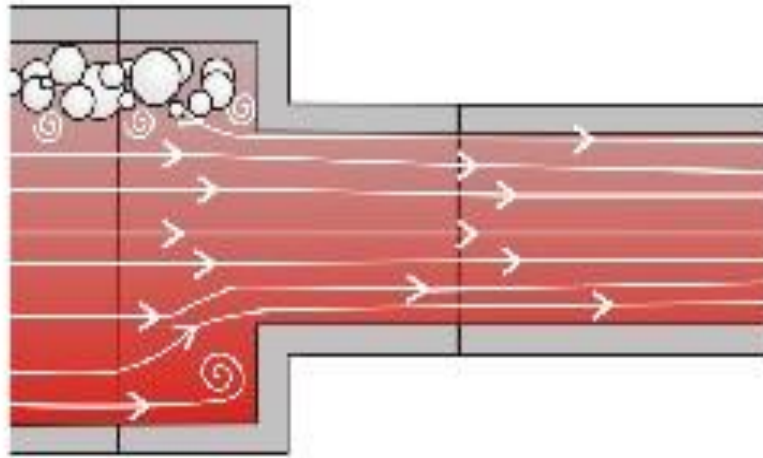
## 2<sup>nd</sup> Question in Re-engineering

Do we need to prevent rupture of the plaque and platelet aggregation in this 50% eccentric lesion?





- Concentric lesion:  
50% and 75%
- Eccentric lesion:  
75%

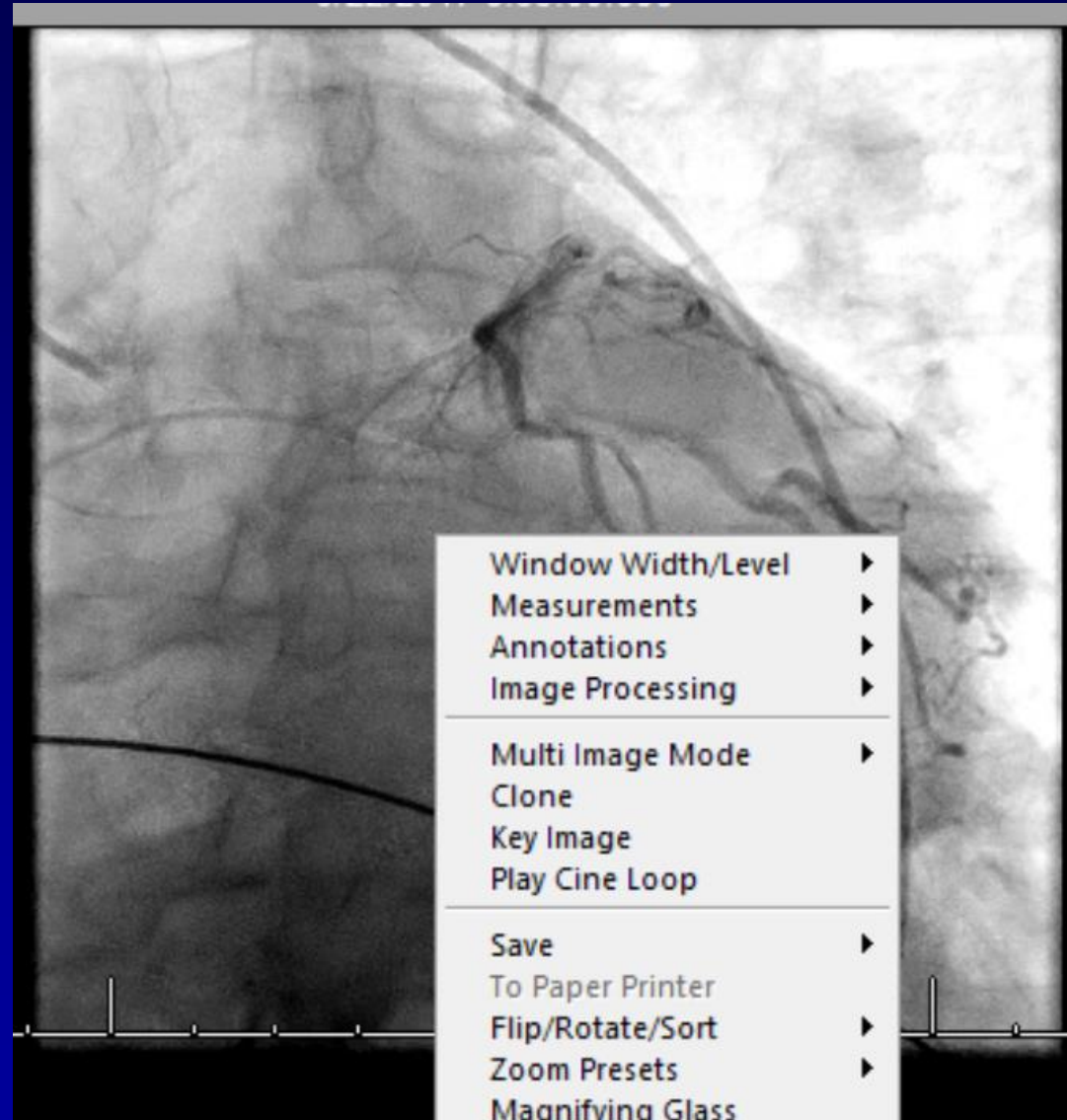


*Eccentric reducers eliminate air/vapour pockets and minimize friction*

<https://www.michael-smith-engineers.co.uk/resources/useful-info/suction-pipeline-design>

# How To Review the Image

- **Right click and use the Key Image option so each frame can be selected at a time. 15 frames per second**





