PATENT CLAIMS

1. A computer-implemented method for calculation of a pressure drop (Δp) between a first cross-section and a second cross-section of an artery, wherein the second cross-section is downstream from the first cross-section and the two sections are separated by an artery channel having a length (l), and wherein the pressure drop (Δp) is expressed as $\Delta p = \Delta p_s$, with Δp_s being a steady-state pressure loss component, wherein the method comprises calculating of the steady-state pressure loss component (Δp_s) using computational fluid dynamics (CFD) simulations, and wherein the computational fluid dynamics (CFD) simulations are steady-state computational fluid dynamics (CFD) simulations, and wherein Δp_s is expressed as $\Delta p_s = \Delta p_0 + \Delta p_1 + \Delta p_2$, where Δp_0 is zero flow pressure, Δp_1 is viscous resistance for straight parts of the channel or parts of the channel with radius of curvature (R) to radius of the part (r) equal $r/R < 10$, Δp_2 is local resistance for parts of the channel with a stenosis, and wherein the viscous resistance (Δp_1) is equal to

$$\Delta p_1 = f \frac{l}{\langle d \rangle} \varrho \frac{\langle v \rangle^2}{2},$$

where f is hemodynamic friction coefficient, ϱ is density of blood, and wherein $\langle d \rangle$ is "equivalent" inner diameter of the channel calculated for a model of the channel which has a round cross-section and length identical to the length of the channel for which the model is created and while assuming that pressure loss for a laminar flow is the same for the channel and for the model of the channel, and $\langle v \rangle$ is "equivalent" flow velocity calculated for the model of the channel while assuming that pressure loss for a laminar flow is the same for the channel and for the model of the channel, and wherein the local resistance (Δp_2) is proportional to $\varrho \frac{\langle v \rangle^2}{2}$.

2. The computer-implemented method of claim 1, wherein the viscous resistance (Δp_1) is calculated using

$$Eu_1 = \frac{f}{2} \frac{l}{\langle d \rangle},$$

where Euler number is equal to $Eu_1 = \frac{\Delta p_1}{\varrho \cdot \langle v \rangle^2}$.

3. The computer-implemented method of claim 2, wherein the Euler number is expressed as

$$Eu_1 = \frac{32}{Re}\frac{l}{\langle d\rangle}$$

and *Re* is expressed as

$$Re = \frac{\langle v\rangle\langle d\rangle\varrho}{\eta} = \frac{4}{\pi}\frac{q\varrho}{\langle d\rangle\eta},$$

where η is dynamic viscosity coefficient, q is flow.

4. The computer-implemented method of any of claims 1-3, wherein the local resistance (Δp_2) is calculated using

$$Eu_2 = k_s\left(\frac{S}{1-S}\right)^2,$$

where k_s is empirical parameter, and

$$S = \frac{< A_0 > - A_s}{< A_0 >} = \frac{\Delta A}{< A_0 >}$$

where ΔA means changes in cross-sectional area of the channel due to stenosis and *S* means degree of stenosis, $<A_0>$ is "equivalent" cross-sectional area calculated using "equivalent" diameter $\langle d\rangle$ that is proximal to the stenosis, and A_s is cross-sectional area at the neck of the stenosis.

5. The computer-implemented method of any of claims 1-4, wherein the sum of the viscous resistance and the local resistance ($\Delta p_1 + \Delta p_2$) is calculated using the Lagrange number

$$La = 32\frac{l}{\langle d\rangle} + k_s\left(\frac{S}{1-S}\right)^2 Re,$$

where k_s is an empirical parameter, and

$$S = \frac{< A_0 > - A_s}{< A_0 >} = \frac{\Delta A}{< A_0 >},$$

where ΔA means changes in cross-sectional area of the channel due to stenosis and *S* means degree of stenosis, $<A_0>$ is "equivalent" cross-sectional area calculated using "equivalent" diameter $\langle d\rangle$ that is proximal to the stenosis, and A_s is cross-sectional area at the neck of the stenosis.

6. The computer-implemented method of any of claims 1-5, wherein "equivalent" diameter ($\langle d \rangle$) satisfies the following system of equations

$$\begin{cases} f \cdot Re = 64 \\ f \cdot Re = \dfrac{\pi \langle d \rangle^4}{2\, l\, \eta} \dfrac{\Delta p}{q}, \end{cases}$$

where η is dynamic viscosity coefficient.

7. The computer-implemented method of any of claims 1-6, wherein the pressure drop (Δp) is defined as $\Delta p = \Delta p_s + \Delta p_t$, where Δp_t being a transient pressure loss component, and Δp_t is expressed as

$$\Delta p_t = k_t \frac{\varrho l}{< A_0 >} \frac{dq}{dt}$$

where t is time, k_t is empirical index defined within the range 1 and 1.2, and $<A_0>$ is "equivalent" surface area calculated using $\langle d \rangle$, and the method includes calculating of the transient pressure loss component (Δp_t).

8. The computer-implemented method of any of claims 1-7, wherein the artery is a coronary artery, carotid artery, renal artery, peripheral artery, or aorta.

9. The computer-implemented method of any of claims 1-8, wherein q is within the range of 1 ml/s to 15 ml/s, or q is equal to 1.5 ml/s, 3.5 ml/s, or 5 ml/s, or where q is within the range $q_0/5$ to $3q_0$ where q_0 is a typical value of flow for the artery.

10. The computer-implemented method of any of claims 1-9, wherein the two cross-sections or the artery channel between the two cross-sections have identical or similar topology, wherein similar topology is defined using a similarity index which takes into account change in internal diameter between the two cross-sections or across the channel between the two cross-sections, branching at the two cross-sections or across the channel between the two cross-sections or all of the above, and wherein the similarity index has a value of at least 50%, 55%, 60%, 65%, 70%, 75%, 80%, 85%, 90%, 95% or 99%.

11. The computer-implemented method of any of claims 1-10, wherein r/R is below 9, 8, 7, or 6.

12. The computer-implemented method of any of claims 1-11, wherein the method further includes calculating of a fractional flow reserve (FFR).

13. A computer program [product] comprising instructions which, when the program is executed by a computer, cause the computer to carry out the method of any of claims 1-12.

14. A computer-readable [storage] medium comprising instructions which, when executed by a computer, cause the computer to carry out the method of any of claims 1-12.