Hemodynamics

- Anesthetic and perioperative management of pregnant patients undergoing neurosurgery: a case series from a single center in Morocco (2017-2024)
- Transitional haemodynamic profiles of intrauterine growth-restricted preterm infants: correlation with antenatal Doppler characteristics
- Biomarkers for Predicting Blood Pressure Response to Renal Denervation
- Improved Home Blood Pressure Control by CT-guided Ozone-mediated Renal Denervation for Patients with Resistant Hypertension
- The Effect of Renal Denervation on Capillary Density in Patients With Uncontrolled Hypertension
- Challenges to Neurocritical Care Management in Polytrauma
- White matter hyperintensities and the risk of vascular dementia: a systematic review and meta-analysis
- Effects of blood pressure lowering in relation to time in acute intracerebral haemorrhage: a pooled analysis of the four INTERACT trials

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Hemodynamics or hæmodynamics is the dynamics of blood flow. The circulatory system is controlled by homeostatic mechanisms, much as hydraulic circuits are controlled by control systems. Hemodynamic response continuously monitors and adjusts to conditions in the body and its environment. Thus hemodynamics explains the physical laws that govern the flow of blood in the blood vessels. The relationships can be challenging because blood vessels are complex, with many ways for blood to enter and exit under changing conditions.

see Cerebral hemodynamics.

Hemodynamic analysis reveals a highly significant effect on the prevention, diagnosis, and treatment of human vascular diseases.

Zhang et al. in an article goes deeply into the periodic pulsatile blood flow in the carotid artery with an elastic vessel wall. In view of blood rheological experimental data, the constitutive equation of fractional Maxwell power-law fluid with yield stress, which can describe the four characteristics of yield stress, viscoelasticity, shear thinning, and thixotropy is established. Meanwhile, drawing support from the data of pulsatile flow, the finite Fourier series of pressure gradient with a period of 1 s has been proposed. Leading into Hooke's law can build the fluid-structure coupling boundary condition of blood flow and elastic vessel wall. The numerical solutions are got hold of finite difference method integrated with the newly developed L1-algorithm, and their convergence and stability of which are verified. The axial velocities of blood under different constitutive relationships are compared. The results throw light that other constitutive relationships underestimate the velocity of blood. Furthermore, the flow rate and wall shear stress on different fluid are calculated. It can be concluded that compared with Bingham fluid, the maximum and minimum flow rate/wall shear stress of fractional Maxwell power-law fluid with yield stress increases by 19% and 32%, respectively. The flow rate lags behind the pressure gradient and has time delay effect, on the contrary, the velocity of blood vessel wall is keeping pace with the pressure gradient. The effects of relevant physical parameters on velocity are discussed. In addition, the spatiotemporal distribution of blood flow in cerebral artery and femoral artery are analyzed [1)]

Hemodynamic analysis is the study and measurement of the physical properties and behavior of blood flow within the circulatory system. It involves the assessment of various parameters related to blood pressure, blood flow, and the forces acting on blood vessels. Hemodynamic analysis is crucial for understanding and diagnosing cardiovascular conditions, evaluating the effectiveness of treatments, and optimizing patient care. Here are some key aspects of hemodynamic analysis:

Blood Pressure: Measuring blood pressure is a fundamental component of hemodynamic analysis. Blood pressure is typically expressed in two values: systolic (the pressure during a heartbeat) and diastolic (the pressure between heartbeats). These values are measured in millimeters of mercury (mm Hg). Abnormal blood pressure can indicate conditions such as hypertension or hypotension.

Cardiac Output: Cardiac output is the volume of blood that the heart pumps in one minute. It is a crucial parameter in hemodynamics because it helps assess the heart's ability to supply blood to the body's tissues. Cardiac output is often measured in liters per minute (L/min).

Stroke Volume: Stroke volume is the amount of blood ejected by the left ventricle of the heart in one contraction (systole). It is an important determinant of cardiac output and can be measured using various techniques, including echocardiography and impedance cardiography.

Vascular Resistance: Vascular resistance refers to the opposition to blood flow offered by the blood vessels. It can be influenced by factors such as vessel diameter, vessel length, and blood viscosity. Increased vascular resistance can lead to increased blood pressure.

Pulse Wave Analysis: Pulse wave analysis involves studying the shape and characteristics of the arterial pressure waveform. It can provide information about arterial stiffness, compliance, and other factors affecting blood flow.

Hemodynamic Monitoring: In clinical settings, various techniques and instruments are used for hemodynamic monitoring. These include invasive methods like catheterization and non-invasive methods like Doppler ultrasound, echocardiography, and impedance cardiography.

Cardiac Catheterization: Invasive hemodynamic analysis can involve the insertion of a catheter into the heart and major blood vessels to directly measure pressures, obtain blood samples, and assess cardiac function. This procedure is often used for precise evaluation in patients with complex cardiac conditions.

Clinical Applications: Hemodynamic analysis is essential in diagnosing and managing cardiovascular conditions, such as heart failure, valvular disorders, cardiomyopathies, and hypertension. It is also crucial in guiding interventions like angioplasty, stent placement, and valve replacement surgeries.

Research and Therapy: Hemodynamic analysis plays a significant role in cardiovascular research to better understand disease mechanisms and develop new treatments. It also helps in optimizing treatment strategies for individual patients.

Overall, hemodynamic analysis is a critical tool in cardiology and vascular medicine, providing valuable insights into the functioning of the cardiovascular system and aiding in the diagnosis and treatment of various cardiovascular diseases.

Intracranial aneurysm hemodynamics

see Intracranial aneurysm hemodynamics.

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Zhang Y, Peng Y, Gao J, Bai Y, Sun D, Sun X, Lv B. Analysis of periodic pulsating blood flow of fractional Maxwell power-law fluid in carotid artery with elastic vessel wall. Comput Methods Biomech Biomed Engin. 2023 Oct 5:1-13. doi: 10.1080/10255842.2023.2262667. Epub ahead of print. PMID: 37795603.