**Frame 25**





**Frame 26**

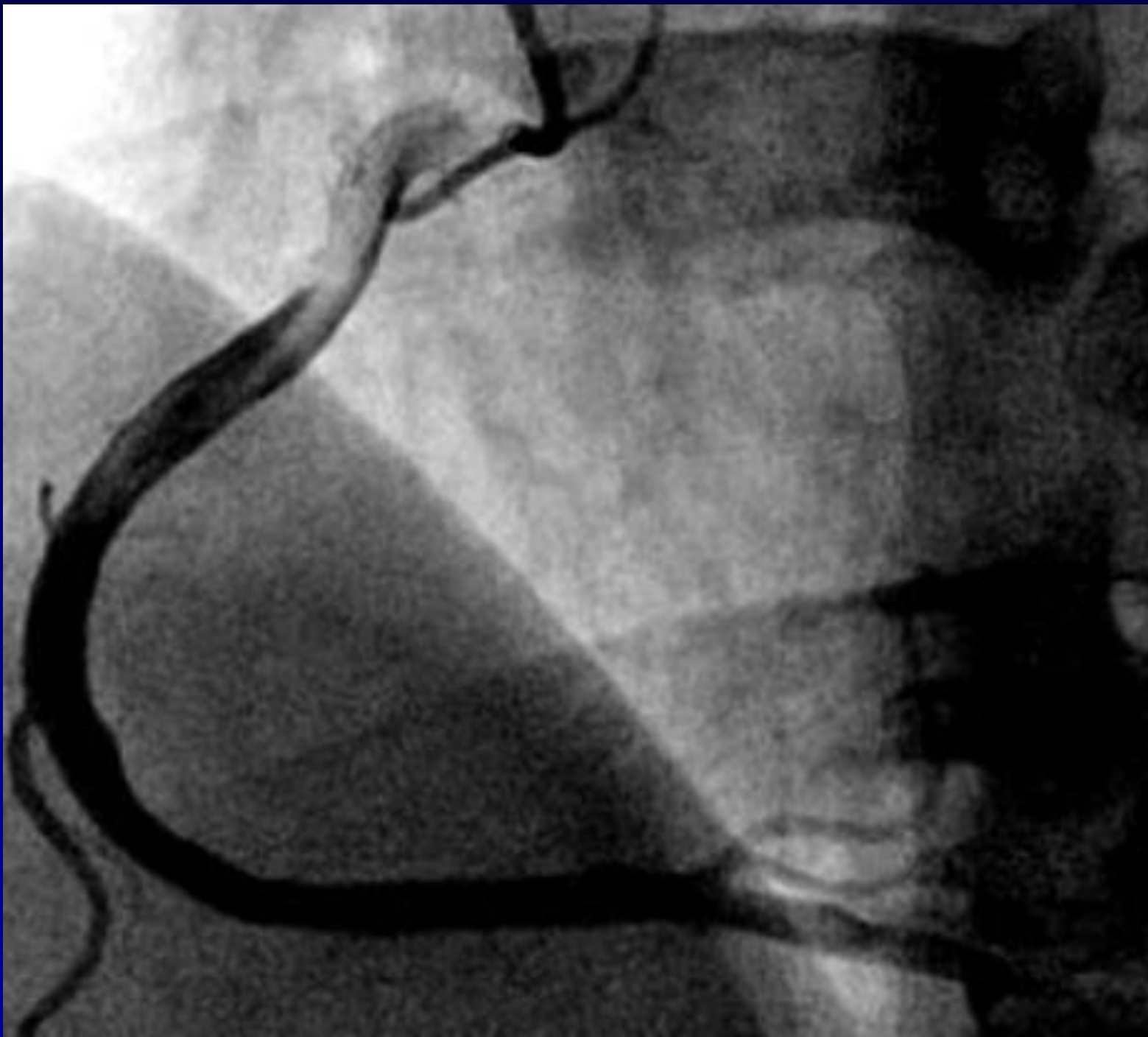


**Frame 27**

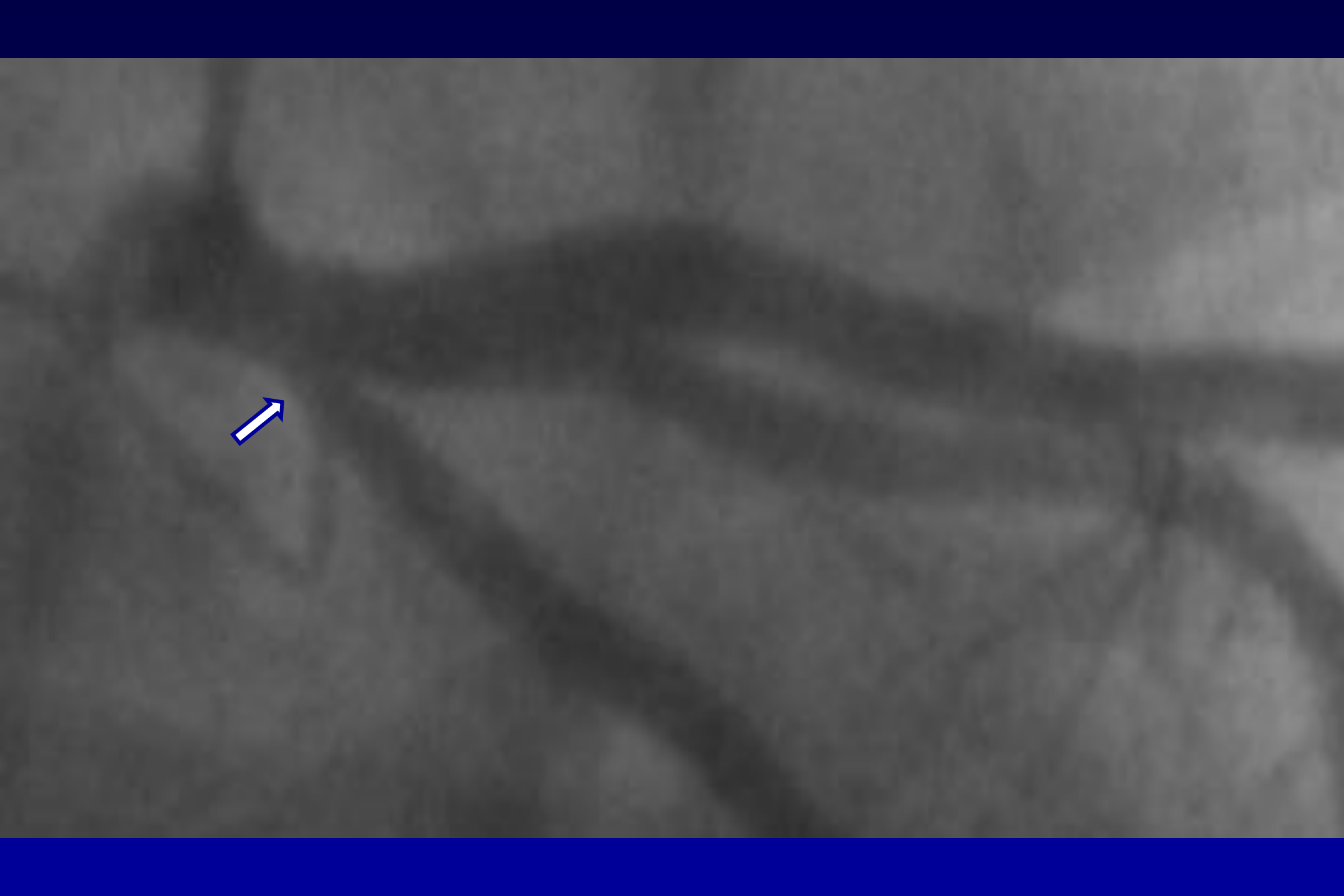
**Separation point**  
**Stream line**

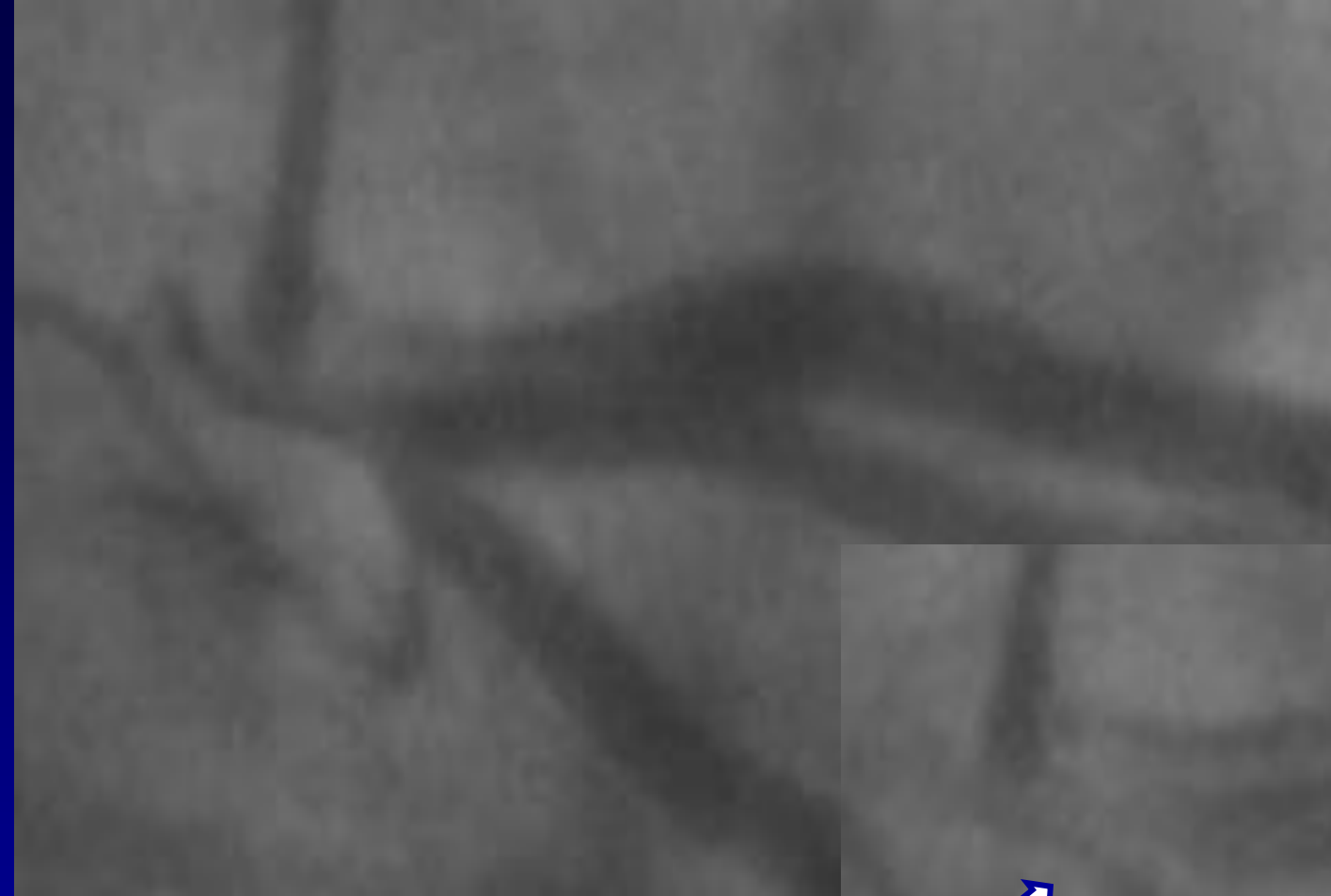


**Frame 28**



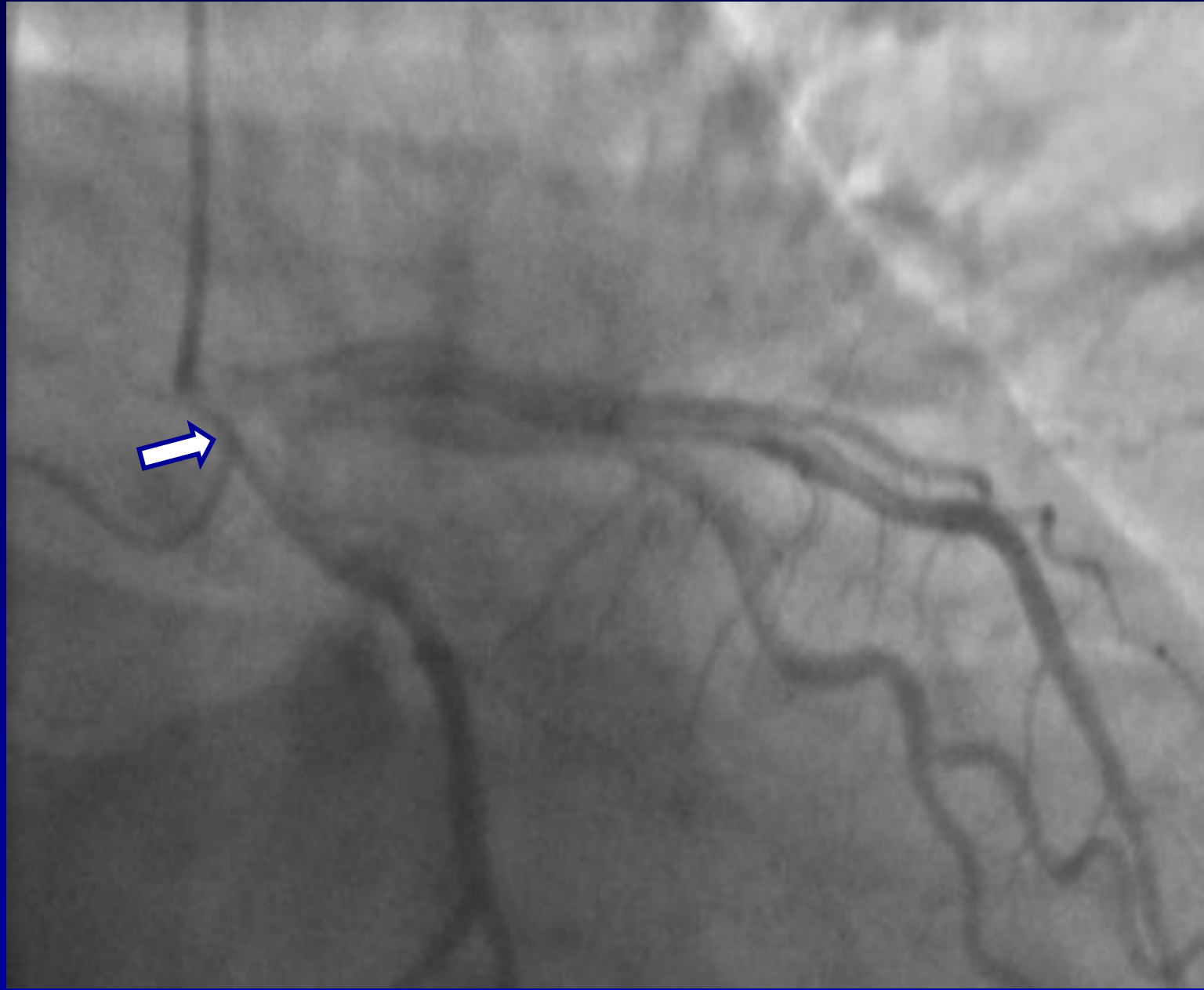
- 60 year young woman

