

ORIGINAL RESEARCH

On the Natural History of Coronary Artery Disease: A Longitudinal Nationwide Serial Angiography Study

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BACKGROUND: The long-term course of coronary atherosclerosis has not been studied in large nationwide cohorts. Understanding the natural history of coronary atherosclerosis could help identify patients at risk for future coronary events.

METHODS AND RESULTS: All coronary artery segments with <50% luminal stenosis in patients with a first-time coronary angiogram between 1989 and 2017 were identified ($n=2661245$ coronary artery segments in 248736 patients) and followed until a clinically indicated angiography within 15 years was performed or until death or end of follow-up (April 2018) using SCAAR (Swedish Coronary Angiography and Angioplasty Registry). The stenosis progression and incidence rates were 2.6% and 1.45 (95% CI, 1.43–1.46) per 1000 segment-years, respectively. The greatest progression rate occurred in the proximal and middle segments of the left anterior descending artery. Male sex and diabetes were associated with a 2-fold increase in risk, and nearly 70% of new stenoses occurred in patients with baseline single-vessel disease (hazard ratio, 3.86 [95% CI, 3.69–4.04]). Coronary artery segments in patients with no baseline risk factors had a progression rate of 0.6% and incidence rate of 0.36 (95% CI, 0.34–0.38), increasing to 8.1% and 4.01 (95% CI, 3.89–4.14) per 1000 segment-years, respectively, in patients with ≥ 4 risk factors. The prognostic impact of risk factors on stenosis progression was greatest in younger patients and women.

CONCLUSIONS: Coronary atherosclerosis progressed slowly but more frequently in the left coronary artery in men and in the presence of traditional risk factors. Coronary artery segments in patients without risk factors had little or no risk of stenosis progression, and the relative impact of risk factors appears to be of greater importance in younger patients and women. These findings help in the understanding the long-term course of coronary atherosclerosis.

Key Words: coronary artery disease ■ ischemic heart disease ■ natural history

The long-term course of coronary atherosclerosis has not been studied in large cohorts. Information derived from autopsies of US soldiers killed in the Korean war showed that 40% had some degree of luminal narrowing.¹ Postmortem and intravascular ultrasound studies have shown that most acute coronary events coincide with thrombosis of a coronary atherosclerotic plaque caused by either rupture or erosion.^{2–5} The prospective PROSPECT II (Providing Regional

Observations to Study Predictors of Events in the Coronary Tree) reported that major adverse cardiovascular events emanates from untreated angiographically mild coronary lesions with a large plaque burden with a lipid-rich core.⁴ Small serial examination studies using coronary angiography and coronary computed tomography angiography (CCTA) have been conducted but follow-up time has primarily been in the range of 1 to 2 years.^{6–10}

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Natural History Of Coronary Atherosclerosis

