Modeling the control parameters of pulsed flow through a stent

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Funding: Chinese scholarship

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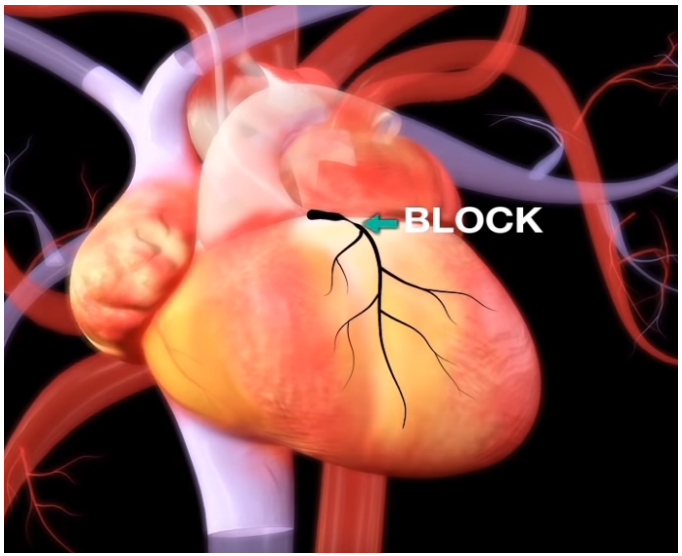
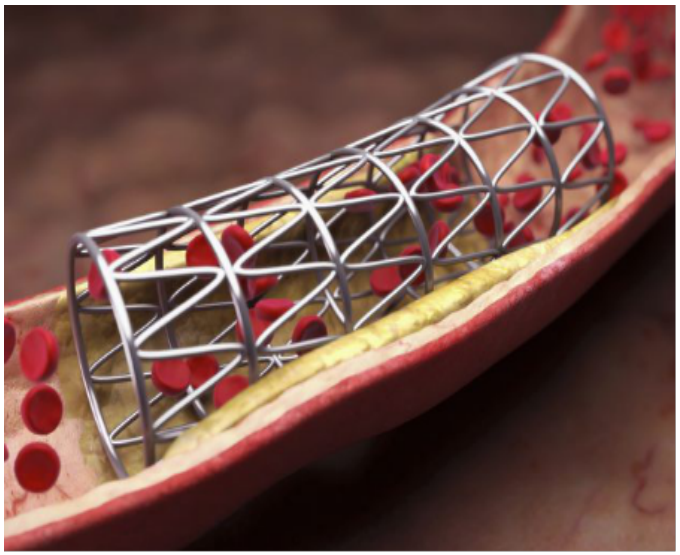
Objective of my PhD

- Study the hemodynamics in the human body in order to avoid the alterations caused by the presence of the stent.

  This project will concern active stent, specific interest will be given to the drug diffusion in the tissue and transport by the blood flow .

