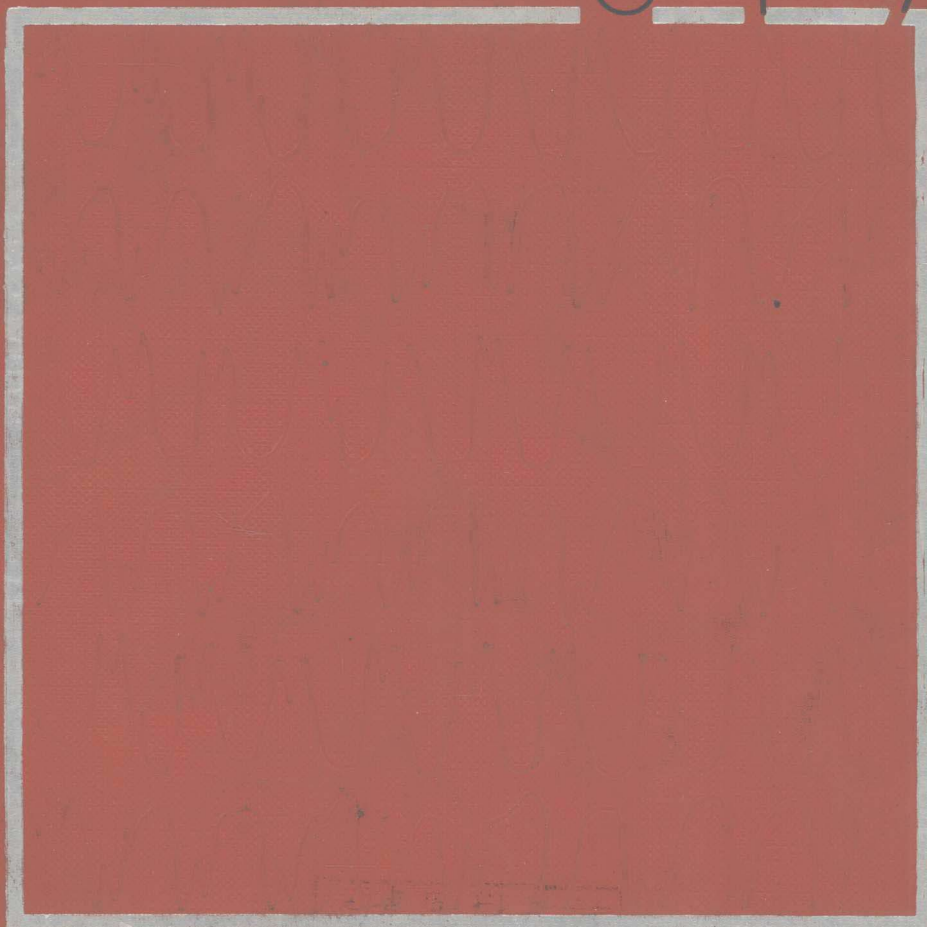


atlas of pediatric echocardiography



Howard P. Gutgesell
Marc Paquet

atlas of PEDIATRIC ECHOCARDIOGRAPHY

HOWARD P. GUTGESELL, M.D.

Assistant Professor, Department of Pediatrics,
Baylor College of Medicine, Houston, Texas;
Associate in Pediatric Cardiology,
Texas Children's Hospital, Houston, Texas

MARC PAQUET, M.D., F.R.C.P.(C)

Associate in Pediatric Cardiology,
Institut de Cardiologie de Québec, Québec, Canada



