

Rotablation and Shockwave in Cardiac Catheterization

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What is Cardiac Catheterization?

- “The insertion and passage of small plastic tubes (catheters) into arteries and veins to the heart to obtain x-ray images (angiography) of coronary arteries and cardiac chambers and to measure pressures in the heart (hemodynamics)” (Sorajja et al., 2020, p. ix).
- In addition to the diagnostic portion of Cardiac Catheterization, interventions such as percutaneous coronary intervention (PCI) and transaortic valve replacement (TAVR) are used to help treat heart disease (Sorajja et al., 2020).

Sheath insertion:

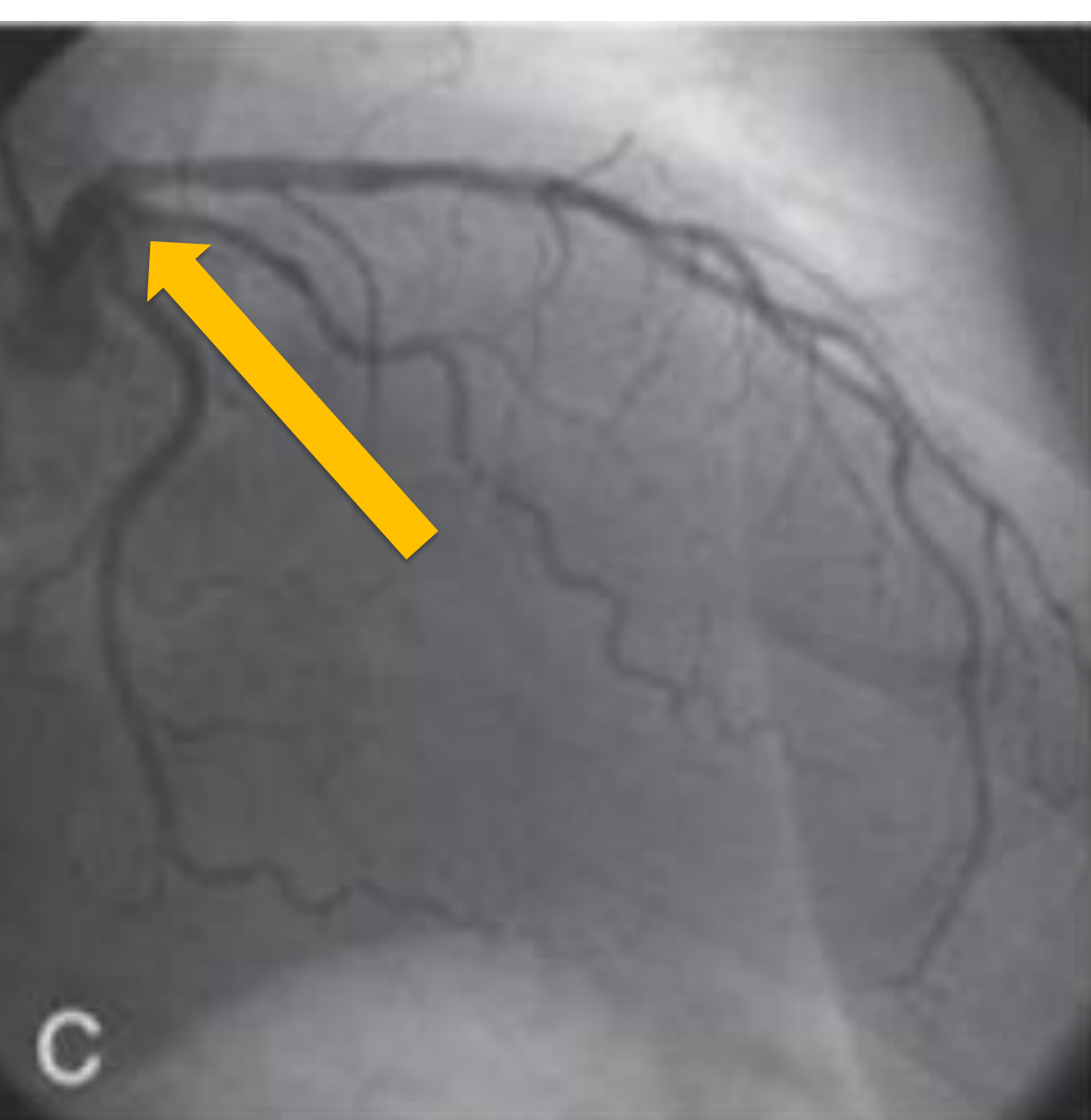
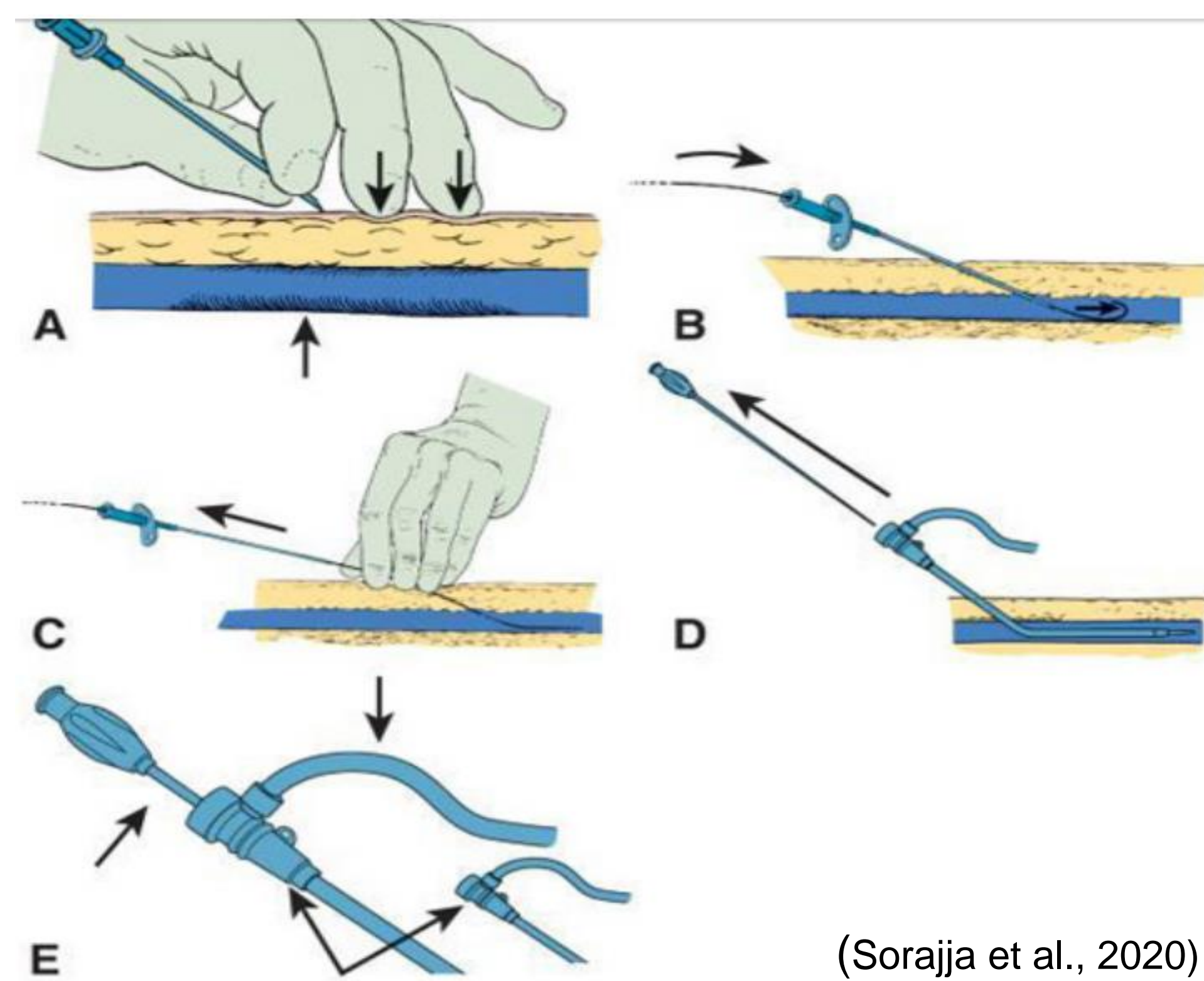