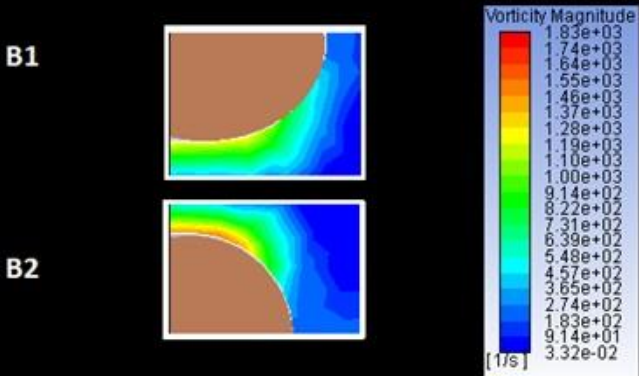
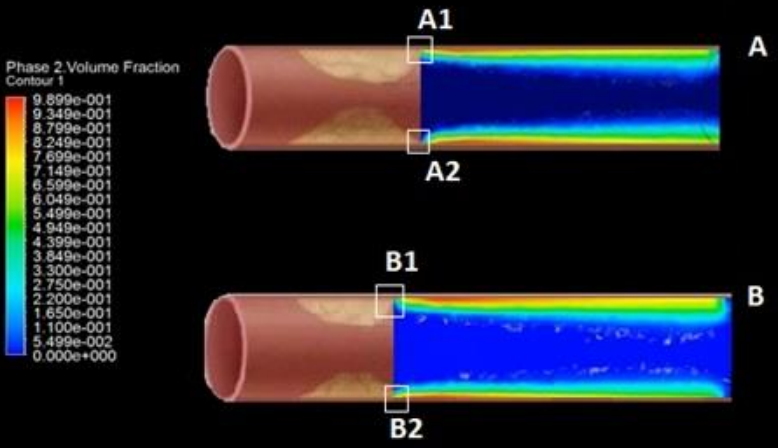
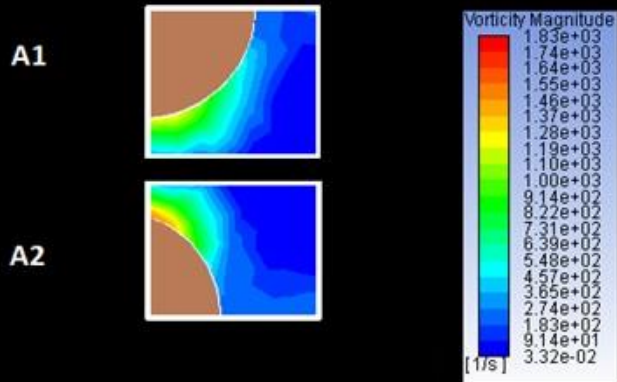




After 0.12 seconds  
flow in the LAD, then  
flow in the LCX

Persisting stain in  
the outer wall  
means area with  
high pressure where  
the bubbles would  
collapse





