In the MFPL lab researchers use In-Vitro experimental setups with fabricated components of the cardiovascular system (heart, aorta, atrium) to get physiologically relevant data without the need for invasive measurements on patients. This enables the researchers to take consistent measurements with varying conditions without the need for patients with these conditions to volunteer.

Objective & Impact of Lab’s Research

MFPL research team uses experimental and clinical data to study the cardiovascular system and cardiovascular diseases. Using computational mathematics and Artificial Intelligence they create new ways for clinicians to diagnose/predict disease and other cardiovascular complications. This creates inexpensive, noninvasive, and immediate diagnosing and treatment approaches that would previously need invasive surgery.

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Compliance Test ($\Delta V / \Delta P$)

We run a compliance test which we can use to tell the theoretical age of our aorta. We fill the aorta with water by removing any air pockets. Then we slowly inject 5 mL of water at a time and use a pressure catheter to record the pressure at each increase in volume. The compliance is calculated by $\Delta V / \Delta P$. The compliance of our aorta is ~1.3 ml/mmHg and when comparing this compliance to real patient data found in the graph below the theoretical age of our aorta is about 60 years old.

Coupling the Aorta

After running the compliance measurement and ensuring that our age is correct for the desired experiment, we then attach the aorta to the experimental setup. Using multiple catheters we can get pressure readings from different locations of the body. Then we collect waveform readings changing the cardiac output and the heart rate to observe the changes in pressure.

Compliance data graph

Figure 3: Graph of compliance related to age

Citations
