Hearts Vortex Intracardiac Blood Flow Phenomena

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Heart's Vortex: Intracardiac Blood Flow Phenomena. Description. This outstanding resource provides a comprehensive guide to intracardiac blood flow phenomena and cardiac hemodynamics, including the developmental history, theoretical frameworks, computational fluid dynamics, and practical applications for clinical cardiology, cardiac imaging and embryology.

Heart's Vortex: Intracardiac Blood Flow Phenomena
This outstanding resource provides a comprehensive guide to intracardiac blood flow phenomena and cardiac hemodynamics, including the developmental history, theoretical frameworks, computational fluid dynamics, and practical applications for clinical cardiology, cardiac imaging and embryology. It is not a mere compilation of the most up-to-date scientific data and relevant concepts.

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9781607950332 - Heart's Vortex: Intracardiac Blood Flow ...
Right heart intracardiac flow was first assessed by 3D real-time echocardiography in dogs using computational fluid dynamic simulations for investigating RV flow patterns 44. It was postulated that intraventricular diastolic vortices represent energy-preserving flow structures which facilitate ventricular filling.

Assessment of intracardiac flow and vorticity in the right ...
One of the main determinants of intracardiac flow is vortex behaviour, which has already shown to be associated with optimal cardiac performance.

Intracardiac flow visualization: current status and future ...
heart The pattern of flow in the human heart changes dramatically during one cardiac cycle. However, flow is redirected within the cardiac chambers through vortex formation, which avoids excessive dissipation of energy and facilitates the efficient passage of blood [11]. Inside the ventricle, just after ejection, the direction of flow reverses towards the

Visualization of blood flow with echocardiography: the ...
This study has demonstrated a spatiotemporal coupling between the left ventricular vortex ring and endocardial wall during diastole, implying that the healthy heart is tuned to accommodate vortex ring formation. Intracardiac vortex ring formation provides a stable, recurring, and predictable flow phenomenon that may dictate and optimize cardiogenesis by providing endocardial shear forces.

Vortex ring behavior provides the epigenetic blueprint for ...
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The heart's vortex : intracardiac blood flow phenomena ...
Vortex flow that form during left ventricular filling have specific geometry and anatomical location that are critical determinants of directed blood flow during ejection. The formation of abnormal vortices relates to the abnormal cardiac function. Therefore, vortex flow may offer a novel index of cardiac dysfunction.

Current Clinical Application of Intracardiac Flow Analysis ...
Intracardiac blood flow is known to influence cardiac development through transduction of endothelial shear forces. Vortex rings inside the left ventricle constitute a possible "blueprint" for cardiogenesis, the hemodynamic determinant of final cardiac shape.

The shape of the healthy heart is optimized for vortex ...
Studies showed that 4D flow MRI is valuable for intracardiac blood flow visualisation [7], vortex detection [8], and flow assessment through all four heart valves [9, 10], as well as for detecting flow alterations after TAVR and other surgical procedures in the aorta [11, 12, 13, 14].

An isolated beating pig heart platform for a comprehensive ...
RESULTS In all subjects vortical flow was observed in the atrium during systole and diastolic diastasis (mean (SD) duration of systolic vortex, 280 (77) ms; and of diastolic vortex, 256 (118) ms). The volume incorporated and recirculated within the vortices originated predominantly from the left pulmonary veins.

Three dimensional flow in the human left atrium | Heart
Intracardiac Flow and Cardiac Vortex The bloods flow through the heart is closely associated with intracardiac structures such as the myocardium, valves and large vessels around the heart.1) In response to the structural and functional changes in the heart, this intracardiac blood flow should be changed accordingly, thereby, optimizing the

Current Clinical Application of Intracardiac Flow Analysis ...
Results: 4D flow MRI acquisitions were successfully conducted in all hearts. Stroke volume was 31 ± 6 mL (mean ± standard deviation), cardiac output 3.3 ± 0.9 L/min, and regurgitation fraction 16% ± 9%. With 4D flow, intracardiac and coronary flow patterns could be visualised in all hearts.

