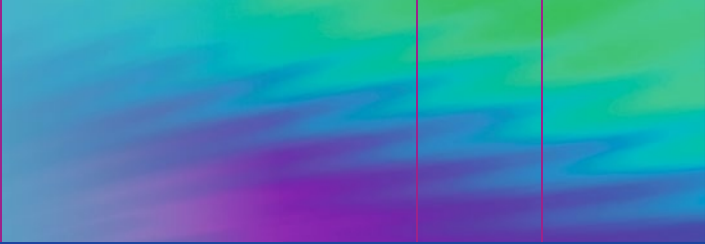


Annette Vegas



**Perioperative  
Two-Dimensional  
Transesophageal  
Echocardiography**

A Practical Handbook  
*Second Edition*

 Springer

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A Practical Handbook

Second Edition

 Springer

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*To my parents, Patrick and Lena, and my brother Derek for their love and support throughout my life*

*To colleagues who have helped me better understand echocardiography*

*To Dr. Andre Denault of the Montreal Heart Institute who has inspired me to be a better clinician, echocardiographer, and educator*

*To current and former fellows, residents, and students who have challenged me to become a better educator*

# Preface

The role of transesophageal echocardiography (TEE) continues to expand as a valuable diagnostic tool used during cardiac surgery and in the intensive care unit. Clinicians from different specialties, including anesthesiology, cardiology, and critical care, train in TEE to provide this added skill to their practice in these venues. Learning to become a proficient echocardiographer can be daunting, particularly within the time pressures of the operating room. The skills and expertise of the echocardiographer must constantly evolve to provide timely accurate information which may impact patient management and outcome.

The first edition of the handbook was initially created to fulfill the need for an illustrative synopsis of common cardiac pathology encountered in cardiac surgery patients. It was designed to provide a compact portable reference for using TEE to recognize cardiac pathology in the perioperative period. The ongoing challenge for the echocardiographer is to integrate new technology, techniques, and updated echocardiography guidelines into everyday practice. The second edition of this handbook meets this need by providing updated reference material readily at hand to confirm echocardiographic findings. This edition has been completely rewritten to better explain new concepts and provide examples for the current use of TEE in clinical practice. The second edition has expanded to over 325 pages, with 4 new chapters and over 200 additional figures, but retains its compactness and portability. It will appeal to anesthesiologists, cardiac surgeons, and cardiologists with a range of experience from novice to expert echocardiographers.

This handbook is a compilation of echocardiography information and TEE images from perioperative TEE studies performed at Toronto General Hospital (TGH), Toronto, ON, Canada. As with all written texts, it does not do justice to the cardiac activity seen in live or recorded TEE. The reader is referred to other sources for video recordings of TEE. The TEE website, <http://pie.med.utoronto.ca/TEE/> developed by the Perioperative Interactive Education (PIE) group at Toronto General Hospital, is a rich online free resource for TEE educational material.

Learning and practicing echocardiography is a career-long process. In the words of Galileo Galilei, "You cannot teach a man anything; you can only help him find it within himself." I hope this handbook will help you along your journey.

Toronto, ON, Canada

Annette Vegas, MD, FRCPC, FASE

# Acknowledgments

To members of the current TGH Perioperative Echocardiography Group (PEG), all talented anesthesiologists and proficient echocardiographers.

To the Perioperative Interactive Education (PIE) group at Toronto General Hospital, under the direction of Gordon Tait, and current and former members, in particular Willa Bradshaw, Michael Corrin, and Jodi Crossingham. I have had the good fortune of working with these imaginative and talented people who have enabled me to indulge my passion for developing free educational tools with a global impact. Their outstanding work is on display throughout this book.

To my colleagues from the Division of Cardiac Surgery, consummate professionals who attract a varied practice that keeps TGH cardiac anesthesiologists challenged to provide exemplary patient care.

To members of the TGH cardiology echocardiography lab, under the direction of Dr. Anna Woo and former directors Dr. Sam Siu and Dr. Harry Rakowski who generously share their knowledge.

To Dr. Gian-Marco Busato, a former summer student, medical student, and now an ENT surgeon, for the extraordinary artistic talent he used to draw the illustrations for this handbook.

Finally to Ms. Willa Bradshaw, B.Sc., M.Sc.B.M.C., medical illustrator, who precisely assembled all the detailed figures and added many of her own fine illustrations to this book.

# Abbreviations

These are the common abbreviations used throughout the book. Other abbreviations are defined in the context in which they are used.