Image C:
Left coronary artery (LCA)

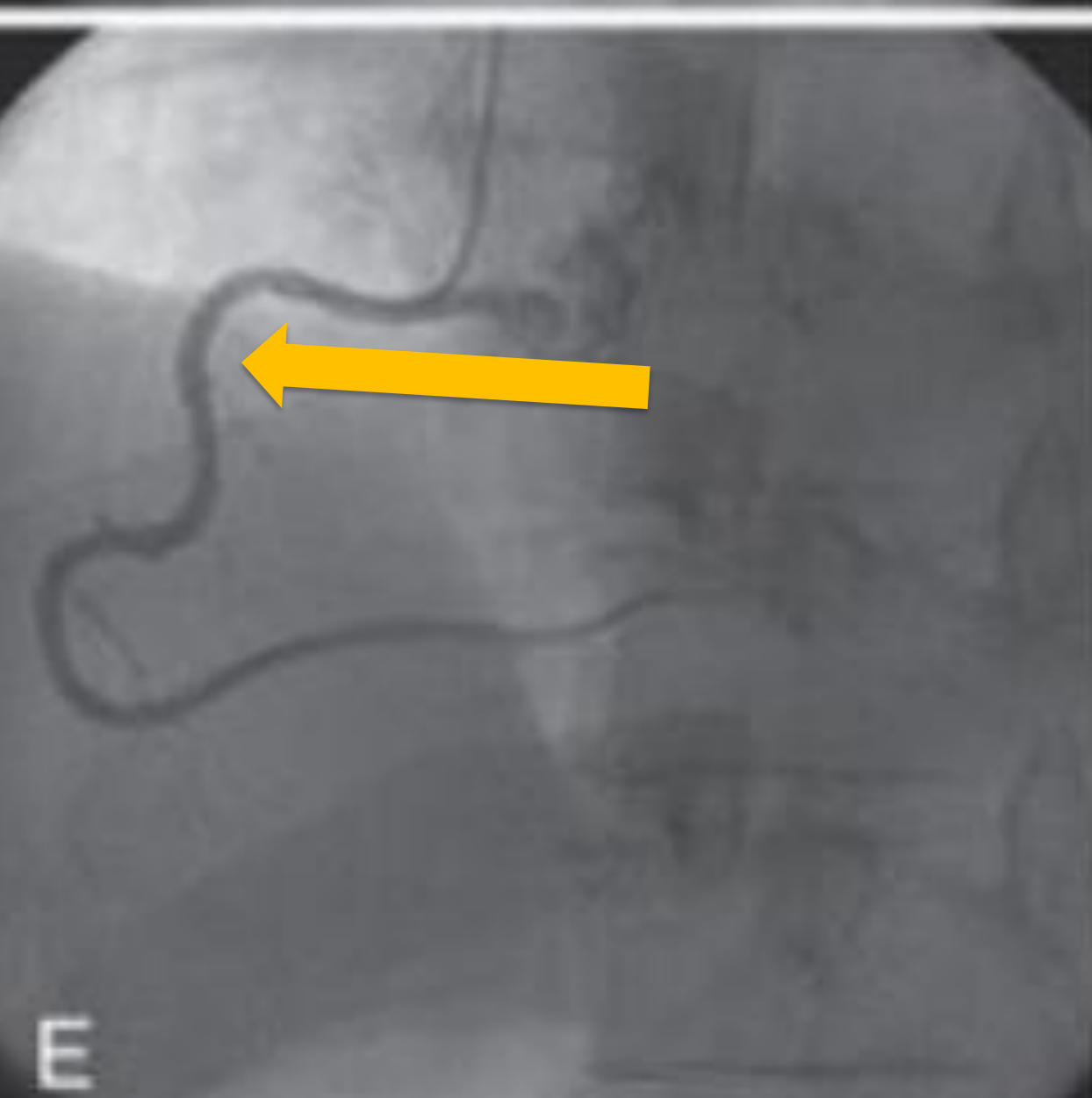
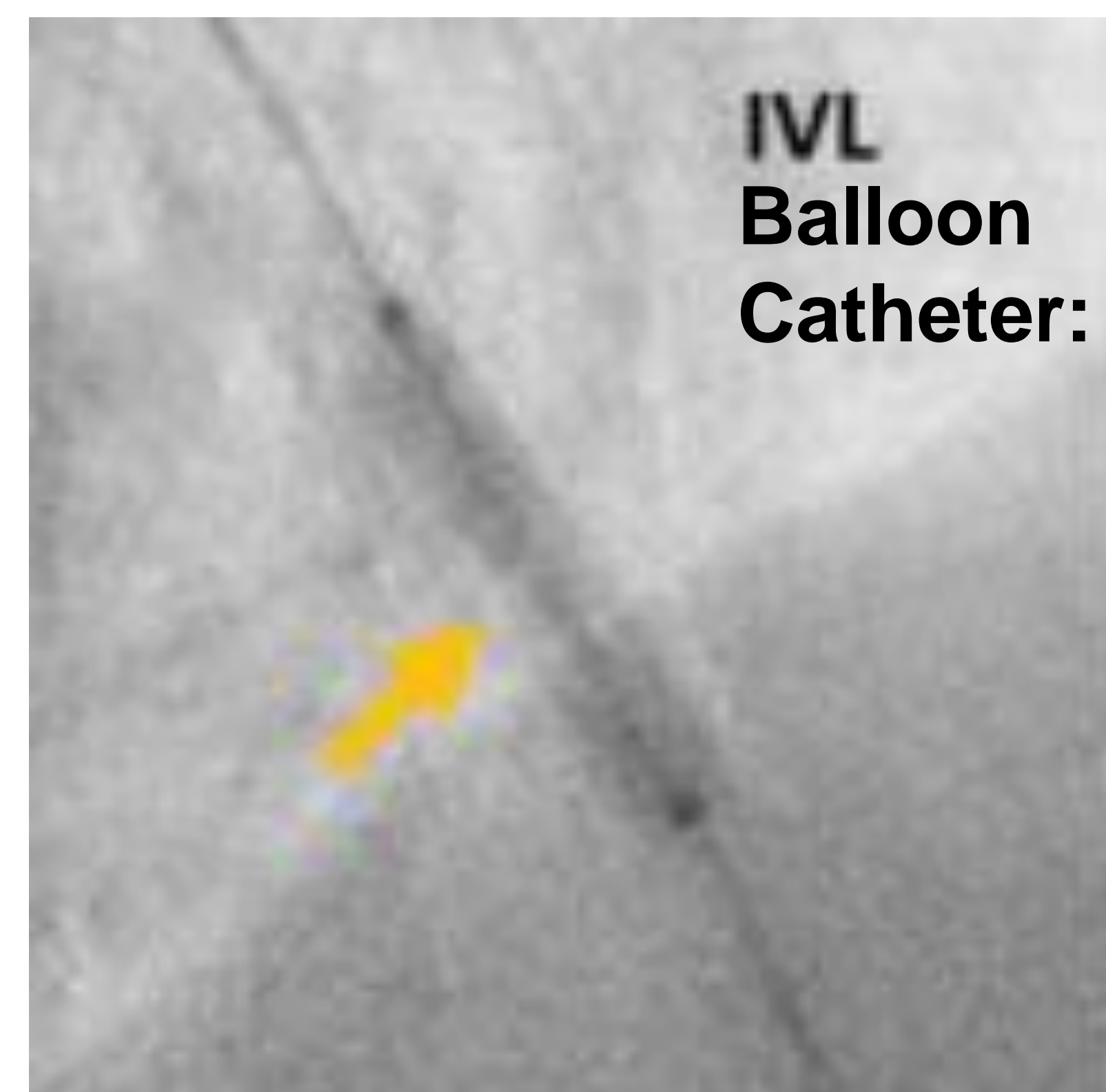


Image E:
Right coronary artery (RCA)

(Sorajja et al., 2020)

What is Shockwave?