An isolated beating pig heart platform for a comprehensive ...
Intracardiac blood flow is known to influence cardiac development through transduction of endothelial shear forces. Vortex rings inside the left ventricle constitute a possible "blueprint" for cardiogenesis, the hemodynamic determinant of final cardiac shape. However, the relation-ship between the vortex ring and endocardium has pre-

ORAL PRESENTATION Open Access The shape of the healthy ...
hearts vortex intracardiac blood flow phenomena published book monograph this 1000 page book includes over 400 figures which were prepared by the author and form a vital part of the pedagogy it is organized in three parts duke authors pasipoularides ares d cited authors pasipoularides a published date december 31 2009 published by pmph usa pages 1000 international hearts vortex intracardiac

This outstanding resource provides a comprehensive guide to intracardiac blood flow phenomena and cardiac hemodynamics, including the developmental history, theoretical frameworks, computational fluid dynamics, and practical applications for clinical cardiology, cardiac imaging and embryology. It is not a mere compilation of the most up-to-date scientific data and relevant concepts. Rather, it is an integrated educational means to developing pluridisciplinary background, knowledge, and understanding. Such understanding allows an appreciation of the crucial, albeit heretofore generally unappreciated, importance of intracardiac blood flow phenomena in a host of multifaceted functional and morphogenetic cardiac adaptations. The book includes over 400 figures, which were prepared by the author and form a vital part of the pedagogy. It is organized in three parts. Part I, Fundamentals of Intracardiac Flows and Their Measurement, provides comprehensive background from many disciplines that are necessary for a deep and broad understanding and appreciation of intracardiac blood flow phenomena. Such indispensable background spans several chapters and covers necessary mathematics, a brief history of the evolution of ideas and methodological approaches that are relevant to cardiac fluid dynamics and imaging, a qualitative introduction to fluid dynamic stability theory, chapters on physics and fluid dynamics of unsteady blood flows and an intuitive introduction to various kinds of relevant vortical fluid motions. Part II, Visualization of Intracardiac Blood Flows: Methodologies, Frameworks and Insights, is devoted to pluridisciplinary approaches to the visualization of intracardiac blood flows. It encompasses chapters on 3-D real-time and "live 3-D" echocardiography and Doppler echocardiography, CT tomographic scanning modalities, including multidetector spiral/helical dataset acquisitions, MRI and cardiac MRA, including phase contrast velocity mapping (PCVM), etc. An entire chapter is devoted to the understanding of post processing exploration techniques and the display of tomographic data, including "slice-and-dice" 3-D techniques and cine-MRI. Part II also encompasses an intuitive introduction to CFD as it pertains to intracardiac blood flow simulations, followed--in separate chapters--by conceptually rich treatments of the computational fluid dynamics of ejection and of diastolic filling. An entire chapter is devoted to fluid dynamic epigenetic factors in cardiogenesis and pre- and postnatal cardiac remodeling, and another to clinical and basic science perspectives, and their implications for emerging research frontiers. Part III contains an Appendix presenting technical aspects of the method of predetermined boundary motion, "PBM," developed at Duke University by the author and his collaborators.

This extensively revised second edition traces the development of the basic concepts in cardiovascular physiology in light of the accumulated experimental and clinical evidence. It considers the early embryonic circulation, where blood circulation suggests the existence of a motive force, tightly coupled to the metabolic demands of the tissues. It proposes that rather than being an organ of propulsion, the heart, serves as an organ of control, generating pressure by rhythmically impeding blood flow. New and expanded chapters cover the arterial pulse, circulation in the upright posture, microcirculation and functional heart morphology. Heart and Circulation offers a new perspective for deeper understanding of the human cardiovascular system. It is therefore a thought-provoking resource for cardiologists, cardiac surgeons and trainees interested in models of human circulation.

This book constitutes the thoroughly refereed post-conference proceedings of the 4th International Workshop on Statistical Atlases and Computational Models of the Heart: Imaging and Modelling Challenges, STACOM 2013, held in conjunction with MICCAI 2013, in Nagoya, Japan, in September 2013. The 31 revised full papers were carefully reviewed and selected from numerous submissions. The papers are organized in topical sections on cardiac image processing; atlas construction; statistical modelling of cardiac function across different patient populations; cardiac mapping; cardiac computational physiology; model customization; atlas based functional analysis; ontological schemata for data and results; integrated functional and structural analyses; as well as the pre-clinical and clinical applicability of these methods.

