



Non-invasive Clinical Measurement of Ocular Rigidity and Comparison to Biomechanical and Morphological Parameters in Glaucomatous and Healthy Subjects

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Purpose: To assess ocular rigidity using dynamic optical coherence tomography (OCT) videos in glaucomatous and healthy subjects, and to evaluate how ocular rigidity correlates with biomechanical and morphological characteristics of the human eye.

Methods: Ocular rigidity was calculated using Friedenwald's empirical equation which estimates the change in intraocular pressure (IOP) produced by volumetric changes of the eye due to choroidal pulsations with each heartbeat. High-speed OCT video was utilized to non-invasively measure changes in choroidal volume through time-series analysis. A control-case study design was based on 23 healthy controls and 6 glaucoma cases. Multiple diagnostic modalities were performed during the same visit including Spectralis OCT for nerve head video, Pascal Dynamic Contour Tonometry for IOP and ocular pulse amplitude (OPA) measurement, Corvis ST for measuring dynamic biomechanical response, and Pentacam for morphological characterization.

Results: Combining glaucoma and healthy cohorts ($n = 29$), there were negative correlations between ocular rigidity and axial length (Pearson $R = -0.53$, $p = 0.003$), and between ocular rigidity and anterior chamber volume ($R = -0.64$, $p = 0.0002$). There was a stronger positive correlation of ocular rigidity and scleral stiffness (i.e., stiffness parameter at the highest concavity [SP-HC]) ($R = 0.62$, $p = 0.0005$) compared to ocular rigidity and corneal stiffness (i.e., stiffness parameter at the first applanation [SP-A1]) ($R = 0.41$, $p = 0.033$). In addition, there was a positive correlation between ocular rigidity and the static pressure-volume ratio (P/V ratio) ($R = 0.72$, $p < 0.0001$).

Conclusions: Ocular rigidity was non-invasively assessed using OCT video and OPA in a clinic setting. The significant correlation of ocular rigidity with biomechanical parameters, SP-HC and P/V ratio, demonstrated the validity of the ocular rigidity measurement. Ocular rigidity is driven to a greater extent by scleral stiffness than corneal stiffness. These *in vivo* methods offer an important approach to investigate the role of ocular biomechanics in glaucoma.

Keywords: ocular rigidity, glaucoma, ocular biomechanics, optical coherence tomography, stiffness parameter, pressure volume relationships

Non Invasive Clinical Measurement

Richard S. C. Cobbold



Non Invasive Clinical Measurement:

Non-invasive Clinical Measurement David Ernest Meguyer Taylor, Joan Whamond, 1977 **Non-invasive Clinical Measurement** David Ernest Meguyer Taylor, Joan Whamond, 1977 Non-Invasive Measurements of Bone Mass & Their Clinical Application Stanton H. Cohn, 2020-04-15 First Published in 1981 this book offers a full comprehensive guide to measuring bone mass Carefully compiled and filled with a vast repertoire of notes diagrams and references this book serves as a useful reference for students of osteology and other practitioners in their respective fields **Non-Invasive Instrumentation and Measurement in Medical Diagnosis** Robert B. Northrop, 2017-10-23 Non Invasive Instrumentation and Measurement in Medical Diagnosis Second Edition discusses NIMD as a rapidly growing interdisciplinary field The contents within this second edition text is derived from Professor Robert B Northrop s experience teaching for over 35 years in the Biomedical Engineering Department at the University of Connecticut The text focusses on the instruments and procedures which are used for non invasive medical diagnosis and therapy highlighting why NIMD is the preferred procedure whenever possible to avoid the risks and expenses associated with surgically opening the body surface This second edition also covers a wide spectrum of NIMD topics including x ray bone densitometry by the DEXA method tissue fluorescence spectroscopy optical interferometric measurement of nanometer tissue displacements laser Doppler velocimetry pulse oximetry and applications of Raman spectroscopy in detecting cancer to name a few This book is intended for use in an introductory classroom course on Non Invasive Medical Instrumentation and Measurements taken by juniors seniors and graduate students in Biomedical Engineering It will also serve as a reference book for medical students and other health professionals intrigued by the topic Practicing physicians nurses physicists and biophysicists interested in learning state of the art techniques in this critical field will also find this text valuable Non Invasive Instrumentation and Measurement in Medical Diagnosis Second Edition concludes with an expansive index bibliography as well as a comprehensive glossary for future reference and reading **Clinical Measurement in Drug Evaluation** Nimmo/Tucker, 1991-09-27 Clinical measurement of the therapeutic and adverse effects of a drug is an important part of drug evaluation and registration This volume presents full coverage of the principles and practice of the measurement of drug effects in humans and its role in the evaluation and development of new drugs Clinical interpretation and relevance of data as well as the acceptability and accuracy of methodology are emphasized together with the special problems of the cardiovascular system and the central nervous system Contributions are from an international team of scientists and clinicians from both academia and industry Clinical Measurement in Drug Evaluation will be useful for clinical and research scientists research based pharmacologists and the pharmaceutical industry *Biomedical Index to PHS-supported Research* ,1990 **Echocardiology** N. Bom, 2012-12-06 Echocardiology comprises all aspects of diagnostic application of ultrasound to cardiac patients It is probably the fastest growing non invasive technique today Almost all progress in this young and exciting field has been the