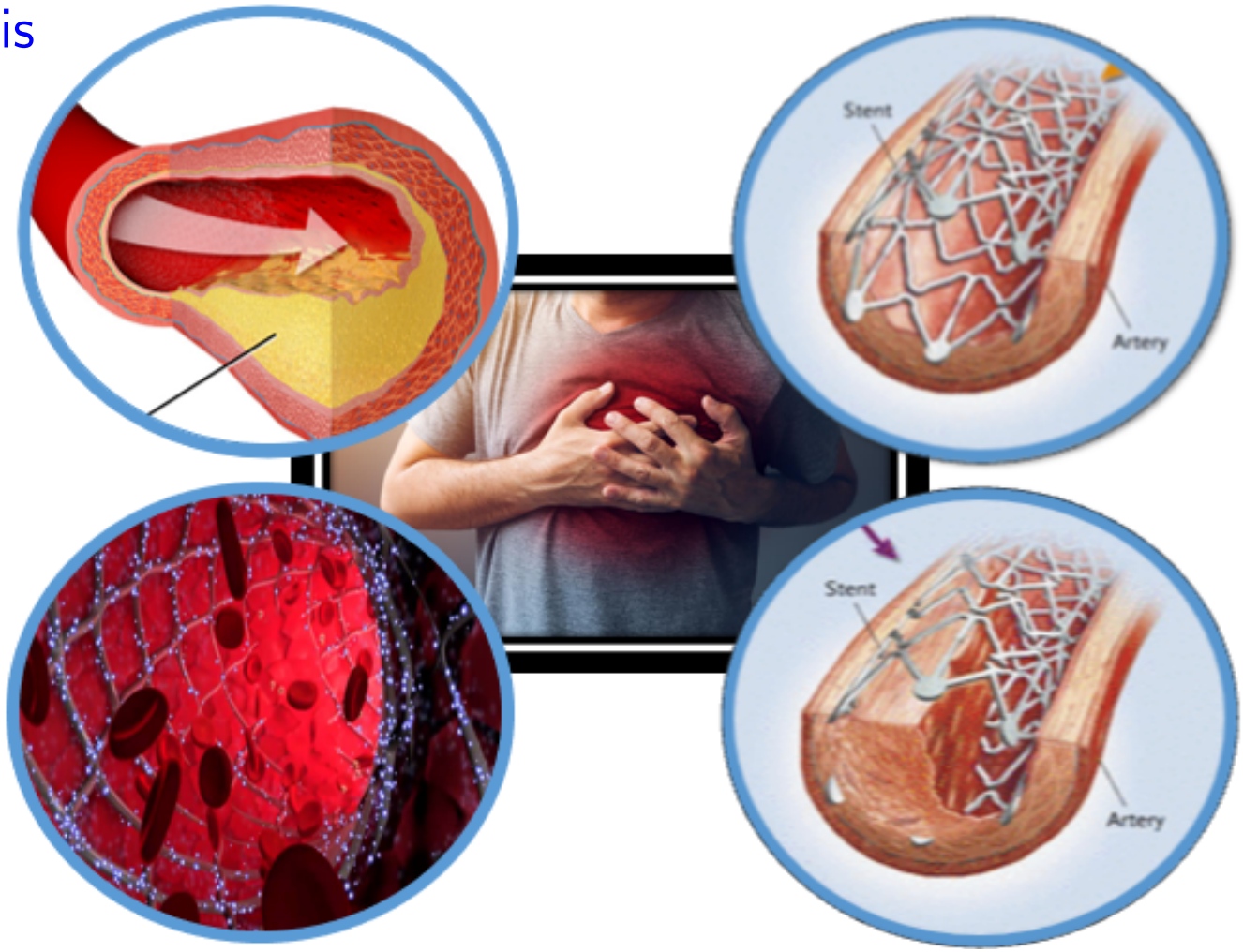




- Background

  Atherosclerosis is a vascular disease that reduces arterial lumen size through plaque formation and arterial wall thickening.