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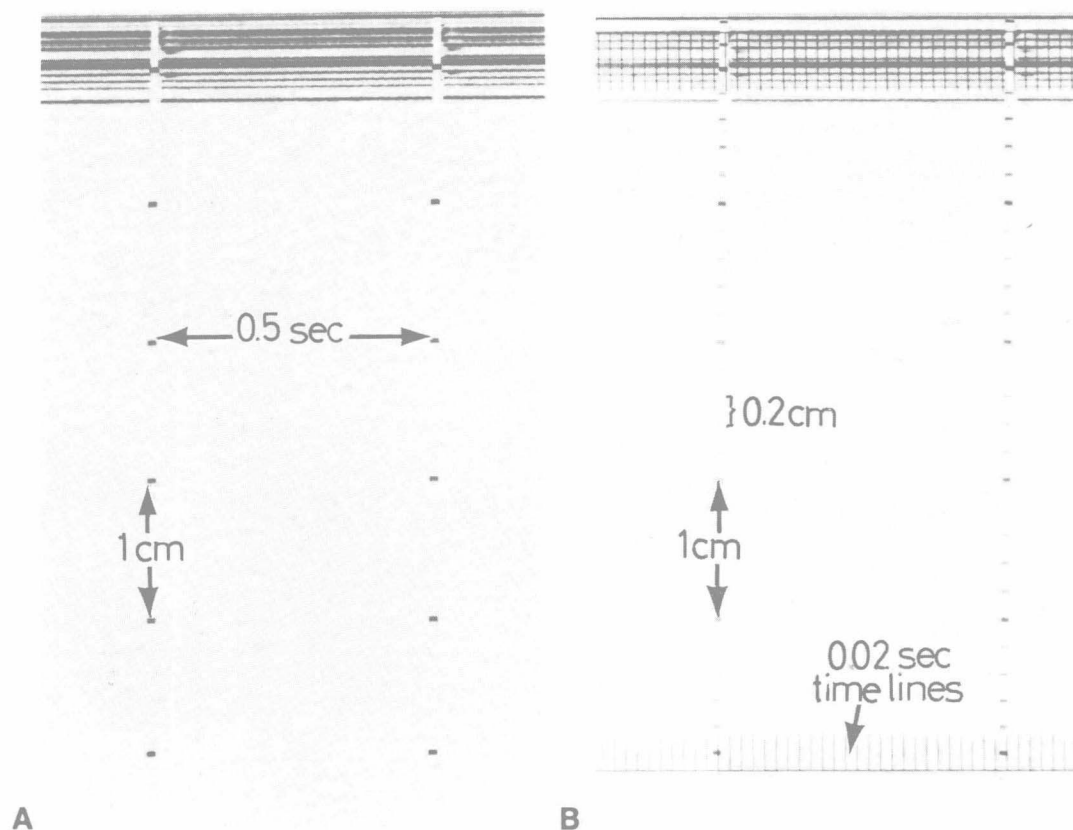


FIG. i-1A, B.

Calibration of echocardiograms. The depth and time calibration marks used on the illustrations in the text are shown here. In the majority of the illustrations, the depth marks represent 1.0 cm and occur every 0.5 sec, as in the left panel (A). More recently the ultrasound equipment at Texas Children's Hospital has been modified to produce the calibration marks on the right (B): the lighter depth marks represent 0.2 cm and allow a more accurate estimation of distances between the darker 1.0-cm marks; in addition, 0.02-sec time lines are printed at the top and bottom of the echocardiogram.

To Our Wives
Margaret and Monique

foreword

Congenital cardiac defects have aroused the curiosity of physicians for centuries long before this interest would serve any practical purpose. Today, the level of professional commitment to these diseases would qualify as an “explosion,” to use the modern metaphor, all to the advantage of the patients and their distraught families.

Much of the stimulus for this increased interest has resulted from the available methods of medical and surgical treatment. I believe, however, that many physicians and scientists have been attracted by the lure of the ingenious diagnostic techniques, with their ever-increasing precision in revealing the structure and function of what seems to be an interminable variety of congenital heart defects.

Now many of these diagnostic techniques, having served their purpose of increasing our understanding of a certain phenomenon, have passed from current use in evaluation of the patient. In fact, only a few have endured which no one concerned with the care of the patient with heart disease would want to do without. The major ones, in chronologic order of development, are: 1) expert clinical evaluation (including chest roentgenography and electrocardiography), 2) cardiac catheterization, 3) selective angiocardiography, 4) exercise stress testing and 5) echocardiography.

From my own 25-year view of the evolution of these techniques in the diagnostic study of the patient with heart disease, the echocardiogram has had more immediate acceptance and clinical application than any other of the diagnostic method—including the necessity for expert clinical evaluation!

This willing embracement of the echocardiogram is not unreasonable. Never before have we been able to obtain such precise information about the structure and function of the heart so safely, painlessly, and speedily—and at the bedside, if need be.

