
19. ELECTROCARDIOGRAPHIC BODY SURFACE POTENTIAL MAPS OF THE QRS AND T OF NORMAL CHILDREN—QUALITATIVE DESCRIPTION AND SELECTED QUANTITATIONS

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A normal data base of electrocardiographic body surface potential maps (BSPM) has yet to be obtained, in either adults or children. Taccardi's [1, 2] studies, mainly in adults, include a small but unknown number of children. Spach [3, 4] has published data on a total of 23 normal children, ages 4 to 14 years, while Tazawa and Yoshimoto [5] have reported upon a small number of normal infants.

We have recently published detailed qualitative data from the QRS of 40 normal children using a newly developed 180-electrode system, with the 180 dry electrodes enclosed in an easily applied vest and with the display in color [6]. Attempts were made to correlate the qualitative observations with the underlying cardiac electrical events, based upon various published

results. These included the activation data of perfused human hearts obtained by Durrer [7], simultaneous records of body surface and epicardial potentials in the chimpanzee obtained by Spach and his group [8], and the Miller-Geselowitz forward simulation [9]. The chimpanzee's chest geometry resembles the human, and the Miller-Geselowitz forward simulation utilized realistic heart and torso geometries. The latter data also utilized source configurations based on measured excitation sequences and cellular action potentials. Distinctive patterns of the BSPM during the QRS of the 40 children were identifiable, but considerable variations in the normal QRS were evident, not predictable from the standard 12 lead ECG or the Frank system orthogonal ECG.

We have more recently presented selected quantifications of the body surface potentials of the QRS and T of 39 of the above 40 children [10]. It is the firm belief of the authors that proper interpretation of normal and abnormal electrocardiographic data is not possible without quantification [11, 12].

This chapter presents both qualitative and

All of the figures in chapter 19 are color figures, and they appear in the color section in the middle of this book. Supported by National Heart, Lung and Blood Institute, National Institutes of Health Grant #HL 17931. Liebman, J., Plonsey, R., and Rudy, Y. (eds.), *Pediatric and Fundamental Electrocardiography*. Copyright © 1987. Martinus Nijhoff Publishing. All rights reserved.

Electrocardiographic Studies In Normal Infants And Children

**Hugh D. Allen, David J. Driscoll, Robert
E. Shaddy, Timothy F. Feltes**



Electrocardiographic Studies In Normal Infants And Children:

Electrocardiographic Studies in Normal Infants and Children Robert F. Ziegler, 1951 **Electrocardiographic studies in normal infants and children** Edward B. Krumbhaar, 1917 **The Normal and Abnormal Unipolar Electrocardiogram in Infants and Children** Richard H. Wasserburger, 1963 *The Fundamentals of Electrocardiographic Interpretation* Jay Bailey Carter, 1945 **Moss & Adams' Heart Disease in Infants, Children, and Adolescents** Hugh D. Allen, David J. Driscoll, Robert E. Shaddy, Timothy F. Feltes, 2013-05-30 This 8th Edition of Moss and Adams Heart Disease in Infants Children and Adolescents Including the Fetus and Young Adult provides updated and useful information from leading experts in pediatric cardiology Added chapters and a companion web site that includes the full text with bonus question and answer sections make this Moss and Adams edition a valuable resource for those who care for infants children adolescents young adults and fetuses with heart disease Features Access to online questions similar to those on the pediatric cardiology board examination to prepare you for certification or recertification Leading international experts provide state of the art diagnostic and interventional techniques to keep you abreast of the latest advances in treatment of young patients Chapters on quality of life quality and safety pharmacology and research design add to this well respected text **ECG in the Child and Adolescent** Hung-Chi Lue, 2008-04-15 Compiled from electrocardiographic data on more than 1 800 normal newborns infants children and adolescents this convenient reference gives you fast access to the limits of normality so that data from an individual patient can be quickly interpreted in terms of comparison to the general population ECGs in the Child and Adolescent presents by age Heart Rate P QRS T interval and duration Frontal plane P QRS T axis P QRS T amplitude Calculated values on RS amplitude and ventricular activation time Save time and effort by keeping this authoritative guide close at hand *Electrocardiography in Infants and Children* Donald E. Cassels, Robert F. Ziegler, American College of Chest Physicians, 1966 **Pediatric and Fundamental Electrocardiography** Jerome Liebman, Robert Plonsey, Yoram Rudy, 2012-12-06 The field of electrocardiography is at a cross roads We have reached an era in cardiovascular about the electrical state of the heart not likely to be available in any other imaging techniques medicine where it is claimed that imaging is king The innovative and useful ultrasound And in the body surface potential map we have an imaging technique that goes beyond structural techniques continue to develop and in the wings lie magnetic resonance position emission tomography the only other being perhaps magnetic resonance which has the potential for metabolic and perhaps other modalities Consequently there are those who state that other than the imaging Clinical electrocardiography is important problems related to cardiac rhythm electrocardiography is not only as a diagnostic tool for it can truly cardiology as a discipline is passe In addition give insight into the effect of the disease in question on the heart muscle itself tion although there is continued superb work in the basic science related to arrhythmias only Therefore it seemed now to be appropriate to a handful of scientists are interested in the bring together leaders in the various fields of myocardial source per se And few scientists are