positive result of close co operation between medical and technical scientists This book contains a series of lectures held at Erasmus University Rotterdam in June 1977 and is divided in three sections clinical echocardiology consisting of both an introduction to the basic principles as well as a wide variety of applications aimed at the clinically oriented reader Doppler methods where in addition to its clinical applications also the engineering of new developments will be presented the two dimensional real time imaging where many new techniques including computer methods holography and acousto optical systems will be discussed We hope that this book will stimulate communication between scientists of various disciplines and nationalities N Bom J Roelandt P G Hugenholtz Rotterdam June 1977 III Preface The last three decades have seen a remarkable advance in diagnostic instrumentation in diseases of the circulation In the 1940 s the only diagnostic aids were the electrocardiogram and simple X ray These were quickly followed by the cardiac catheter phonocardiography radio isotope methods and angiocardiology The development of cardiac surgery provided the impetus to developing more accurate methods of diagnosis preferably those that did not need invasion of the patient The introduction of ultrasound has contributed towards this aim in the last few years

Clinical Engineering Azzam Taktak,Paul Ganney,David Long,2013-11-12 Clinical Engineering is intended for professionals and students in the clinical engineering field who need to successfully deploy medical technologies The book provides a broad reference to the core elements of the subject and draws from the expertise of a range of experienced authors In addition to engineering skills clinical engineers must be able to work with patients and with a range of professional staff including technicians and clinicians and with equipment manufacturers They have to keep up to date with fast moving scientific and medical research in the field and be able to develop laboratory design workshop and management skills This book is the ideal companion in such studies covering fundamentals such as IT and software engineering as well as topics in rehabilitation and assistive technology Provides engineers in core medical disciplines and related fields with the skills and knowledge to successfully collaborate to in developing medical devices to approved procedures and standards Covers US and EU standards FDA and MDD respectively plus related ISO requirements the de facto international standards and is backed up by real life clinical examples case studies and separate tutorials for training and class use The first comprehensive and practical guide for engineers working in a clinical environment

Maths, Physics and Clinical Measurement for Anaesthesia and Intensive Care Hozefa Ebrahim,David Ashton-Cleary,2019-10-31 Covers essential information on maths physics and clinical measurement for anaesthesia and critical care Innovation in Glaucoma Michele Lanza,Dariusz Dobrowolski,Soosan Jacob,2022-03-25

Asthma:
Epidemiology, Anti-Inflammatory Therapy and Future Trends Mark A. Giembycz,Brian J. O'Connor,2012-12-06 1 1
Invasive versus Non Invasive Clinical Measurements in Medicine Clinical measurement has become an essential complement to traditional physical diagnosis An ideal clinical measurement should be quantitative have a high level of reliability and accuracy be safe acceptable to the patient easy to perform and non invasive The latter demands that the technique should

not break the skin or the lining epithelium and should be devoid of effects on the tissues of the body by the dissipation of energy or the introduction of infection 1 It is therefore logical that for a given measurement a non invasive test will be preferred if it provides the same information with the same accuracy and precision In the following sections we will discuss the role of various non invasive or relatively non invasive methods to assess airway inflammation in asthma and concentrate on the only direct method of induced sputum examination 1 2 Why Is Assessment of Airway Inflammation Important in Asthma Inflammation is a localized protective response elicited by injury or destruction of tissues which serves to destroy dilute or wall off both the injurious agent and the injured tissue 2 The role of inflammation in asthma was recognized long ago In his textbook *The Principles and Practice of Medicine* in 1892 Sir William Osler described bronchial asthma in many cases as a special form of inflammation of the smaller bronchioles

Fetal Physiological Measurements Peter Rolfe, 2013-10-22 *Fetal Physiological Measurements* provides information pertinent to the fundamental aspects of fetal and neonatal physiological measurements This book discusses the accuracy of ultrasound autocorrelation method Organized into seven parts encompassing 45 chapters this book begins with an overview of the various factors that cause fetal heart sounds to differ from those after birth This text then examines the importance of phonocardiography in monitoring the fetal cardiovascular system Other chapters consider the significant relationship between the fetal heart rate patterns and uterine activity wherein each uterine contraction represents a stress for the fetus This book discusses as well the assessment of fetal motor activity in utero which became feasible after the introduction of real time ultrasound into obstetrics The final chapter deals with the primary causes of neurological morbidity and mortality related to determinable events in the neonatal period This book is a valuable resource for obstetricians pediatricians physiologists and biomedical engineers