- Antiplatelet therapy is indicated for 50% and 75% concentric lesion and 75% eccentric lesion:





### 3<sup>rd</sup> Question in Re-engineering

**What causes the lesion mid RCA? How to prevent it?**



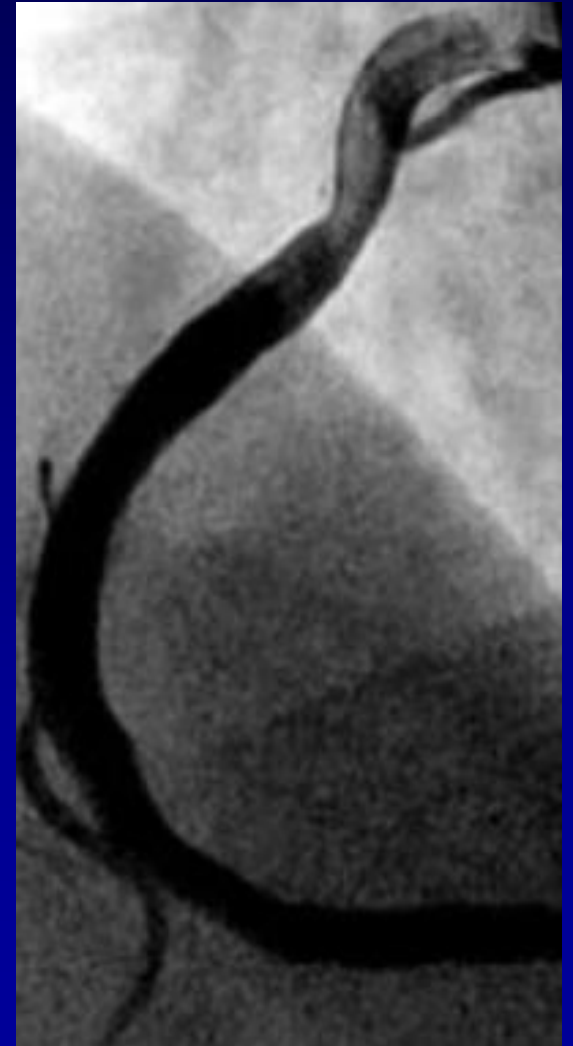
**Which  
kind of  
proximal  
flow causes  
the lesion  
mid RCA?**