electrocardiography with the only constraint interested in what happens to that myocardial being a concentration on newer concepts and electrical source on its trip from the endo ideas *Moss & Adams' Heart Disease in Infants, Children, and Adolescents, Including the Fetus and Young Adult* Hugh D. Allen, 2016-02-02 The 9th edition of the gold standard in pediatric cardiology offers up to date comprehensive coverage of this challenging and rapidly changing field New chapters based on reader requests two new associate editors new contributing authors and an enhanced digital version of the text make Moss and Adams Heart Disease in Infants Children and Adolescents the reference you ll turn to when caring for patients From cover to cover this award winning two volume resource provides the authoritative state of the art information you need when caring for young patients with heart disease New reader requested chapters cover Development of Myocardial Structure and Function Global Challenge of Heart Disease Impact of Congenital Heart Disease on Other Organ Systems Non Compaction Cardiomyopathy Beyond the Cardiac Device and Transition to Adult Care All chapters have been updated and revised including vital new information on genetics and embryo development Two new associate editors Drs Daniel J Penny and Frank Cetta offer fresh perspectives in their areas of expertise Enhanced digital access includes the full text bonus question and answer sections similar to those on the pediatric cardiology board examination videos of echoes angiograms aortic arch anomalies open heart operations and more and phonocardiograms with accompanying audio of various heart sounds and murmurs *Moss & Adams' Heart Disease in Infants, Children, and Adolescents* Robert E. Shaddy, 2021-02-19 Widely recognized as the definitive text in pediatric cardiology Moss and Adams Heart Disease in Infants Children and Adolescents provides the authoritative state of the art information you need when caring for young patients with heart disease The editorial team led by Dr Robert Shaddy from Children s Hospital Los Angeles and the University of Southern California ensures that you are kept fully up to date with recent advances in this complex and fast changing field This award winning title now in its Tenth Edition continues to be the reference of choice for today s cardiology fellows pediatric cardiologists and cardiology practitioners worldwide *Pediatric Anesthesiology* Morton Digby Leigh, Mabel Kathleen Belton, 1960 **Moss and Adams' Heart Disease in Infants, Children, and Adolescents** Hugh D. Allen, 2008 Established since 1968 as a classic pediatric cardiology text this two volume work is now in its Seventh Edition Leading international experts describe state of the art diagnostic and interventional techniques for young patients with congenital and acquired heart diseases and for adult survivors of congenital heart disease This edition s section on pediatric cardiac intensive care has new chapters on interventricular and cardiopulmonary interactions and on the extreme premature premature and normal newborn A section From the Gene to the Neonate provides in depth coverage of genetics fetal echocardiography and fetal cardiology An extensive section focuses on adult survivors of congenital heart disease A companion Website will include the fully searchable online text and a full color image bank **Papers from the Mayo Foundation for Medical Education and Research and the Medical School** Mayo Foundation for Medical Education and Research, 1921 Project Report USAF