But lest our enthusiasm for this relatively new study be thwarted by our stumbling, unprepared, over the limitations of the procedure, there is great urgency for echocardiographers to educate those of us who will simply be requesting the study in our patients as well as those who will be obtaining and interpreting the record.

The authors of this atlas tell you early in their preface that they do not intend to cover the rudiments of this educational need. To the contrary, the reader who lacks elementary knowledge of either echocardiography or of congenital heart disease

must refer to other texts and papers, for this work was written with a strong resolve to keep the pages uncluttered with repetition of the fundamentals of sonography or pediatric cardiology which are accessible elsewhere.

Gutgesell and Paquet's answer to this educational need is a remarkable collection of models that are usable for easy and repeated reference. Rather than overselling the "echo," the authors, possessing an easy confidence in the worth of the technique, have featured its limitations as well as its benefits.

Gutgesell and Paquet belong to that young generation of pediatric cardiologists who show an intuitive aptitude for echocardiography. During their pediatric cardiology training each of them received more encouragement than instruction in echocardiography, yet became expert in the method—and their first students were their faculty supervisors!

The unexpected bonus to the diligent student of echocardiography is the acquisition of a clear and usable understanding of the interrelationship of the temporal events in the cardiac cycle. Also, if studied in conjunction with the other indispensable diagnostic methods, echocardiography should accelerate and solidify the learning of the normal and abnormal cardiac anatomy and function.

It is only appropriate that echocardiography has become an essential element of current cardiology training programs, and, I anticipate, will be included in certifying examinations in both pediatric and adult cardiology.

*Dan G. McNamara, M.D.
Chief of Pediatric Cardiology
Baylor College of Medicine and
Texas Children's Hospital*

preface

Echocardiography has rapidly gained popularity as a noninvasive technique for the diagnosis of congenital and acquired heart disease. As opposed to the electro- and vectorcardiograms which record the electrical activity of the heart, the echocardiogram records the patterns of movement of the cardiac structures themselves. It is not surprising, then, that this technique has been of value in the evaluation of heart disease in children.

The available literature describing the application of echocardiography to congenital heart disease is contained in journals of cardiology, radiology, medicine, and pediatrics. The present text stems our feeling that echocardiography is a "visual art," and that it would be valuable to have in one volume a collection of echocardiograms representing normal echocardiographic anatomy as well as a variety of cardiac disorders in children. Consistent with our intention of producing an atlas rather than a textbook, the emphasis is on the echocardiograms themselves; thanks to our photographers, medical illustrators and publisher, the reproductions are large and clearly labeled. The appendix contains a series of graphs relating cardiac dimensions to body size in normal children.

The text is intended for use by physicians and ultrasound technologists involved in the care of children with heart disease. We have assumed that the reader is familiar with the anatomy of the various types of congenital heart defects, and we have concentrated on the echocardiographic features of these defects. Since other texts have described echographic technique, instrumentation, and the physics of ultrasound in considerable detail, we have deliberately not emphasized these subjects. We have not attempted to provide a complete review of the literature, but have included a short list of the pertinent references at the conclusion of each chapter.

H.P.G.
M.P.

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We are especially indebted to Dr. Dan G. McNamara, Professor of Pediatrics, Baylor College of Medicine, and Director, Pediatric Cardiology Department, Texas Children's Hospital. Dr. McNamara not only taught us the fundamentals of pediatric cardiology but provided an atmosphere in which our interest in echocardiography could develop. Without his continued encouragement and support, the publication of this atlas would not have been possible.

We are also indebted to the staff of the Cardiology Section of the Texas Children's Hospital, Drs. Charles E. Mullins, Thomas A. Vargo, Michael R. Nihill, Paul C. Gillette, Sara Blumenschein, Jill Morriss, and Desmond Duff. Initially skeptical, they nonetheless referred patients for echocardiographic study so that we were able to obtain the experience necessary to complete the present text. We have been stimulated and challenged by the Pediatric Cardiology Fellows who have worked with us. They include Drs. Joes Jacobsen, Marlene Rabinovitch, Erna Eterovic, Ingrid Dannheimer, William Pinsky, Co-burn Porter, David Driscoll, John Kugler, Junichiro Fukushima, and Arthur Garson.