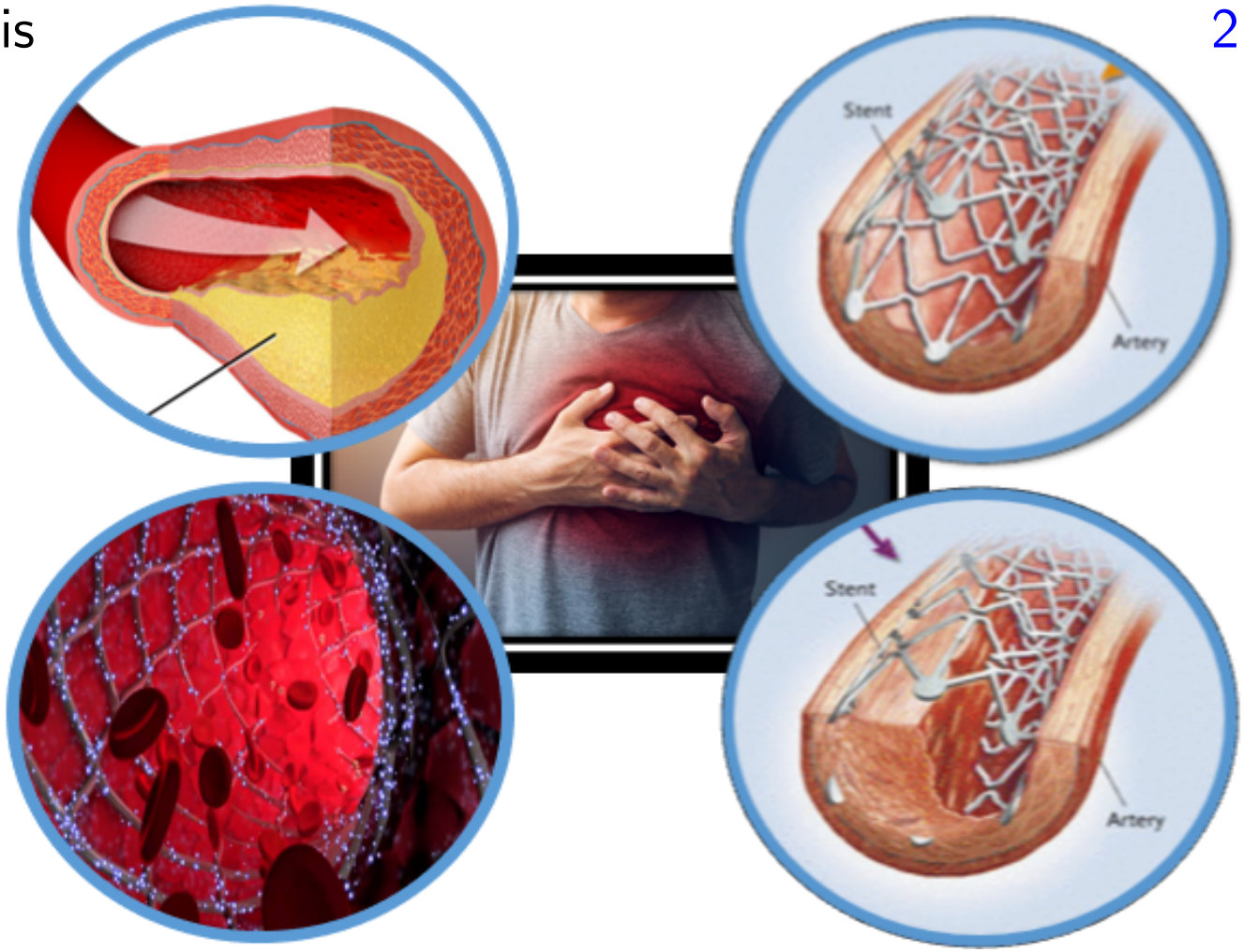
1. Stenosis



- Background

  The standard treatment of arterial stenosis is coronary stenting. Bare mental stent is the first generation of stent.