School of Aerospace Medicine,1960 *The Developing Heart: A 'History' of Pediatric Cardiology* Catherine A. Neill,E.P. Clark,2013-04-18 Pediatric cardiology is celebrating in the 1990s the 50th anniversary of the beginnings of the age of therapy This informal history describes how the discipline grew from the era of pathologic anatomy to the dawn of therapy the beginnings of closed heart surgery between 1939 and 1945 That dawn ushered in a remarkable half century of change and growth leading from clinicophysiologic correlations through the start of open heart surgery in the 1950s The text celebrates some of the achievements of this vivid and heroic age and describes how in the mid 1970s new surgical and medical approaches including prostaglandins and Doppler echocardiography led to successful cardiac treatment in infancy the infant era Interventional cardiology and the study of childhood arrhythmias began Now in the 1990s a new era emphasising molecular biology and cardiac development is growing from the tools and concepts of the past The four eras have focused on pathologic anatomy clinicophysiologic correlations and surgery heart problems in infancy and now the developing heart In each era there have been advances in the four domains of pediatric cardiology the heart before birth the normal heart heart disease and defects and preventive cardiology Growth in knowledge has been both episodic and dramatic yet not a picture of unalloyed achievement The later chapters discuss some of the problems beginning to be recognised in the new and current developmental era The pioneers of pediatric cardiology both men and women are more than eponyms for each used in new and original ways the tools and concepts available in their era The interaction of tools and concepts is a theme in this book Just as the tool of the stethoscope was vital in delineating the clinical profile of ventricular septal defect and patent ductus the fluoroscope played a role in developing the concept of the Blalock Taussig shunt Pioneers also includepatients and their families and the book includes some discussion of what little is known of childhood and of the child with heart disease in the four different eras This is a brief overview of the growth of knowledge of children s hearts from before William Harvey until our own time and includes references to histories of cardiac surgery and to collections of classic cardiac papers By its emphasis on the child as the central historic figure and on the interaction of tools and concepts in the growth of knowledge the text provides a celebratory approach to the 50th anniversary of modern pediatric cardiology

Chou's Electrocardiography in Clinical Practice Borys Surawicz,Timothy Knilans,2008-03-05 Widely considered the optimal electrocardiography reference for practicing physicians and consistently rated as the best choice on the subject for board preparation this is an ideal source for mastering the fundamental principles and clinical applications of ECG The 6th edition captures all of the latest knowledge in the field including expanded and updated discussions of pediatric rhythm problems pacemakers stress testing implantable cardioverter defibrillator devices and much more It s the perfect book to turn to for clear and clinically relevant guidance on all of today s ECG applications Comprehensively and expertly describes how to capture and interpret all normal and abnormal ECG findings in adults and children Features the expertise of internationally recognized authorities on electrocardiography for advanced assistance in mastering the subtle but critical nuances of this

complex diagnostic modality Features new chapters on pediatric electrocardiography that explore rhythm problems associated with pediatric obesity heart failure and athletic activity Presents a new chapter on recording and interpreting heart rhythms in patients with pacemakers Includes new material on interpreting ECG findings associated with implantable cardioverter defibrillators Provides fully updated coverage on the increased importance of ECGs in stress testing *The ECG* Marc Gertsch, 2013-06-29 Introduction by Bernhard Meier x Acknowledgements xi Abbreviations xxxiii Theoretical Basics and Practical Approach Introduction and Concept of the Book 1 Introduction 1 The Value of the ECG Today Limitations of the Pattern ECG 1 Conclusions 2 Concept of the Book 2 Theoretical Basics 3 Anatomy of the Impulse Formation and Impulse Conduction Systems 3 2 Normal Impulse Conduction 3 3 Action Potential of a Single Cell of Working Myocardium and its Relation to Ion Flows 4 4 Atrial Depolarization and Repolarization 5 5 Ventricular Depolarization and Repolarization 6 5 1 Vectors and Vectorcardiogram 6 5 2 Simplified QRS Vectors 6 6 Lead Systems 7 7 Magnifying Glass and Proximity Effects 7 8 Refractory Period 9 9 Nomenclature of the ECG 9 References 11 Practical Approach 13 1 The Practical Approach 14 1 1 Definitive ECG diagnosis 15 xiii 2 Practical approach 16 2 1 Analysis of rhythm 16 2 2 Detailed analysis of morphology 17 References 18 Pattern ECG The Normal ECG and its Normal Variants 19 Components of the Normal ECG 19 1 1 Sinus Rhythm 19 1 1 1 Atrial Vectors in Sinus Rhythm 20 1 2 PQ Interval 21 1 3 QRS complex 21 1 3 1 QRS Axis in the Frontal Plane QRS 21 p 1 3 2 QRS Axis in the Horizontal Plane 22 1 3 3 Two Special QRS Patterns 22 1 3 4 Other Normal Variants of the QRS Complex 22 1 4 ST Segment **Papers from the Mayo Foundation for medical education and research and the medical school** , 1921 Proceedings of the Fourth Annual Conference of State Directors in Charge of the Local Administration of the Maternity and Infancy Act (Act of Congress of November 23, 1921) Mary Mather Leete, Nettie Pauline McGill, Neva Ruth Deardorff, United States. Children's Bureau, 1927 *Publications of the Children's Bureau* United States. Children's Bureau, 1927

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