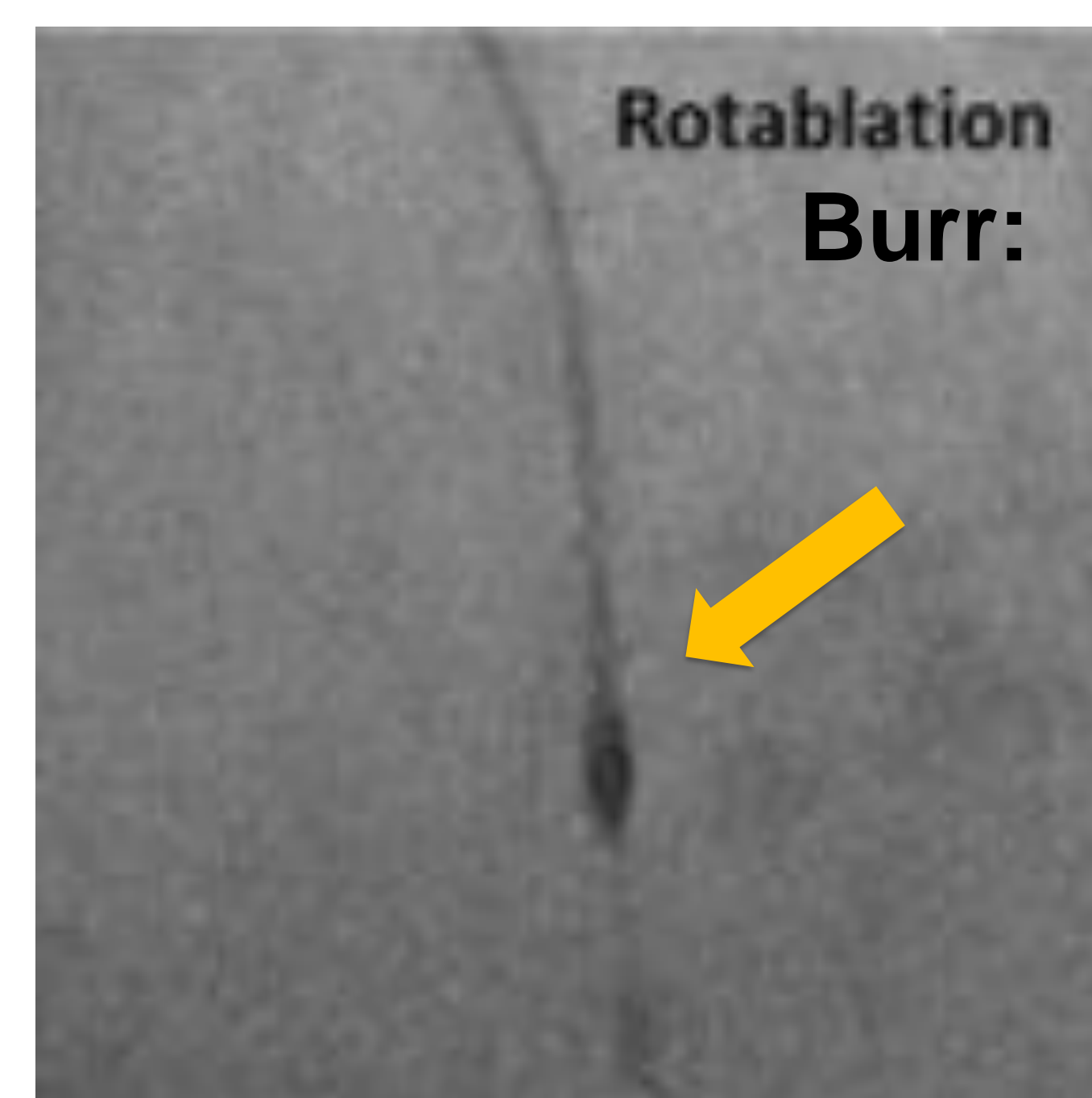
- It is often referred as Intravascular Lithotripsy (IVL) and is more beneficial in treating deeper calcification (Rola et al., 2021).
- Originates from Lithotripsy used on the kidneys to break up stones. The “system emits pulsatile mechanical energy” (Mousa et al., 2023, p. 3).
- Uses a small balloon to send pulses of sonic pressure waves to break up calcification in the coronary arteries (Bennett et al., 2023).