Special thanks are due to our ultrasonic technicians, Linda Kaufman and Paula Kligman. In addition to obtaining many of the recordings shown herein, they have made appointments, kept records, pacified frightened children, and answered the countless questions of curious parents.

The photographic reproduction of the echocardiograms was done by the medical illustration departments of the Baylor College of Medicine and the Hospital Laval, Québec.

The lettering of the illustrations was done by Americo Simonelli and Cecile Bilodeau. Sue Lambert, Dortha Perkins, and Deborah Latson typed the manuscript and provided editorial assistance.

*Howard P. Gutgesell, M.D.
Marc Paquet, M.D.*

abbreviations

Ao	aorta
AMV	anterior leaflet of mitral valve
AV	aortic valve
Ch	chordae tendineae
ECG	electrocardiogram
EDD	end-diastolic diameter
Epi	epicardium
Endo	endocardium
ESD	end-systolic diameter
ET	ejection time
HR	heart rate
IVS	interventricular septum
LA	left atrium
LV	left ventricle
LVET	left ventricular ejection time
LVOT	left ventricular outflow tract
LVPW	left ventricular posterior wall
MV	mitral valve
Myo	myocardium
PA	pulmonary artery
PCG	phonocardiogram
PE	pericardial effusion
Peri	pericardium
PEP	preejection period
PMV	posterior leaflet of mitral valve
PV	pulmonary valve

PW	left ventricular posterior wall
RV	right ventricle
RVET	right ventricular ejection time
RVOT	right ventricular outflow tract
SEP	interventricular septum
TV	tricuspid valve

atlas of pediatric echocardiography

contents

FOREWORD	xi
PREFACE	xiii
ACKNOWLEDGMENTS	xv
ABBREVIATIONS	xvii

1	THE NORMAL ECHOCARDIOGRAM	1
----------	----------------------------------	----------

mitral valve 2, aortic valve 2, mitral–aortic relationship 3, tricuspid valve 3, pulmonary valve 3, left ventricle 4, right ventricle 4, interventricular septum 5, aorta 5, left atrium 5

2	LEFT VENTRICULAR VOLUME OVERLOAD	25
----------	-----------------------------------------	-----------

aortic insufficiency 26, mitral insufficiency 26, ventricular septal defect 27, patent ductus arteriosus 27

3	RIGHT VENTRICULAR VOLUME OVERLOAD	45
----------	------------------------------------------	-----------

atrial septal defect 46, atrioventricular canal 46, total anomalous pulmonary venous return 47, tricuspid and pulmonary insufficiency 47, Ebstein's anomaly 47

4	LEFT VENTRICULAR OUTFLOW OBSTRUCTION	65
----------	---------------------------------------------	-----------

aortic valve stenosis 66, subaortic stenosis 66, supralvalvular stenosis 66, aortic valve atresia 67

5	LEFT VENTRICULAR INFLOW OBSTRUCTION	87
	acquired mitral stenosis 88, congenital mitral stenosis 88, cor triatriatum 89	
6	GREAT ARTERY ANOMALIES	105
	tetralogy of fallot 106, truncus arteriosus 106, double-outlet right ventricle 106, dextro-transposition of the great arteries (d-TGA) 107, levo-transposition of the great arteries (l-TGA) 107	
7	RIGHT HEART OBSTRUCTIVE LESIONS	127
	pulmonary valve stenosis 128, pulmonary valve atresia with intact ventricular septum 128, tricuspid valve atresia 128	
8	COMMON VENTRICLE AND SINGLE (DOUBLE-INLET) VENTRICLE	139
9	CARDIOMYOPATHY	149
	congestive cardiomyopathy 150, hypertrophic cardiomyopathy 150, restrictive cardiomyopathy 150	
10	PERICARDIAL EFFUSION	161
11	ESTIMATION OF PULMONARY ARTERY PRESSURE	169
12	ECHOCARDIOGRAPHIC CONTRAST STUDIES	177
13	CARDIAC TUMORS	189

ARTIFACTS**195**

lateral resolution errors 196, reverberations
196, "receiver overload" 196, motion artifacts 196

APPENDIX**203**

normal values 203
cardiac dimensions 204

INDEX**211**

1

the normal echocardiogram