1. Stenosis

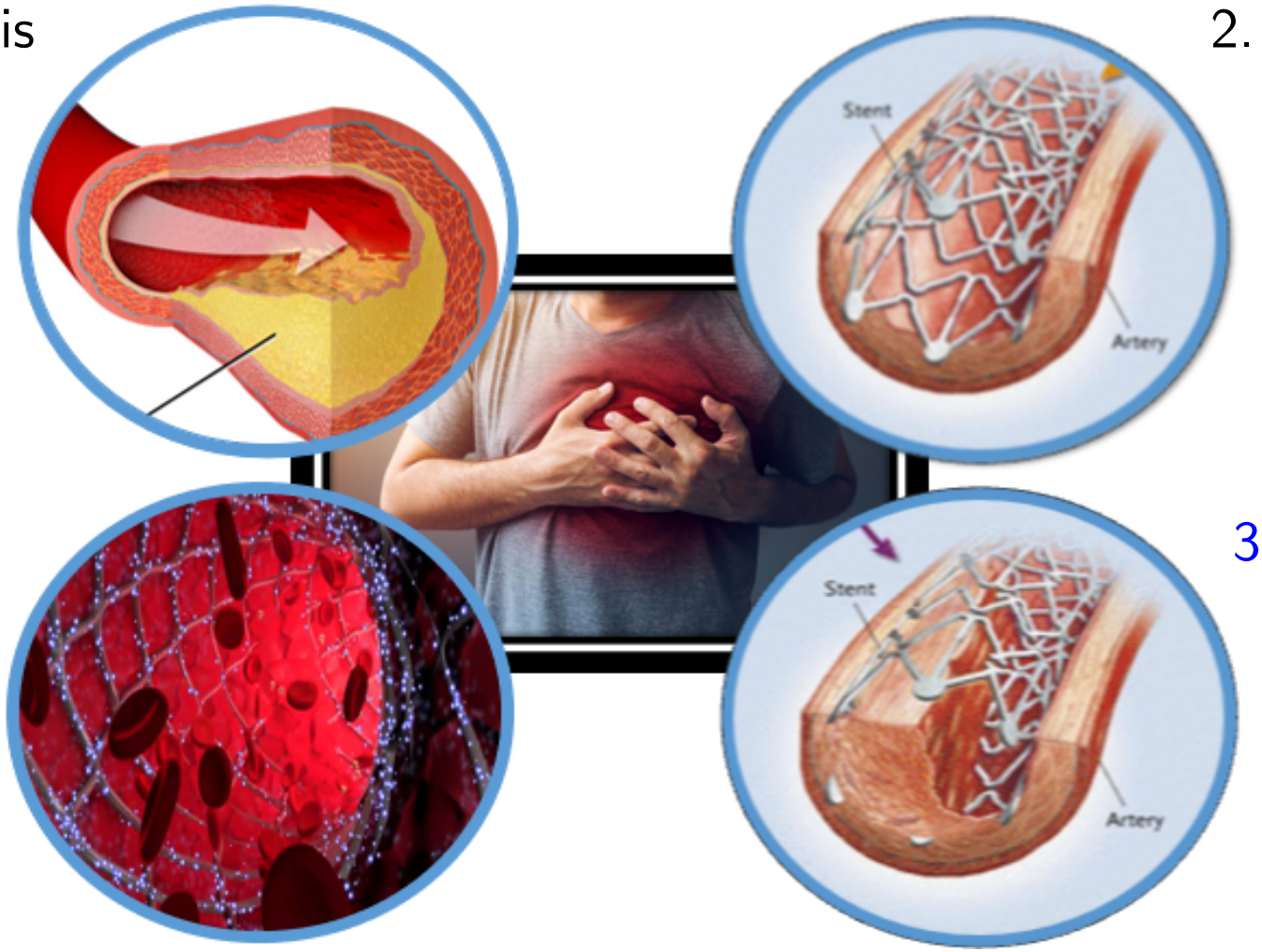


2. Bare metal stent

- Background

  The following complication of stent implantation is restenosis which will block the blood flow again.