This book traces the development of the basic concepts in cardiovascular physiology in the light of the accumulated experimental and clinical evidence and, rather than making the findings fit the standard pressure-propulsion mold, let the phenomena "speak for themselves". It starts by considering the early embryonic circulation, where blood passes through the valveless tube heart at a rate that surpasses the contractions of its walls, suggesting that the blood is not propelled by the heart, but possesses its own motive force, tightly coupled to the metabolic demands of the tissues. Rather than being an organ of propulsion, the heart, on the contrary, serves as a damming-up organ, generating pressure by rhythmically impeding the flow of blood. The validity of this model is then confirmed by comparing the key developmental stages of the cardiovascular system in the invertebrates, the insects and across the vertebrate taxa. The salient morphological and histological features of the myocardium are reviewed with particular reference to the vortex. The complex, energy-dissipating intracardiac flow-patterns likewise suggest that the heart functions as an organ of impedance, whose energy consumption closely matches the generated pressure, but not its throughput. Attention is then turned to the regulation of cardiac output and to the arguments advanced by proponents of the "left ventricular" and of the "venous return" models of circulation. Hyperdynamic states occurring in arteriovenous fistulas and congenital heart defects, where communication exists between the systemic and pulmonary circuits at the level of atria or the ventricles, demonstrate that, once the heart is unable to impede the flow of blood, reactive changes occur in the pulmonary and systemic circulations, leading to pulmonary hypertension and Eisenmenger syndrome. Finally, the key points of the nook are summarized in the context of blood as a "liquid organ" with autonomous movement.

Vortex Formation in the Cardiovascular System will recapitulate the current knowledge about the vortex formation in the cardiovascular system, from mechanics to cardiology. This can facilitate the interaction between basic scientists and clinicians on the topic of the circulatory system. The book begins with a synopsis of the fundamentals aspects of fluid mechanics to give the reader the essential background to address the proceeding chapters. Then the fundamental elements of vortex dynamics will be discussed, explaining the conditions for their formation and the rules governing their dynamics. The main equations are accompanied by mathematical models. Cardiovascular vortex formation is first analyzed in physiological, healthy conditions in the heart chambers and in the large arterial vessels. The analysis is initially presented with an intuitive appeal grounded on the physical phenomena and a focus on its clinical significance.In the proceeding chapters, the knowledge gained from either clinical or basic science literature will be discussed. The corresponding mathematical elements will finally be presented to ensure the adequate diligence. The proceeding chapters ensue to the analysis of pathological conditions, when the reader may have developed the ability to recognize normal from abnormal vortex formation phenomenon. Pathological vortex formation represents vortices that develop at sites where normally laminar flow should exist, e.g. stenosis and aneurisms. This analysis naturally leads to the interaction of vortices due to the surgical procedures with respect to prediction of changes in vortex formation. The existing techniques, from medical imaging to numerical simulations, to explore vortex flows in the cardiovascular systems will also be described. The presentations are accompanied by the mathematical definitions can that be understandable for reader without the advanced mathematical background, while an interested reader with more advanced knowledge in mathematics can be referred to references for further quantitative analyses. The book pursues the objective to transfer the fundamental vortex formation phenomena with application to the cardiovascular system to the reader. This book will be a valuable support for physicians in the evaluation of vortex influence on diagnosis and therapeutic choices. At the same time, the book will provide the rigorous information for research scientists, either from medicine and mechanics, working on the cardiovascular circulation incurring with the physics of vortex dynamics.

Imagine mathematics, imagine with the help of mathematics, imagine new worlds, new geometries, new forms. Imagine building mathematical models that make it possible to manage our world better, imagine combining music, art, poetry, literature, architecture and cinema with mathematics. Imagine the unpredictable and sometimes counterintuitive applications of mathematics in all areas of human endeavour. Imagination and mathematics, imagination and culture, culture and mathematics. This sixth volume in the series begins with a homage to the architect Zaha Hadid, who died on March 31st, 2016, a few weeks before the opening of a large exhibition of her works in Palazzo Franchetti in Venice, where all the Mathematics and Culture conferences have taken place in the last years. A large section of the book is dedicated to literature, narrative and mathematics including a contribution from Simon Singh. It discusses the role of media in mathematics, including museums of science, journals and movies. Mathematics and applications, including blood circulation and preventing crimes using earthquakes, is also addressed, while a section on mathematics and art examines the role of math in design. A large selection presents photos of mathematicians and mathematical objects by Vincent Moncorge. Discussing all topics in a way that is rigorous but captivating, detailed but full of evocations, it offers an all-embracing look at the world of mathematics and culture.

