

Plaque

The Silent Killer

Background

Heart attacks are the leading cause of death worldwide, killing 500,000 people per year in the U.S. alone. Of these, an estimated 80 percent of patients die due from heart attacks caused by hidden plaque in the arteries undetected by conventional medical imaging technology. Predicting the location of the plaque could greatly improve patient care and save lives.

Challenge

Current endoscopic procedures require running tubing into the patient to take pictures of arterial plaque and areas of buildup. This limited viewing method leaves uncertainty to the exact location of potentially fatal plaque, making it a guessing game for heart specialists to determine if and where to place arterial stents in patients with blockages.

Solution

Harvard Engineering, Harvard Medical School, and Brigham & Women's Hospital in Boston have teamed up to prevent surprise deaths with a non-invasive system that estimates where deadly plaque resides in arteries. Using advanced computing, an advanced fluid dynamics simulation of the blood flow through the patient's arteries can be conducted to identify areas of reduced endothelial shear stress on the arterial wall.

Tapping into the computational power of GPUs, doctors can begin to model how the blood travels through the heart to identify stress points in the arteries. The overall result of the simulation provides doctors with an atherosclerotic risk map indicating the location of hidden plaque and where stents may eventually need to be placed. All of this preventative knowledge is gained without invasive imaging techniques or exploratory surgery.

Impact

GPUs provide 20x more computational power and an order of magnitude more performance per dollar to the application of image reconstruction and blood flow simulation, finally making such advanced simulation techniques practical at the clinical level.

Without GPUs, the amount of computing equipment—in terms of size and expense—would render a hemodynamics approach unusable. Due to early detection of dangerous arterial plaque earlier than any other method, it is expected that this breakthrough technology could save numerous lives when it is approved for deployment in hospitals and research centers worldwide.