1. Stenosis



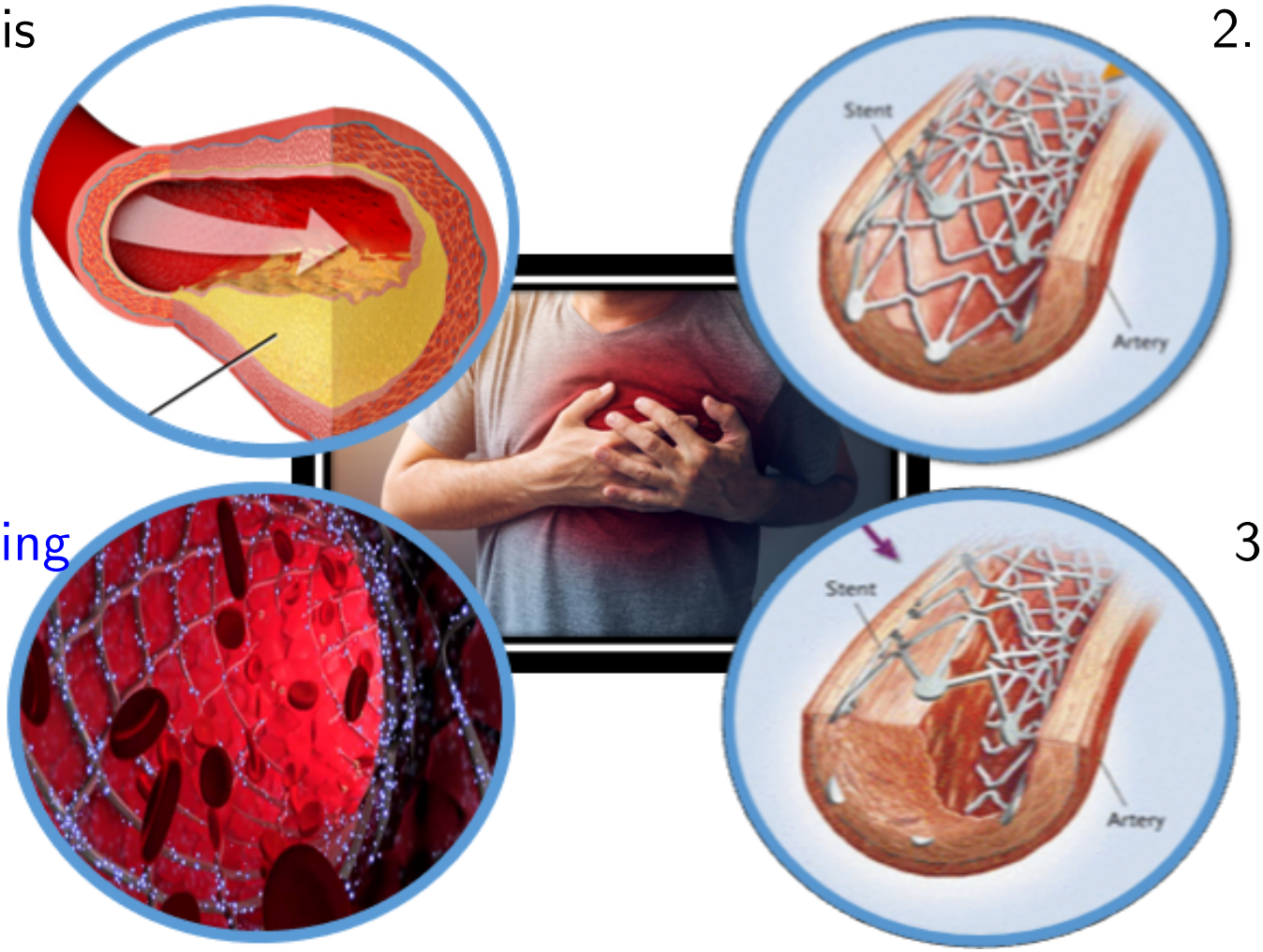
2. Bare metal stent

3. Restenosis

- Background

  Drug eluting stent is developed to hinder the in-stent restenosis with the coated polymer on the surface.