# Frame 22 and 23

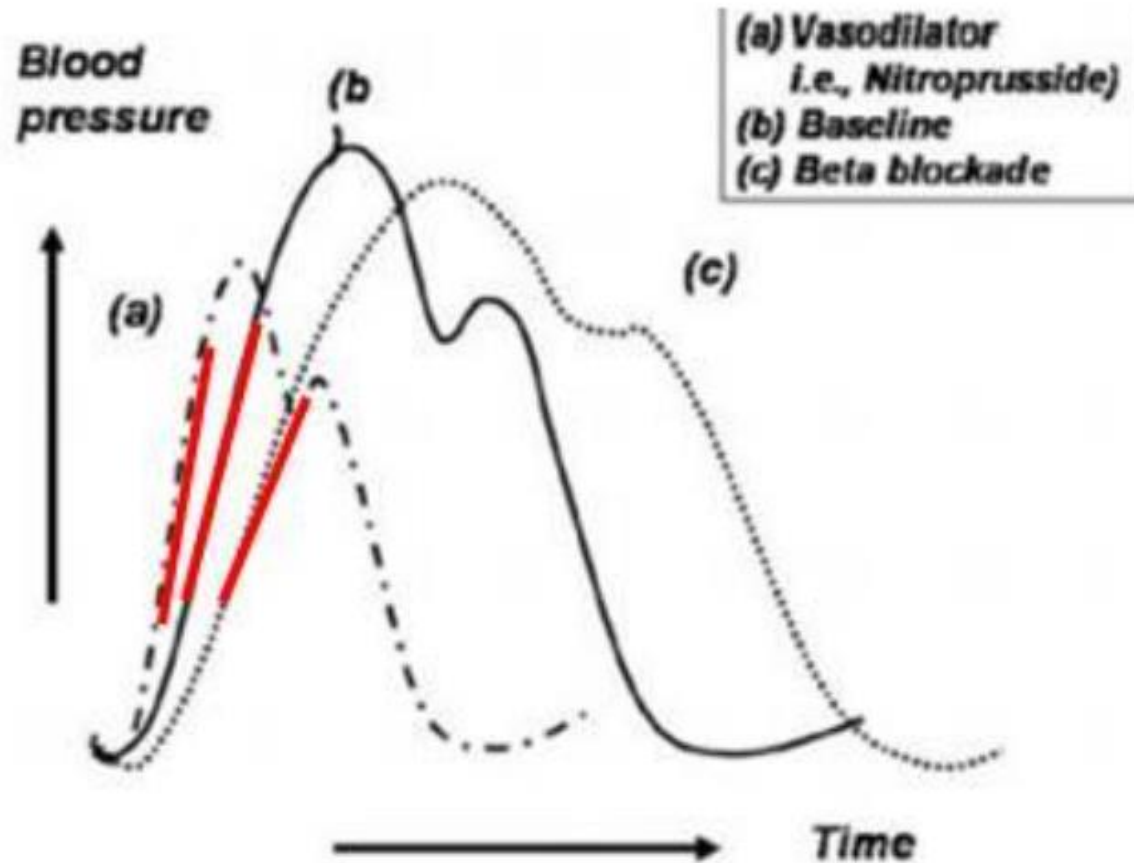


# Frame 24, 25 and 26





**Effects of  
Betablocker:  
Is BB an  
antiplatelet  
agent?**



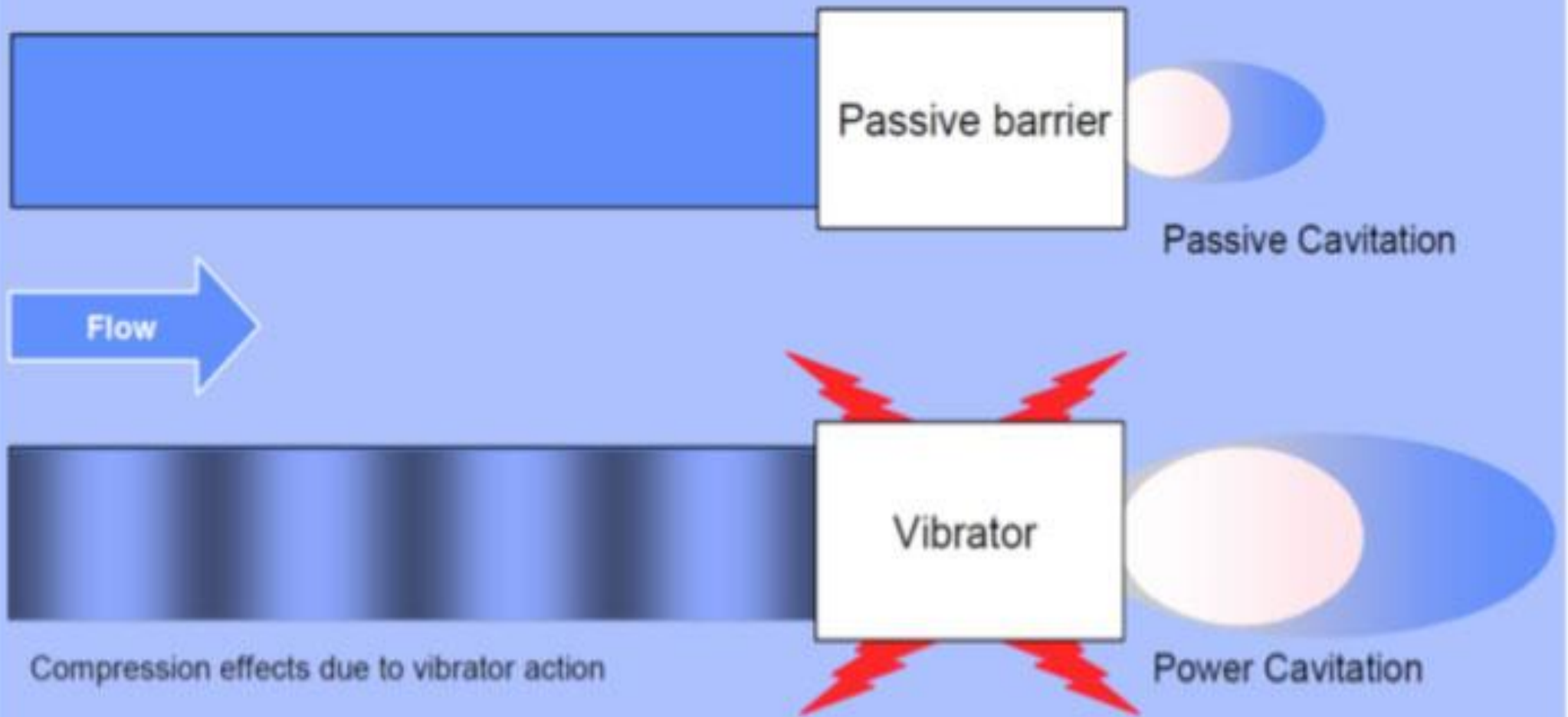
Reproduced from Sanz J et al. (2007)<sup>30)</sup>

**Fig. 7.** Aortic pressure curves under various conditions.

Curve (a), the administration of a vasodilator agent such as nitroprusside; curve (b), the baseline state; curve (c),  $\beta$ -blockade administration.