**Seymour Glagov, William P., III
Newman, Sheldon A. Schaffer**



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Pathobiology of the Human Atherosclerotic Plaque Seymour Glagov, William P., III Newman, Sheldon A. Schaffer, 2012-12-06 Seymour Glagov The last meeting devoted exclusively to an examination of the atherosclerotic plaque took place in Chicago 25 years ago under the joint auspices of the Council on Arteriosclerosis of the American Heart Association and the Chicago Heart Association The proceedings were published subsequently in a volume entitled Evolution of the Atherosclerotic Plaque edited by Richard J Jones 1 Both experimental and human lesions were considered and several provocative new approaches to the disorder were discussed The electron microscope was being applied systematically to the study of blood vessels at that time so that details of the infrastructure and cellular composition of the artery wall and of atherosclerotic lesions were presented in some detail There was as one result of these explorations considerable discussion of morphologic evidence suggesting that the principal cell involved in the atherogenic process was neither the fibroblast nor the macrophage as had been supposed but the smooth muscle cell In particular the findings indicated that this cell could incorporate lipid and become a foam cell Atherosclerosis and Arteriosclerosis Rodney A. White, 2019-11-14 Selected as an outstanding book in vascular surgery by members of the Society for Vascular Surgery This unique new text describes the current understanding of the etiology and pathogenesis of human atherosclerosis It also details the methods for quantitating and characterizing both experimental and clinical lesions and describes the methods for preparing available animal models Providing an in depth review of each of these topics the text organizes the information in one volume for the convenience of the reader The text is divided into two sections First is a description of the cell biology biochemistry and pharmacology of normal vessels and of atherosclerotic human lesions with details of the methods to accurately characterize and quantitate the disease Secondly it presents a description of the methods for preparing the available experimental animal models including a discussion of the distribution and pathological characteristics of the lesions It also includes comparisons of human atherosclerosis and experimental animal models Intended to provide a basis for expediting future research in this priority health care area this text compiles the available information for those who treat patients with atherosclerosis or who are involved in atherosclerosis research It is of particular interest to students physicians and academic and commercial researchers *Prehypertension and Cardiometabolic Syndrome* Reuven Zimlichman, Stevo Julius, Giuseppe Mancia, 2018-12-06 This book sheds new light on the management of patients with borderline cardiovascular risk factors in order to prevent their progression to end organ damage The book stimulates discussion of this poorly understood condition and lays the groundwork for developing recommendations and guidelines While the diagnostic and therapeutic approach to full blown diabetes hypertension dyslipidemia and obesity is well defined there is still a lack of clear understanding and guidelines as far as patients with borderline conditions especially when multiple are concerned Moreover end organ damage depends on several factors including genetic factors making it difficult to predict its extent As such the gradual transition

from a healthy subject to one with functional hemodynamic changes and then one with structurally asymptomatic changes and lastly to overt disease needs further investigation In order to address these knowledge gaps the book covers a broad variety of topics making it a valuable tool for identifying which asymptomatic subjects could profit from being appropriately screened and at what stage Furthermore it offers insights into better treating these patients to prevent their progression to overt disease The book appeals to cardiologists primary care physicians and all those healthcare professional looking to optimize the management of these complex and often undiagnosed cases

Imaging Coronary Atherosclerosis Stephen J. Nicholls, Tim Crowe, 2014-06-04 For over 50 years coronary angiography has been the mainstay of diagnosing and quantifying the extent of coronary artery disease However appreciation of the inherent limitations of conventional angiography has led to a plethora of new imaging modalities each with their relative strengths and potential pitfalls Advances in these techniques have given clinicians as well as researchers an overwhelming amount of information and the need for thoughtful interpretation This outstanding book provides a comprehensive overview of the current status of imaging of coronary atherosclerosis Covering the wide variety of available imaging modalities the book provides state of the art knowledge from leading authorities in each area In their discussion the authors include both invasive and non invasive modalities including the gold standard coronary angiography the growing field of IVUS and novel techniques such as functional imaging molecular imaging and the integration of biomarkers The key concepts and practical information given in this volume will provide the reader with the necessary understanding to choosing appropriate imaging studies and building confidence in their skill set with each

Intravascular Imaging: Current Applications and Research Developments Tsakanikas, Vasilios D., 2011-10-31 Limitations of angiography the traditional invasive method for assessing vascular pathology have led to an interest in alternative invasive techniques that visualize the arterial wall and allow characterization of plaque type These alternative techniques which include intravascular ultrasound angioscopy thermography optical coherence tomography near infrared spectroscopy and intravascular magnetic resonance imaging are able to provide valuable information regarding plaque vulnerability the composition of plaque and luminal morphology Intravascular Imaging Current Applications and Research Developments presents all available intravascular imaging techniques and analyzes their impact in clinical practice and research This publication aims to inform medical specialists biomedical engineers bioinformaticians and researchers of current developments and future trends in intravascular imaging techniques promoting continued evolution of this discipline