1. Stenosis
2. Bare metal stent



4. Drug eluting stent
3. Restenosis

- Results analysis in 2D model

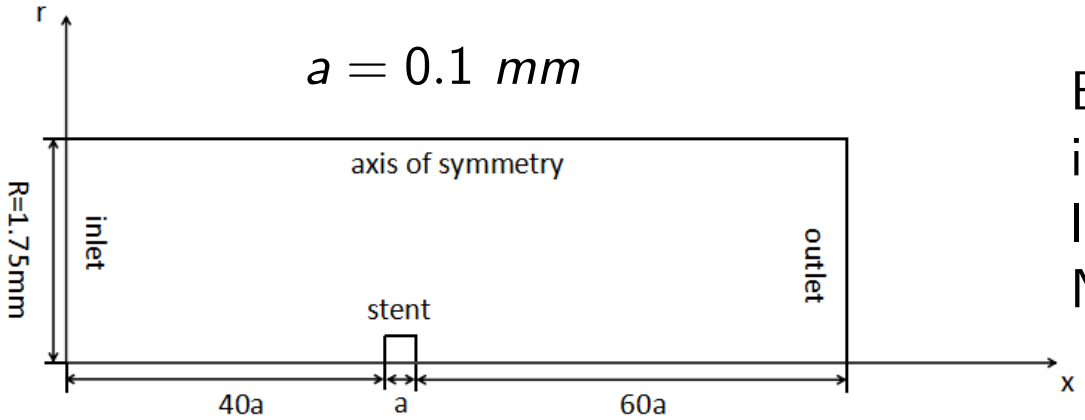


Figure: 2D artery model with stent

Blood flow is considered as incompressible, Newtonian, laminar and controlled by the Navier-Stokes equations.