Foundations of Biomedical Ultrasound Richard S. C. Cobbold, 2006-09-07 *Foundations of Biomedical Ultrasound* provides a thorough and detailed treatment of the underlying physics and engineering of medical ultrasound practices It covers the fundamental engineering behind ultrasound equipment properties of acoustic wave motion the behavior of waves in various media non linear waves and the creation of images The most comprehensive book on the subject *Foundations of Biomedical Ultrasound* is an indispensable reference for any medical professional working with ultrasound imaging and a comprehensive introduction to the subject for students The author has been researching and teaching biomedical ultrasonics at the University of Toronto for the past 25 years

Noninvasive Diagnostic Techniques in Vascular Disease Eugene F. Bernstein, 1985

Biomedical Index to PHS-supported Research: pt. A. Subject access A-H, 1992

Continuous System Simulation D.J. Murray-Smith, 2012-12-06 obtained by simulation more quickly effectively and cheaply than by experimentation and testing of the real system System performance in the physical sciences engineering biology and medicine The reasons for this trend can also be investigated using simulation relate not only to the steadily increasing demand for a much wider range of conditions than

can be contemplated for the real system power of computers and the rapidly falling costs of hardware but also to the availability because of operating constraints or safety of appropriate software tools in the form of requirements. Similar factors can apply in simulation languages. Problem oriented languages in other fields such as biomedical systems languages of this kind assist those who are not engineering specialists in computational methods to transform system simulation using digital computers can relate either to models based on continuous or discrete mathematical descriptions or to discrete event descriptions. They can also provide useful diagnostic information when difficulties are encountered. Therefore a simulation language can handle differential equations and algebraic equations.

Mathematical and Computational Methods in Physiology L. Fedina, B. Kanyár, B. Kocsis, 2013-10-22. Mathematical and Computational Methods in Physiology discusses the importance of quantitative description of physiological phenomena and for quantitative comparison of experimental data. An article explains the homeostasis of the body with a focus on the controlling aspects. This section evaluates the concepts of modern physiology and biocybernetics. The canal-ocular reflex and the otolith-ocular reflex in man stimulates eye rotations compensatory for head angular and linear displacements. The book enumerates some modelling and simulation to observe the visual-vestibular interaction during angular and linear body acceleration. A section on the determination of cardiovascular control is given. The text reviews the mathematical models of the biological age of the rat. A numerical simulation of water transport in epithelial junctions is explained comprehensively. A chapter analyzing the computer simulation of drug receptor interaction is presented. The book will provide useful information to zoologists, doctors, ophthalmologists, students and researchers in the field of medicine.

Alternatives to Animal Use in Research, Testing, and Education, 1986

Medical Physics and Biomedical Engineering B.H Brown, R.H Smallwood, D.C. Barber, P.V Lawford, D.R Hose, 2017-09-06. Medical Physics and Biomedical Engineering provides broad coverage appropriate for senior undergraduates and graduates in medical physics and biomedical engineering. Divided into two parts, the first part presents the underlying physics, electronics, anatomy and physiology, and the second part addresses practical applications. The structured approach means that later chapters build and broaden the material introduced in the opening chapters. For example, students can read chapters covering the introductory science of an area and then study the practical application of the topic. Coverage includes biomechanics, ionizing and nonionizing radiation and measurements, image formation techniques, processing and analysis, safety issues, biomedical devices, mathematical and statistical techniques, physiological signals and responses, and respiratory and cardiovascular function and measurement. Where necessary, the authors provide references to the mathematical background and keep detailed derivations to a minimum. They give comprehensive references to junior undergraduate texts in physics, electronics, and life sciences in the bibliographies at the end of each chapter.

Maximizing Healthcare Delivery and Management through Technology Integration Iyamu, Tiko, 2015-09-08. Improvements in

health services require continual attention and dedication to ensure proper care and treatment for citizens To support this endeavor professionals rely more and more on the application of information systems and technologies to promote the overall quality of modern healthcare Maximizing Healthcare Delivery and Management through Technology Integration is an authoritative reference source for the latest scholarly research on the integration of ICT within the health services sector Featuring comprehensive coverage on a range of topics from technical and non technical perspectives this book is an essential reference source for IT specialists professionals managers and students seeking current research on the growing relationship between technology and healthcare

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