Cholesterol Crystals in Atherosclerosis and Other Related Diseases George S. Abela, Stefan Mark Nidorf, 2023-11-22 This book is the first authoritative and comprehensive text dedicated to the understanding of how cholesterol triggers vascular inflammation and mechanical injury that leads to heart attacks strokes as well as other organ and tissue pathology It includes chapters on the background of cholesterol crystal formation and methods for their detection as well as a description of the physiochemical transformation of metastable liquid cholesterol to a solid flat

plate crystalloid within the cellular and extracellular environment resulting in volume expansion Chapters also discusses cholesterol crystals and other crystalloid molecules found in atherosclerotic plaque In addition the book examines how cholesterol crystals can induce similar injurious processes in other organs including the retina of the eye to cause blindness in solid cancers causing further tumor growth and in the brain of patients with Alzheimer s And lastly the book addresses various potential therapeutics that disrupt the physiochemical transformation of cholesterol from a liquid to a solid inhibit its role in triggering inflammation and tissue injury while ushering a path towards targeted therapies Cholesterol Crystals in Atherosclerosis and Other Related Diseases will be of interest to cardiologists as well as individuals in various fields of science including crystallography basic and clinical imaging cardiac oncology and drug discovery

The Natural and Unnatural History of Congenital Heart Disease Julien I. E. Hoffman, 2011-09-07 Evaluates the natural history of congenital heart lesions as a background to finding out if and how much treatment has improved outcomes Introduces and defines lesions providing general information about its frequency familial or syndromic associations and associated congenital heart lesions Provides sections on pathological anatomy and physiology important in determining outcomes Includes results of surgery both in terms of survival and also in terms of event free survival that is survival free of reoperation cardiac failure arrhythmias and other late complications that are often seen Helps cardiologists and cardiac surgeons understand what is likely to happen to patients with or without treatment and which forms of treatment currently in use provide the best outcomes to date

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Atherothrombosis and Coronary Artery Disease Valentin Fuster, Eric J. Topol, Elizabeth G. Nabel, 2005 Written by the world s foremost authorities this volume provides comprehensive coverage of current approaches to the prevention diagnosis and management of atherothrombosis and its coronary and noncoronary complications This edition has been thoroughly updated sharply focused on clinical information and trimmed to one manageable volume Coverage begins with a review of risk factors and prevention emphasizing lipid abnormalities hypertension smoking diabetes and obesity Subsequent sections examine the pathogenesis of atherosclerosis markers and

imaging acute coronary syndromes chronic stable angina and noncoronary atherothrombosis Clinical presentations medical management and the latest interventional strategies are included Atherosclerosis Teruo Watanabe, Jianglin Fan, 2025-05-24 This book covers all aspects of atherosclerosis from human pathology to experimental studies from basic science to clinical applications It comprises 20 chapters including human pathology of human atherosclerosis cellular biology of atherosclerosis endothelial cells smooth muscle cells monocyte macrophages dendritic cells and so on molecular biology of lipid metabolism and hyperlipidemia pathophysiology of acute coronary syndrome plaque vulnerability and plaque rupture aortic aneurysms peripheral atherosclerosis The chapters begin with the history of atherosclerosis followed by different hypotheses regarding atherosclerosis Through these introductions readers can learn the state of the art information from human pathological observations to basic research from experimental animal studies to clinical practice The book includes more than 100 color pictures along with schematic illustrations An effort has been made to show real pathological observations with clinical implications side by side This book not only helps researchers and clinicians understand the molecular basis of atherosclerosis but also guides them to explore the unknown questions based on the experience of the authors It also serves as a useful reference for medical students interested in learning about cardiovascular diseases or those planning to participate in atherosclerosis research **Cumulated Index Medicus**, 1991 *Research Grants Index* National Institutes of Health (U.S.). Division of Research Grants, 1975 Adalat® in the Asian Pacific Region David T. Kelly, 2012-12-06 These are the proceedings of the third Asian Pacific Adalat Symposium The first was held in Tokyo in 1982 and the second in Sydney in 1985 We were honoured that the late Dr Sukaman and his colleagues were able to host this third symposium in Jakarta This meeting was designed to contribute to and to promote international collaboration in cardiovascular research and to help promote further knowledge and understanding about the treatment of vascular disease in the Asian Pacific area Nifedipine was originally investigated in the mid 1960s by Prof Fleckenstein His first results showed this drug was a powerful calcium antagonist which altered excitation contraction At this time there was a rapid development of knowledge about the pathophysiology of ischaemic heart disease and thus the important pharmacological work on calcium antagonists such as nifedipine paralleled and complimented the newer understanding of coronary physiology in man In a short time most therapy was designed to reduce myocardial oxygen consumption and demand **Cardiovascular Imaging E-Book** Vincent Ho, Gautham P. Reddy, 2010-11-09 Cardiovascular Imaging a title in the Expert Radiology Series edited by Drs Vincent Ho and Gautham P Reddy is a comprehensive 2 volume reference that covers the latest advances in this specialty It provides richly illustrated advanced guidance to help you overcome the full range of diagnostic therapeutic and interventional challenges in cardiovascular imaging and combines an image rich easy to use format with the greater depth that experienced practitioners need Online access at www.expertconsult.com allows you to rapidly search for images and quickly locate the answers to any questions Access the fully searchable text online at www.expertconsult.com along with