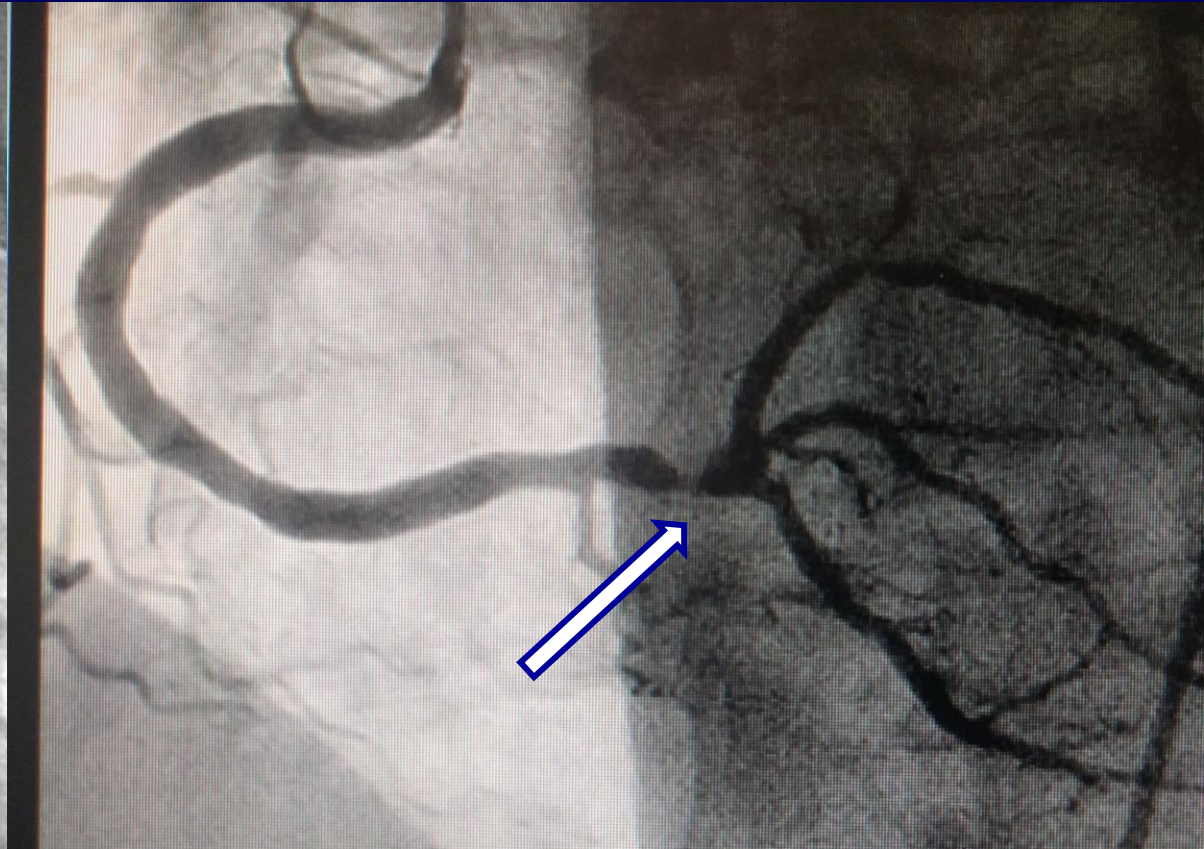
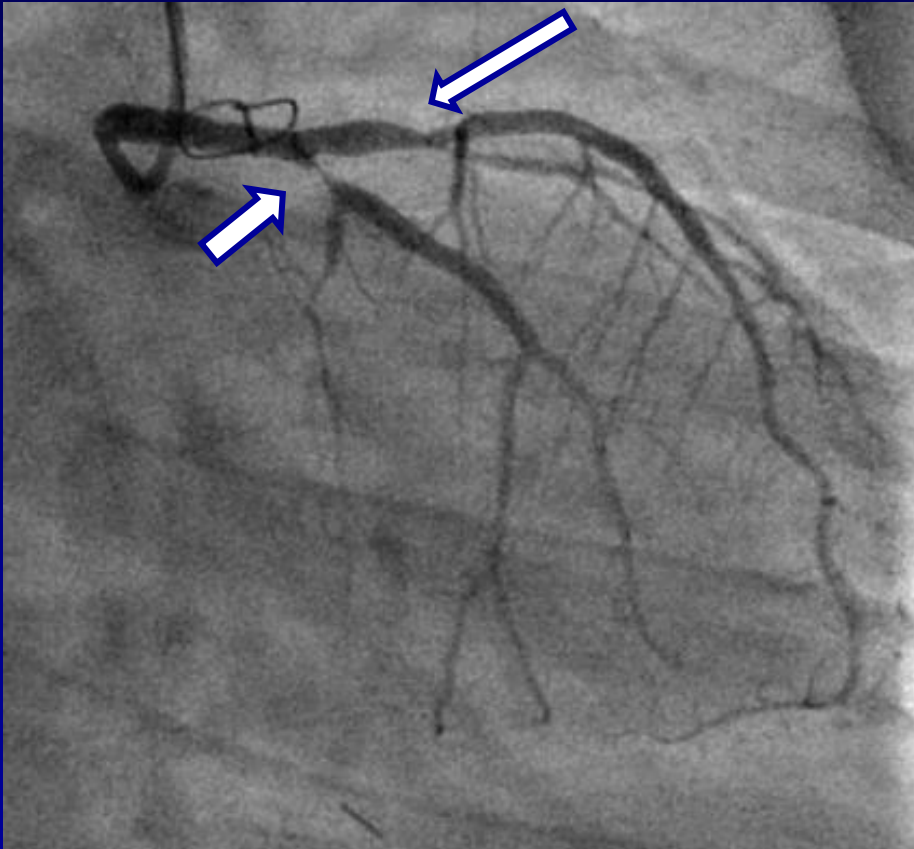