(Mousa et al., 2023)

What is Rotational Atherectomy?

- Often referred to as Rotablation (RA) and is most beneficial in treating superficial calcification (Rola et al., 2021).
- Uses a single burr made of diamond crystals. Making it abrasive to the calcification (Mousa et al., 2023).
- Uses the rough head and quick rotation to create a passage way through calcified lesions (Bennett et al., 2023).



(Mousa et al., 2023)

Why are RA & IVL important?

- These two “therapies” are important because plaque buildup in the coronary arteries can cause heart attacks.
- Keeping calcium buildup to a minimum is important in preventing heart attacks.
- Stenting can aid in keeping the coronary arteries clear but the plaque needs to be cleared so there is no stent restenosis.

RA vs IVL:

- RA itself is a good way to drill through calcium in arteries, however they often only act as a “roadmap” or can help with the “superficial calcification” (Hlinomaz et al., 2021, p. E 136).
- RA has substantial risk associated with it including complications such as “perforation, short-time closure, side branch loss, and the slow-flow/no-flow phenomenon, vasospasm, and burr entrapment” (Rola et al., 2021, p. 214).
- IVL is a good therapy to clear deep and thick plaque. It creates “multiple fissures and microexplosions” to allow the plaque buildup to be moved and flushed out in order for stents to be placed (Hlinomaz et al., 2021, p. E 136).
- Greater fluoroscopy times have been seen with RA in comparison to IVL. The fluoroscopy times for IVL on average were 8.5 minutes shorter than that of RA (Mousa, 2023). “Recent study suggested that shockwave intravascular lithotripsy might be a simple, safe, and effective alternative method aiming at modification of heavily calcified lesions” (Rola et al., 2021, p. 214).
- IVL is still a newer therapy compared to RA. With more use of IVL the greater outcomes are likely to increase with more use. IVL can be seen as a “bail-out option” when RA has not broken up enough plaque to place any stents. However, with more experience with IVL it is anticipated that the therapy will begin to be used more and provide “patients with overall better cardiovascular outcomes” (Wong et al., 2022, p.297).

RA & IVL- “Rotatripsy”

- The use of RA and IVL together may be necessary when the one therapy is not enough to clear enough plaque. Many studies look at the use of RA to create a passageway for the IVL catheter to clear the last of the plaque and allow for stent placement (González-García et al., 2022).

Case study- RA vs IVL:

- 63 year old man, referred to hospital for PCI with RA after an unsuccessful PCI. Right Coronary artery (RCA) lesion was attempted to be dilated with RA and a scoring balloon but all failed and resulted in a “dog-bone” look of the artery.
- Procedure was terminated due to long exposure time & large amounts of contrast but was brought back two weeks later for successful IVL treatment. Two overlapping drug-eluting stents (DES) were implanted. “This case highlights that RA is merely paving the road & may help in superficial calcifications” (Hlinomaz et al., 2021, p. E136).