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Improvement of Myocardial Perfusion J. Meyer,R. Erbel,H.J. Rupprecht,2012-12-06 This book contains the manuscripts of the majority of the papers given during the symposium Improvement of Myocardial Perfusion which was held from September 27-29 1984 in Mainz Germany It has been the purpose of this meeting to focus the interest of scientifically and clinically interested cardiologists on the new developments in this field We therefore chose the subtitle Medical Mechanical Surgical Approach The medical improvements in myocardial perfusion have been brought about by the application of streptokinase urokinase and tissue type plasminogen activator in the first hours after the onset of an acute myocardial infarction The different modes of application and the possibilities to evaluate and eventually to quantify the results of these treatments were addressed during the first part of the meeting The mechanical way to improve perfusion nowadays mainly consists of the application of intracoronary balloon angioplasty Although since 1977 the treatment has become a routine method several questions are still open such as the exact mode of action the reaction of the vessel wall the optimal pressure and balloon size as well as the long term results and the prevention of restenosis Vascular Mechanics and Pathology Mano J. Thubrikar,2007-01-06 Nowhere in the scientific progress has the schism in the knowledge been as striking as in the case of vascular mechanics and pathology This joint subject would serve as a classic example of science developed in two different directions It provided the motivation to put forth this book and establish a correlation between vascular mechanics and pathology The book focuses on the artery and arterial diseases The most fundamental functions of the artery are 1 to

serve as a conduit of blood flow and 2 to serve as a container of blood pressure The artery carries the blood to all organs of the body and it uses pressure to drive the blood through the tissue to provide nourishment Hence the artery is both a pipe and a pressure vessel The artery pulsates about 103 000 times a day along with the beating heart In a lifetime the artery sustains cyclic pressure for about 3 8 billion cycles This obviously poses a significant challenge to the artery and therefore the artery must be endowed with special structure and properties to meet this challenge In the event that additional challenges are imposed such as high blood pressure it would not be surprising that the artery could break down or become diseased In the book we examine the structure and properties of the artery and study the challenges imposed on it with a view to understand the survival of and the development of the diseases in the artery Cardiovascular Medicine James T. Willerson, Jay N. Cohn, Hein J.J. Wellens, David R. Holmes, 2007-12-06 This book offers the most up to date user friendly guidance on the evaluation diagnosis and medical and surgical treatment of heart and vascular disease The book and DVD package is designed to provide comprehensive coverage of every aspect of cardiovascular medicine The book has consistent chapter organization relevant to modern cardiovascular practice clear design and engaging text The reader will have all the guidance to diagnose and manage the full range of cardiovascular conditions in one textbook resource while also benefiting from access to additional video material from the integral DVD ROM This includes over 100 individual heart sounds

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