## Difference between passive and active cavitation

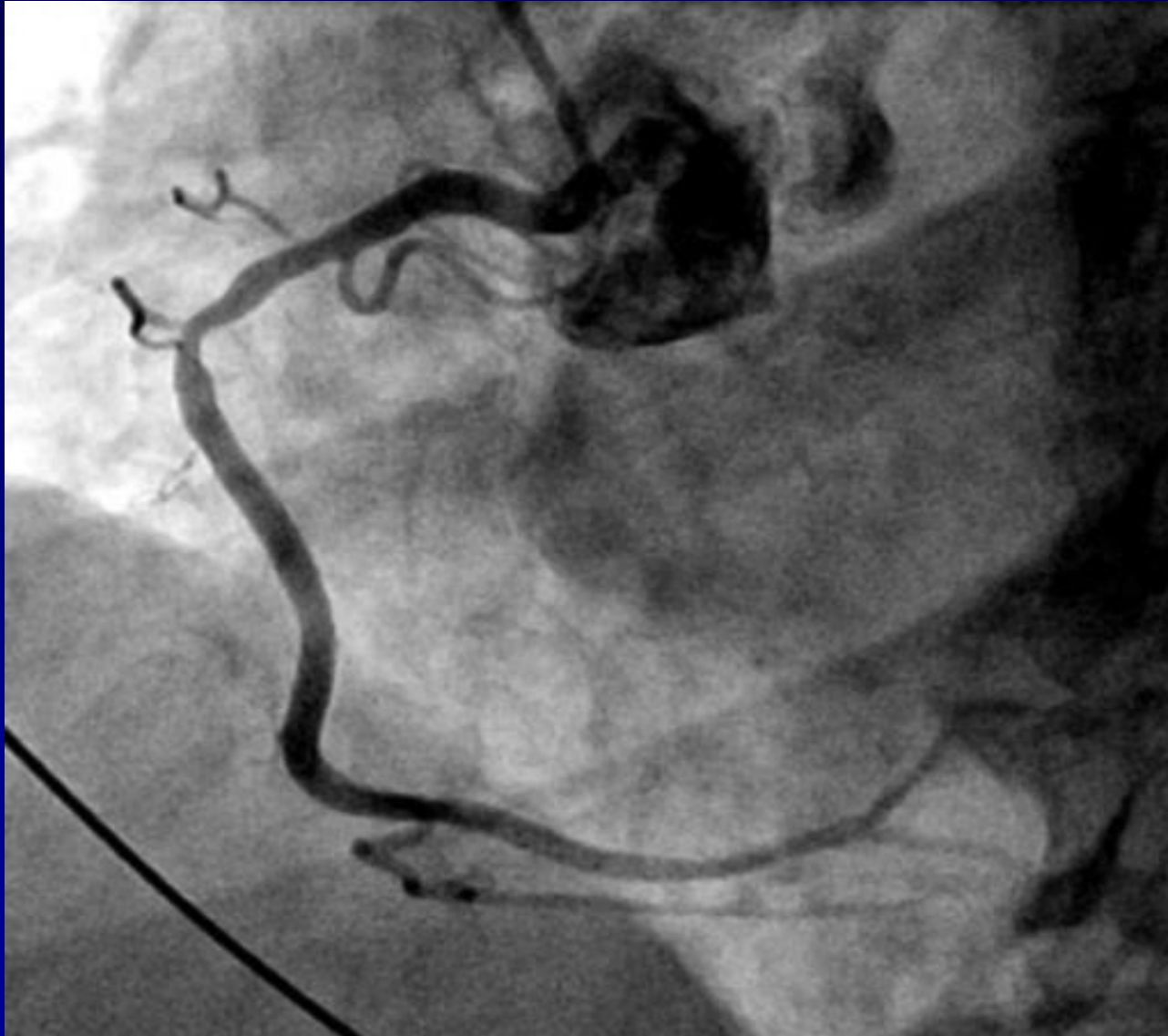




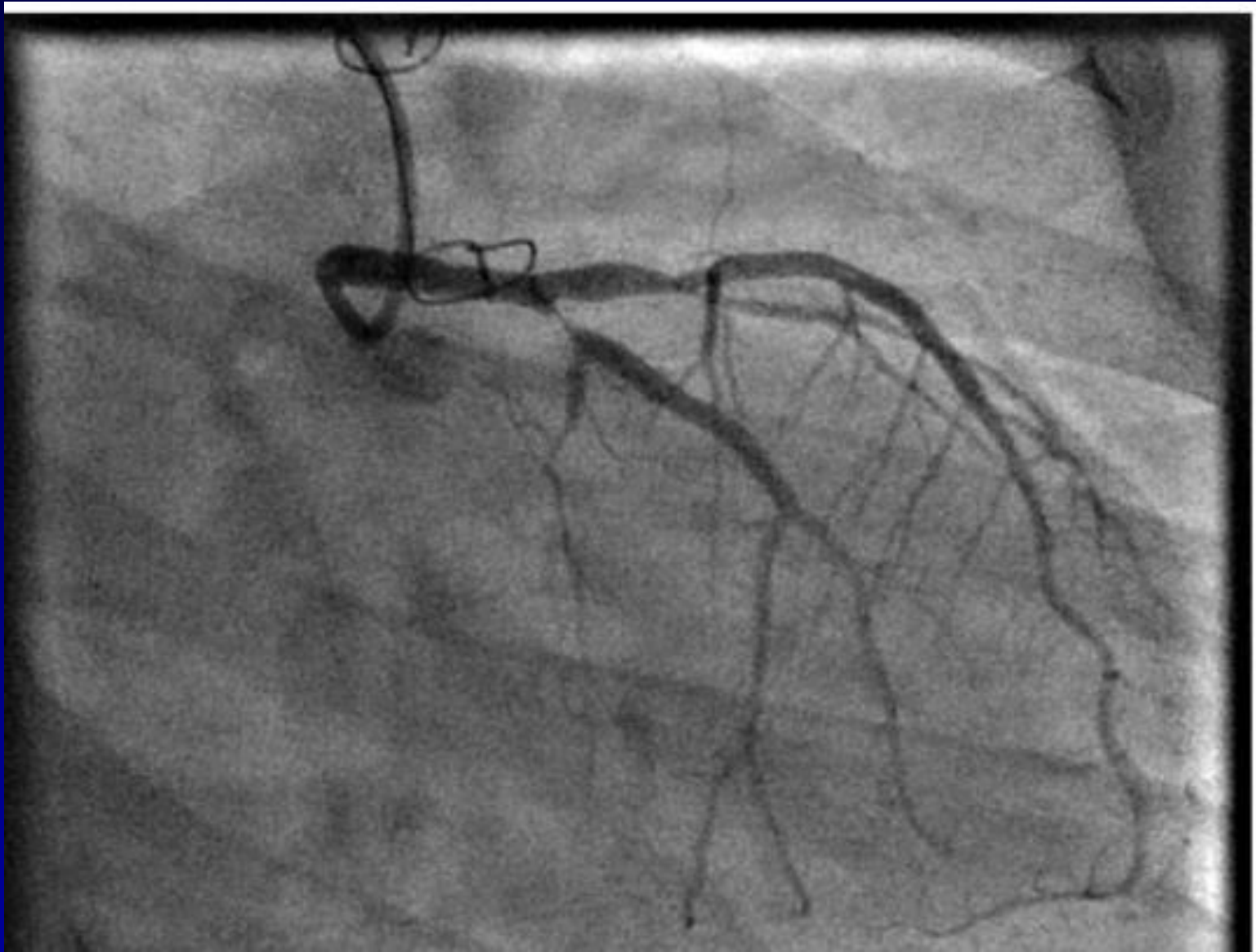
**What is the difference in the mechanism of formation of plaque in the proximal segment vs distal segment ?**



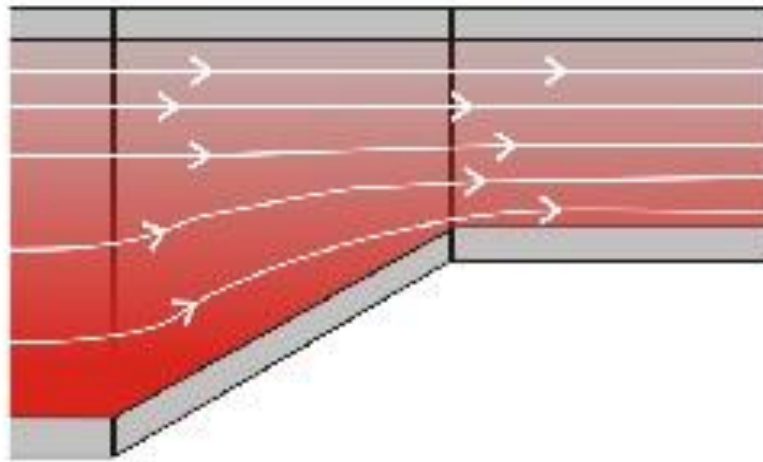
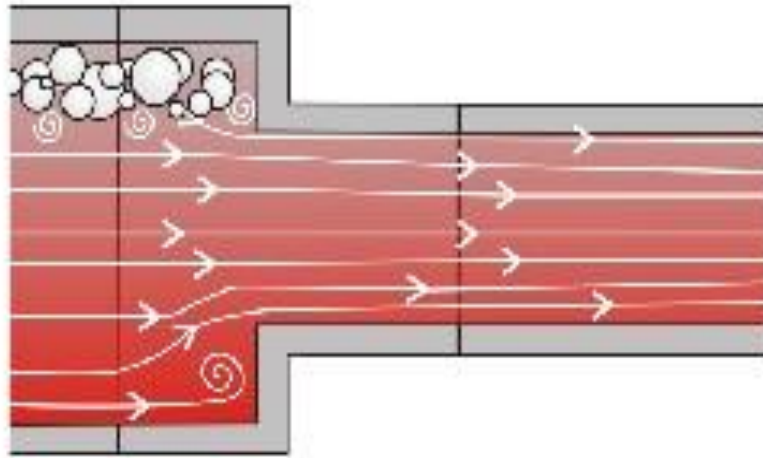
**Why did the lesions happen here? We analyze the flow proximal to the lesion**