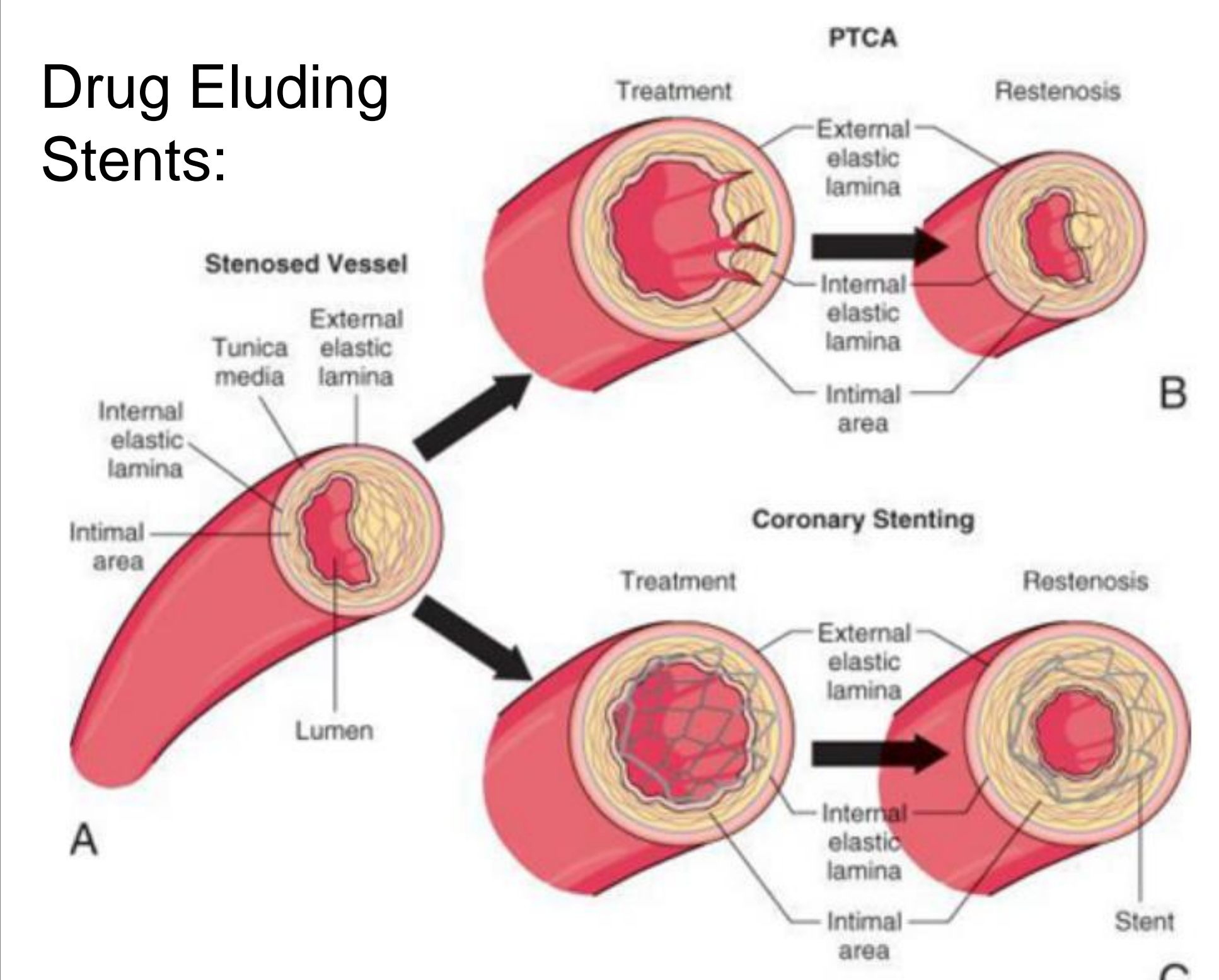
Case study- RA & IVL “Rotatripsy”:

- 76 year old male, increasing chest pain, severe calcification in the left anterior descending artery (LAD). Initial dilatation attempt with non-compliant balloon and result was under expansion with a “dog-bone” image.
- RA was performed, lesion continued to have a “dog-bone image and IVL was then used for “calcium debulking”. Plaque cleared enough to place two overlapping DES. (González-García et al., 2022, p. 180).

Conclusion:

The use of RA and IVL can be more beneficial when used in conjunction than alone. RA can act as a roadmap so that the IVL catheter can enter the lesion to produce pulses and break up the leftover calcium in order for DES to be implanted.

Drug Eluting Stents:



(Sorajja et al., 2020)