

## ABSTRACT

**Background:** Assessment of blood flow characteristics before and after carotid artery stenting give insights into the effects of stent placement and it might lead to improved patient and stent selection. Quantitative flow analysis can be performed using ultrasound particle image velocimetry (echoPIV), however, the performance of this technique in the presence of a stent is unknown.

**Methods:** Differences between stented and non-stented areas in an in-vitro carotid artery phantom with a Wallstent were analyzed using PIV on high-frame-rate contrast-enhanced ultrasound acquisitions.

**Results:** Laminar flow patterns were visible in both stented and non-stented areas. Mean and peak velocities were lower in stented area compared to non-stented area. The experimental peak velocities were lower than theoretical and numerical estimations of peak velocity.

**Conclusions:** EchoPIV is a suitable technique for blood flow analysis in a stent in an in-vitro setup.

## BACKGROUND

- Carotid artery stenting
- Pre-procedural patient and stent selection
- Detailed analysis of blood flow characteristics
- Technique: EchoPIV

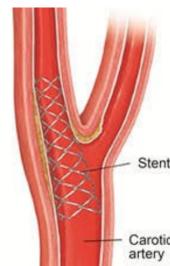


Figure 1: Carotid artery stent [1]

## PURPOSE

To evaluate the performance of echoPIV in a carotid artery stent

[1] <https://www.uwmedicine.org/health-library/pages/carotid-angiogram.aspx>

## METHODS

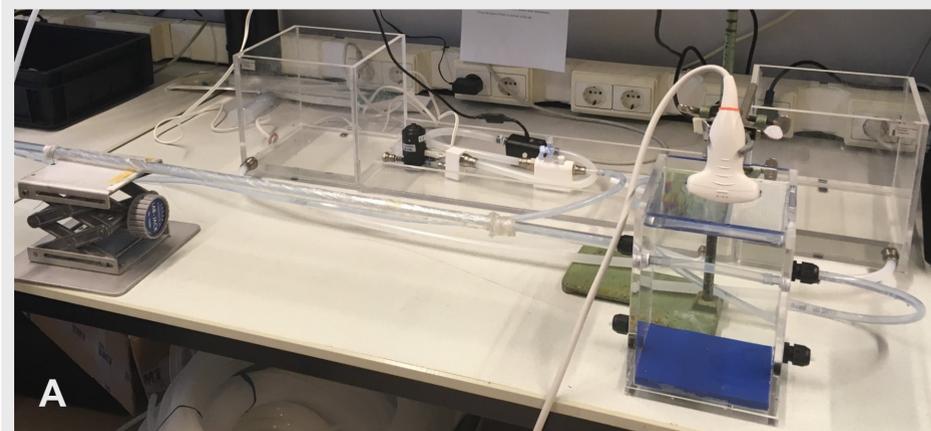
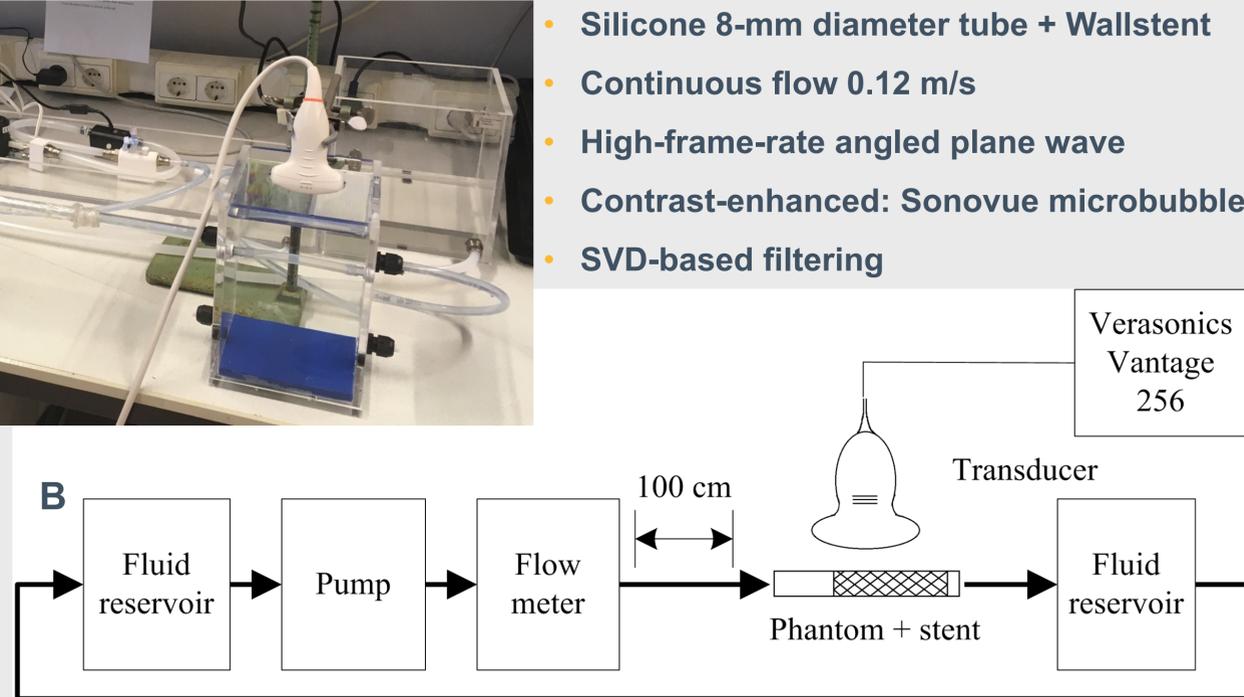