HTN versus Hyperlipidemia

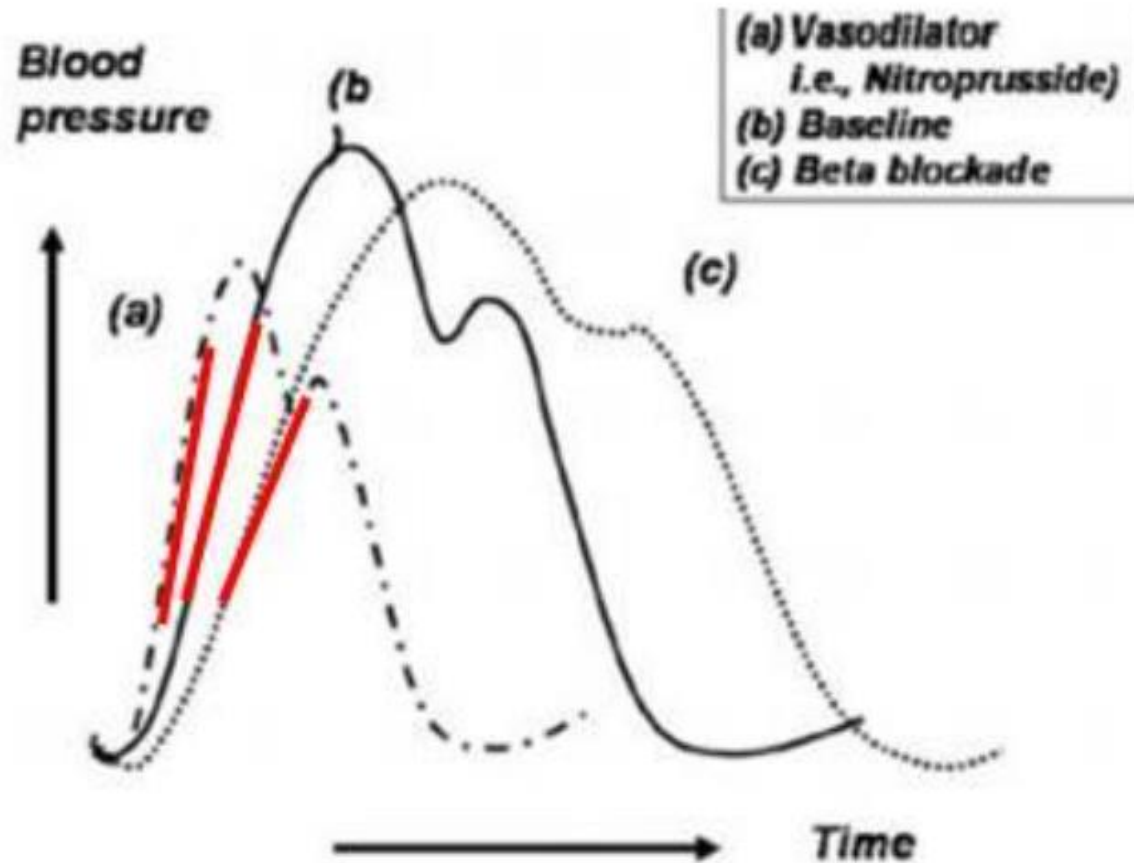


*Eccentric reducers eliminate air/vapour pockets and minimize friction*

<https://www.michael-smith-engineers.co.uk/resources/useful-info/suction-pipeline-design>



**BB is an  
antiplatelet  
agent**



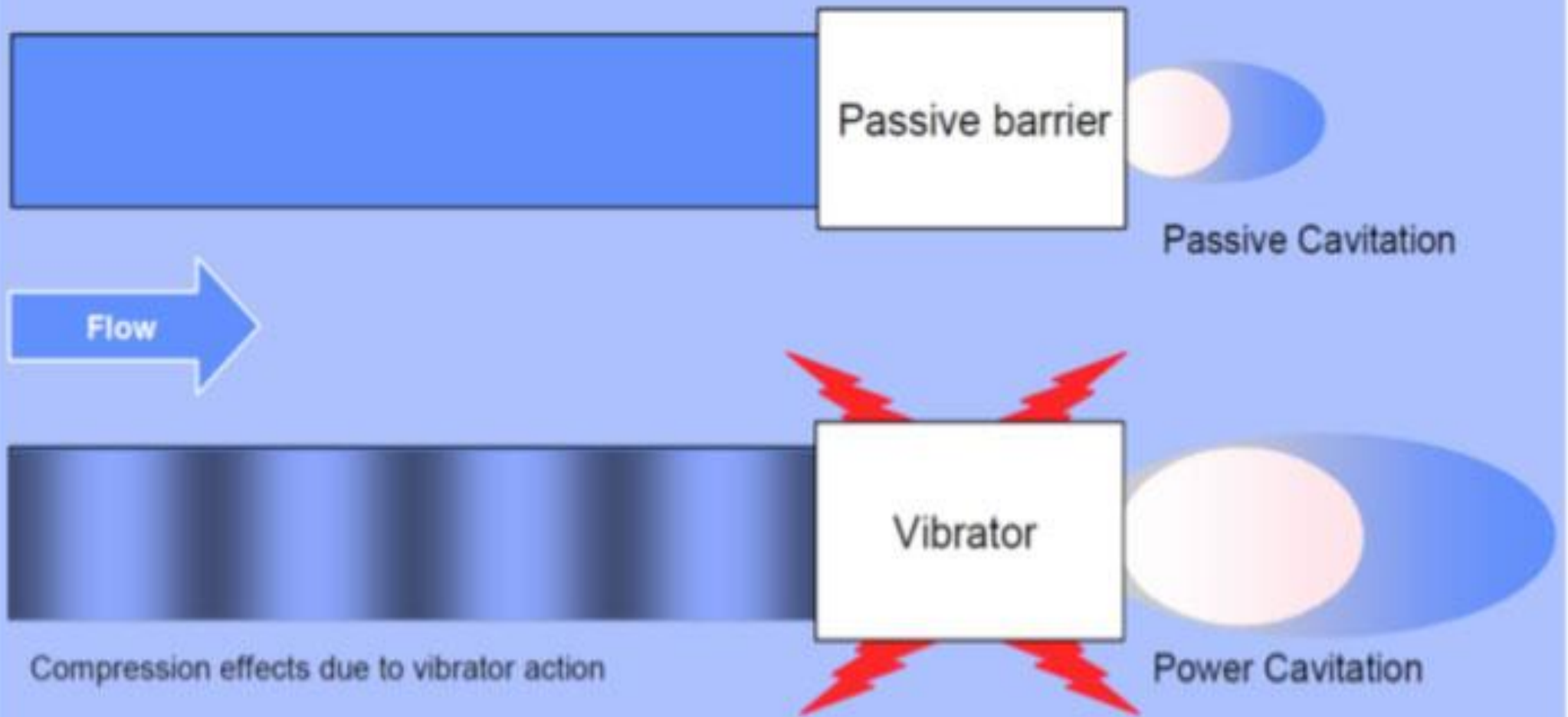
Reproduced from Sanz J et al. (2007)<sup>30</sup>

**Fig. 7.** Aortic pressure curves under various conditions.

Curve (a), the administration of a vasodilator agent such as nitroprusside; curve (b), the baseline state; curve (c),  $\beta$ -blockade administration.



## Difference between passive and active cavitation





Thank You