bpm: beat per minute

$$Q(t) = \frac{P(t)}{R} + C\frac{dP(t)}{dt}$$

$$C = 1e-11\ m^3/Pa$$
$$R = 1e10\ Pa \cdot s/m^3$$

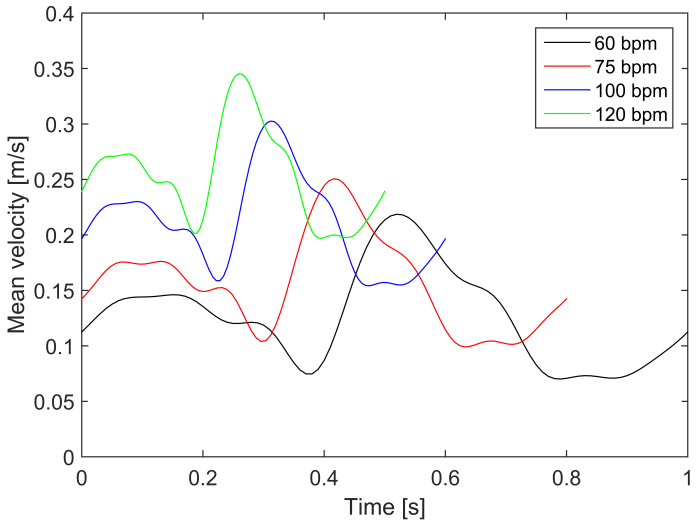


Figure: Inlet flowwave at different pulse rate

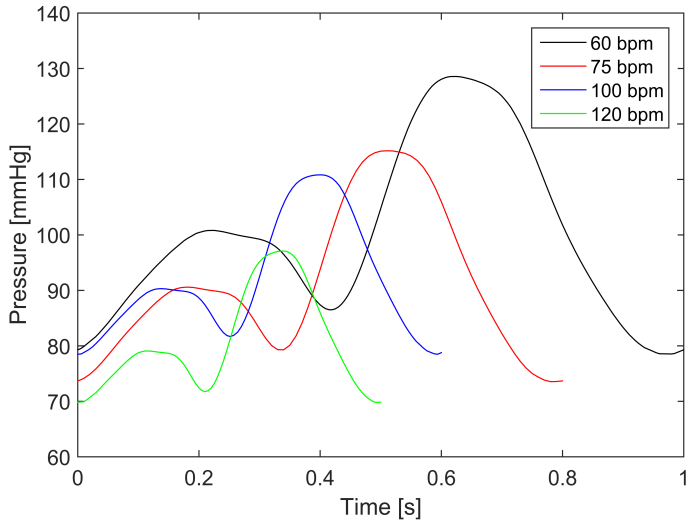


Figure: Outlet pressurewave at different pulse rate

- Results analysis in 2D model

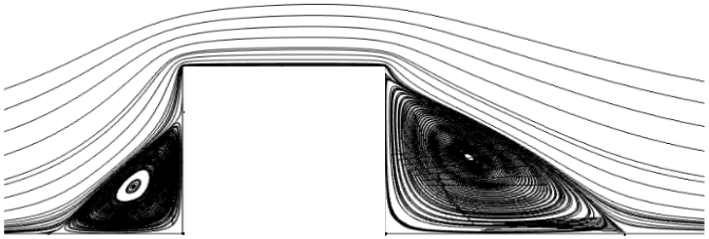


Figure: Streamlines around stent

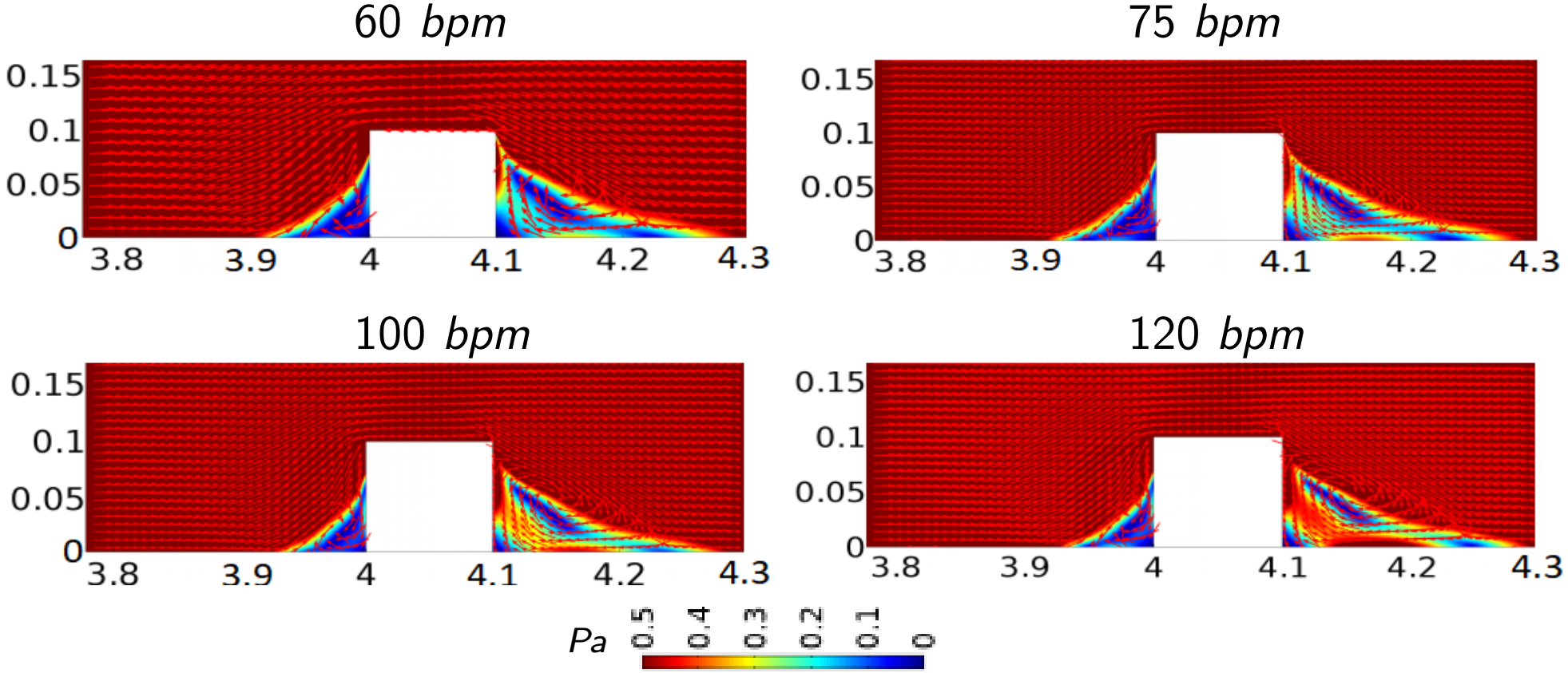


Figure: Velocity vectors and shear stress distribution at different pulse rate at $t = T/2$

Thanks!