This volume presents a collection of contributions on advanced approaches of continuum mechanics, which were written to celebrate the 60th birthday of Prof. Holm Altenbach. The contributions are on topics related to the theoretical foundations for the analysis of rods, shells and three-dimensional solids, formulation of constitutive models for advanced materials, as well as development of new approaches to the modeling of damage and fractures.

The leading cause of death in the United States is heart disease. In the heart, opening and closing of valve leaflets during diastole leads to formation of ring vortices in the Left Ventricle (LV) chamber. Within the past decade, emphasis on the effect of wall and fluid interaction within the LV is evident in imaging techniques and Computational Fluid Dynamics (CFD). The effect of the left ventricle wall movement on the vortex dynamics is examined through an analysis with the commercial CFD software Fluent. The healthy LV is modeled as an idealized two-dimensional ellipsoid with blood pumped into the chamber in a piston motion during diastole, or ventricular filling phase. All wall motion is transient, updated per time step with Fluent dynamic mesh and user defined function capabilities. Results on vortex evolution exhibits similar flow characteristics to coupling of direct-numerical simulations and magnetic resonance imaging found in literature, including circulation of the primary vortex ring and subsequent roll up of a secondary vortex due to wall interaction. In addition to requiring little computational resources, the models developed through Fluent is a non-intrusive diagnostic tool to the biomedical engineer or physician. Future experiments include developing three-dimensional models to understand the factors behind heart disease.

ECHOCARDIOGRAPHY IN PEDIATRIC AND CONGENITAL HEART DISEASE The new edition of the acclaimed reference text on the most critical tool in pediatric cardiology practice Echocardiography in Pediatric and Congenital Heart Disease provides comprehensive guidance on the use of non-invasive ultrasound imaging in the diagnosis and treatment of pediatric cardiac conditions. Written by a team of experts from the world's leading pediatric cardiology centers, this highly-illustrated, full-color reference covers anatomy, pathophysiology, ultrasound physics, laboratory setup, patient preparation and safety, pediatric echocardiogram protocols, quantitative methods of echocardiographic evaluation, and more. Offering a wealth of additional material on state-of-the-art techniques and technologies in echocardiography, the thoroughly revised third edition features entirely new chapters on examination guidelines and standards, quality improvement in the laboratory, perioperative echocardiography, hemodynamic assessment of the neonate, early fetal echocardiography, and multimodality imaging. This edition offers updated and expanded discussion of the latest advances in echocardiography, particularly those related to speckle tracking and 3D echocardiography. An essential resource for all practitioners, instructors, and trainees in the field, Echocardiography in Pediatric and Congenital Heart Disease: Provides up-to-date reference to ultrasound imaging of the hearts of fetuses, children, and adults with both acquired and congenital heart disease Covers the echocardiographic examination of congenital cardiovascular abnormalities before, during, and after treatment Describes quantitative methods of echocardiographic evaluation, including assessment of diastolic function, right ventricular function and assessment of the post-Fontan patient Discusses intraoperative echocardiography, heart disease in pregnancy, and other special techniques and topics Includes more than 1200 high-quality color images as well as a companion website with over 600 video clips Echocardiography in Pediatric and Congenital Heart Disease, Third Edition, remains an essential textbook for cardiac sonographers, pediatric and adult cardiologists, echocardiography nurses and technicians, and adult cardiologists with interest in congenital heart disease.

Principles of Heart Valve Engineering is the first comprehensive resource for heart valve engineering that covers a wide range of topics, including biology, epidemiology, imaging and cardiovascular medicine. It focuses on valves, therapies, and how to develop safer and more durable artificial valves. The book is suitable for an interdisciplinary audience, with contributions from bioengineers and cardiologists that includes coverage of valvular and potential future developments. This book provides an opportunity for bioengineers to study all topics relating to heart valve engineering in a single book as written by subject matter experts. Covers the depth and breadth of this interdisciplinary area of research Encompasses a wide range of topics, from basic science, to the translational applications of heart valve engineering Contains contributions from leading experts in the field that are heavily illustrated