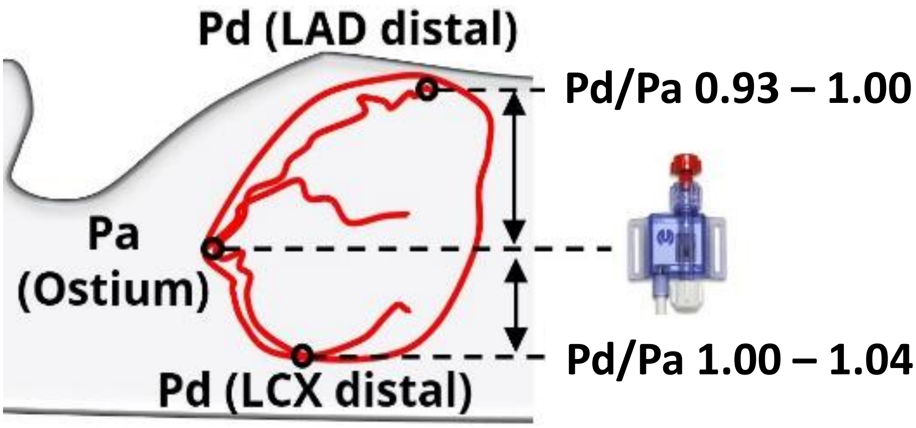
Abstract published by ESC
https://esc365.escardio.org/presentation/250751?resource=abstract

A novel fluid-filled pressure wire avoids hydrostatic errors in physiologic measurements

Authors:
O. Angeras[1], M. Hilmersson[2], P. Torild[1], G. Hirlekar[1], A. Myredal[1], T. Ramunddal[1], C. Dworeck[1], B. Redfors[1]
(1) Sahlgrenska University Hospital, Gothenburg, Sweden, (2) Cavis Technologies AB, Uppsala, Sweden

BACKGROUND

Hydrostatic pressure impacts intracoronary pressure measurements, generally causing overestimation of stenosis significance in the LAD and underestimation in non-LAD vessels (1, 2, 3). Different cut-offs have been suggested for post-PCI FFR (4), corresponding to average hydrostatic effects (1, 2, 3). Different cut-offs and stenosis misclassification may be avoided if hydrostatic effects are eliminated.



Hydrostatic effects ~99% of population (1, 3)

PURPOSE

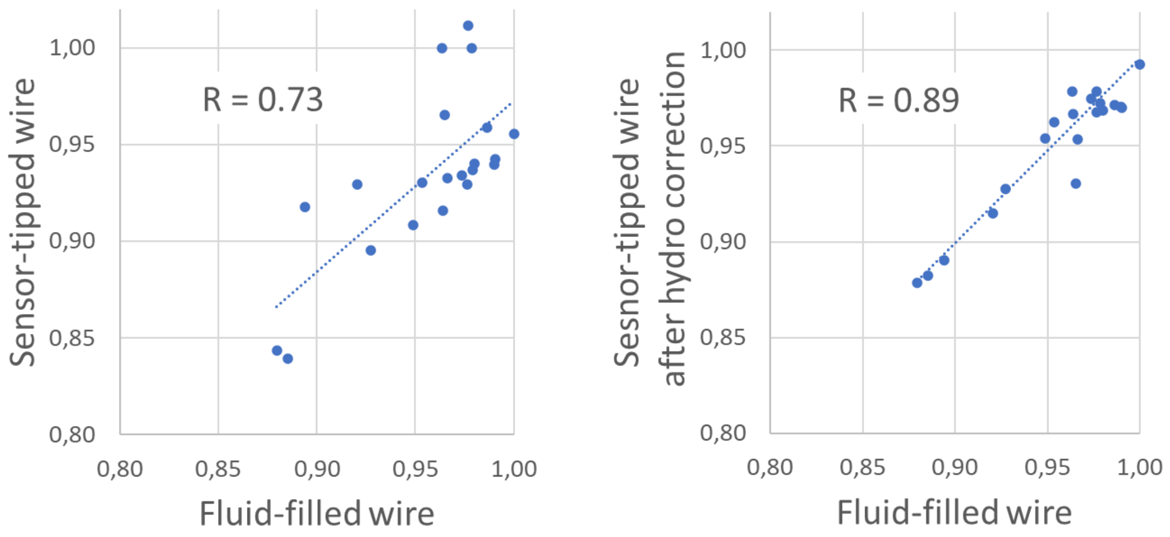
We aimed to compare the effect of hydrostatic pressure on resting distal-to-aortic coronary pressure ratio (Pd/Pa) and FFR, using a conventional sensor-tipped- versus a novel fluid-filled pressure wire. Since the fluid-filled wire has an outside-the-body pressure transducer instead of a sensor at the tip, the fluid (saline) compensates for the hydrostatic pressure that is inside the patient's body.

METHODS

We placed the sensor of a sensor-tipped wire and the measure point of a fluid-filled wire at the same location in the coronary vessel. By performing simultaneous measurements, we aimed to assess the relationship between vertical height differences and distal pressure (Pd). We measured the vertical height difference between the tip of the guide catheter and the measure point, by changing the vertical position of the cath lab table and assessing the total distance in mm between the two table positions.

RESULTS

The two wires were used simultaneously in 21 arteries. The lower in the coronary tree the measurements were made, (e.g., in the LCX or RCA), the higher the Pd value by the conventional wire was, compared to the novel wire; the higher the measurement was made, (e.g., in the LAD), the lower the Pd value. After we corrected for hydrostatic effect on the sensor-tipped wire using the height measurement (0.77 mmHg/cm (2)), sensor-tipped wire pressure correlated better with fluid-filled wire pressure (R=0.73 vs. R=0.89 at rest and R=0.83 vs. R=0.96 at hyperaemia).



Pd/Pa at rest, with and without hydrostatic error

Drift was also compared in 33 simultaneous measurements. The fluid-filled wire demonstrated less drift than the sensor-tipped wire (standard deviation 0.11 vs. 0.18). With an increasing number of cases, less drift was observed, possibly learning curve-related.

Finally, we compared measurements of pressure-derived CFR using the fluid-filled wire, versus echocardiography-CFR (n=10) and bolus thermodilution-CFR (n=11). Pressure-derived CFR with the fluid-filled wire correlated to echocardiography-CFR and thermodilution-CFR (R=0.69 and R=0.76 respectively). Sensor-tipped wire pressure-derived CFR did not correlate to thermodilution-CFR measurements (n=11; R= -0.57).

CONCLUSIONS

Hydrostatic pressure introduces a variable error in conventional intracoronary pressure measurements. Resting indices are more susceptible to the hydrostatic error than hyperaemic. There is a slight learning curve associated with use of the novel wire, but hydrostatic errors in physiologic measurements can be avoided thanks to the wire's fluid-filled design and external pressure transducer.

References

1. Härle T et al. JACC Cardiovasc Interv. 2017 Apr 24;10(8):764-773

2. Kawaguchi Y et al. J Interv Cardiol. 2019 Sep 2;2019:4532862

3. Al-Janabi F et al. . Cardiol J. 2021;28(1):41-48

4. Hwang D et al. . EuroIntervention. 2019 Aug 29;15(5):457-464