Figure 2: In-vitro flow setup. A Photograph. B Schematic overview



- Silicone 8-mm diameter tube + Wallstent
- Continuous flow 0.12 m/s
- High-frame-rate angled plane wave
- Contrast-enhanced: Sonovue microbubbles
- SVD-based filtering

### Analysis

- Stented vs. non-stented**
- Mean and peak velocity
  - Correlation coefficients
- Comparison to**
- Theoretical
  - Numerical

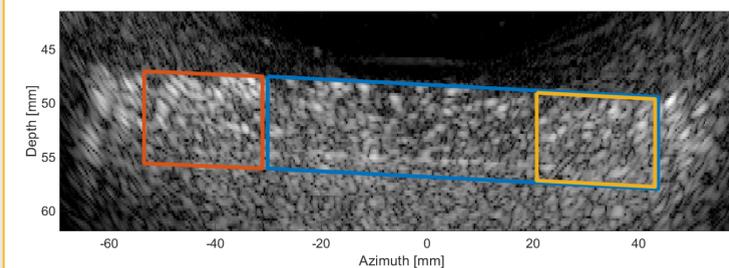


Figure 2: SVD-filtered ultrasound image showing the stented region (blue) and analyzed regions: non-stented (red) and stented (yellow)

## RESULTS

	Theoretical		Experimental	
	No stent	Stent	No stent	Stent
Mean velocity (m/s)	0.115	0.118	0.118	0.096
Peak velocity (m/s)	0.231	0.236	0.174	0.159
Correlation coefficients	1	1	0.891	0.743

Table 1: Calculated velocities and correlation coefficients in stented and non-stented areas.

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## RESULTS

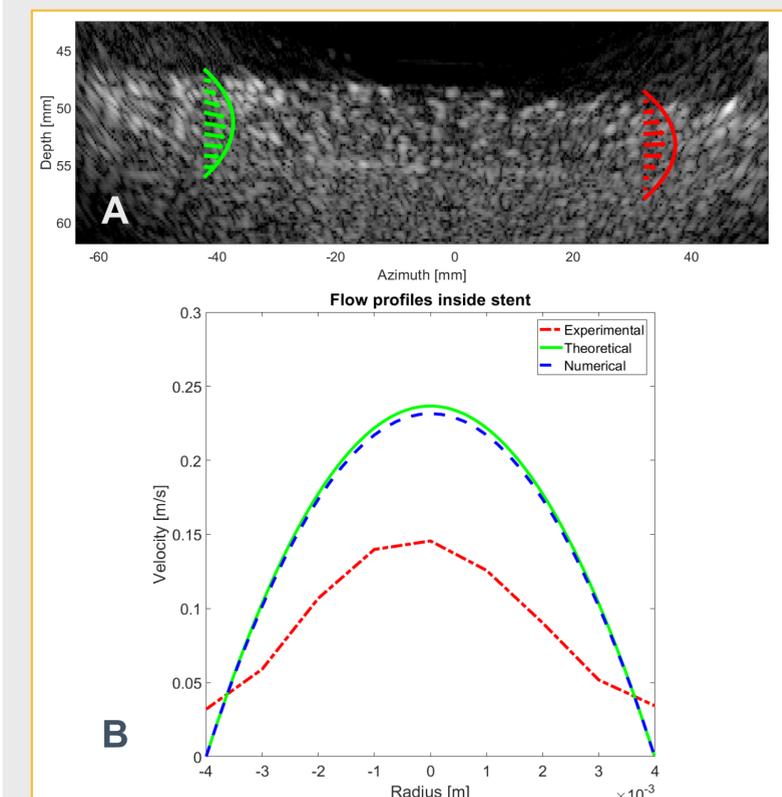


Figure 4: A. Flow profiles in stented (red) and non-stented area (green). B. Experimental (red), theoretical (green) and numerically (blue) estimated flow profiles inside the stent

## CONCLUSION

Microbubbles can be tracked and PIV-analysis can be performed in a carotid artery stent using high-frame-rate ultrasound

NO DISCLOSURES