A	Anterior
AC	Anterior commissure
ACHD	Adult congenital heart disease
AI	Aortic insufficiency
AL	Anterolateral
AMVL	Anterior mitral valve leaflet
Ao	Aorta
ARVD	Arrhythmogenic right ventricular dysplasia
AS	Aortic stenosis or antero-septal
ASD	Atrial septal defect
ASE	American Society of Echocardiography
At	Acceleration time
AV	Aortic valve
AVA	Aortic valve area
A-V	Atrioventricular
BAV	Bicuspid aortic valve
BPM	Beats per minute
BSA	Body surface area
C	Chamber
CAD	Coronary artery disease
CO	Cardiac output
CPB	Cardiopulmonary bypass
CS	Coronary sinus
CSA	Cross-sectional area
CT	Computer tomography
CVP	Central venous pressure
Cx	Circumflex artery
CW	Continuous wave
D	Dimension or diameter
DBP	Diastolic blood pressure
DS	Deceleration slope
DT	Deceleration time
DVI	Dimensionless valve index
ED	End diastole
EDA	End diastolic area



EDD	End diastolic diameter
EDP	End diastolic pressure
EDV	End diastolic volume
EF	Ejection fraction
EI	Eccentricity index
EROA	Effective regurgitant orifice area
ES	End systole
ESA	End systolic area
ESD	End systolic diameter
ESV	End systolic volume
ET	Ejection time
FAC	Fractional area change
FR	Frame rate
FS	Fractional shortening
GE	Gastroesophageal
GLPSS	Global longitudinal peak systolic strain
HBP	High blood pressure
HF	Heart failure
HOCM	Hypertrophic obstructive cardiomyopathy
HR	Heart rate
HV	Hepatic vein
HVF	Hepatic vein flow
I	Inferior
IABP	Intra-aortic balloon pump
IAS	Inter-atrial septum
ICT	Isovolumic contraction time
IE	Infective endocarditis
IL	Infero-lateral
IPPV	Intermittent positive pressure ventilation
IS	Infero-septal
IVC	Inferior vena cava
IVRT	Isovolumic relaxation time
IVS	Interventricular septum
JA	Jet area
JH	Jet height
L	Left or lateral or length
LAA	Left atrial appendage
LA	Left atrium
LAD	Left anterior descending
LAP	Left atrial pressure
LAX	Long axis
LCA	Left coronary artery
LCC	Left coronary cusp
LCCA	Left common carotid artery
LLPV	Left lower pulmonary vein
LMCA	Left main coronary artery
LSVC	Left superior vena cava
LUPV	Left upper pulmonary vein
LV	Left ventricle
LVAD	Left ventricular assist device
L VH	Left ventricular hypertrophy
LVM	Left ventricular wall mass
LVID	Left ventricle internal diameter
LVOT	Left ventricular outflow tract
MAC	Mitral annular calcification
MAPSE	Mitral annular plane systolic excursion
MC	Mitral commissural

ME	Mid-esophageal
MI	Myocardial infarction
MPI	Myocardial performance index
MR	Mitral regurgitation
MRI	Magnetic resonance imaging
MS	Mitral stenosis
MV	Mitral valve
MVA	Mitral valve area
MVI	Mitral valve inflow
N	Non
NSR	Normal sinus rhythm
P	Pressure or posterior
PA	Pulmonary artery
PAC	Pulmonary artery catheter
PAP	Pulmonary artery pressure
PAPVD	Partial anomalous pulmonary venous drainage
PASP	Pulmonary artery systolic pressure
PDA	Patent ductus arteriosus
PFO	Patent foramen ovale
PHT	Pressure half-time
PI	Pulmonic insufficiency
PISA	Proximal isovelocity surface area
PM	Papillary muscles or posteromedial
PMVL	Posterior mitral valve leaflet
Pr	Prosthetic
PS	Pulmonic stenosis
PSS	Peak systolic strain
PV	Pulmonic valve
PVF	Pulmonary vein flow
PVR	Pulmonary vascular resistance
PW	Pulsed wave
Qp	Pulmonary blood flow
Qs	Systemic blood flow
R	Right
RA	Right atrium
RAA	Right atrial appendage
RAP	Right atrial pressure
RCA	Right coronary artery
RCC	Right coronary cusp
RLPV	Right lower pulmonary vein
RPA	Right pulmonary artery
RUPV	Right upper pulmonary vein
RV	Right ventricle
RVH	Right ventricular hypertrophy
RegF	Regurgitant fraction
RegV	Regurgitant volume
RVH	Right ventricular hypertrophy
RVOT	Right ventricular outflow tract
RVSP	Right ventricular systolic pressure
RWMA	Regional wall motion abnormality
SAM	Systolic anterior motion
S	Systole
SAM	Systolic anterior motion
SAX	Short axis
SC	Saline contrast
SCA	Society of Cardiovascular Anesthesiology
SLE	Systemic lupus erythematosus

SOVA	Sinus of Valsalva aneurysm
SR	Strain rate
STE	Speckle tracking echocardiography
STJ	Sinotubular junction
SV	Stroke volume
SVi	Stroke volume index
SVC	Superior vena cava
SVR	Systemic vascular resistance
TAH	Total artificial heart
TAPSE	Tricuspid annular plane systolic excursion
TDI	Tissue Doppler imaging
TEE	Transesophageal echocardiography
TG	Transgastric
TGC	Time gain compensation
TOF	Tetralogy of Fallot
TGA	Transposition of the great arteries
TR	Tricuspid regurgitation
TS	Tricuspid stenosis
TTE	Transthoracic echocardiography
TV	Tricuspid valve
TVI	Tricuspid valve inflow
UE	Upper esophageal
VAD	Ventricular assist device
VSD	Ventricular septal defect
VTI	Velocity time integral
W	Width

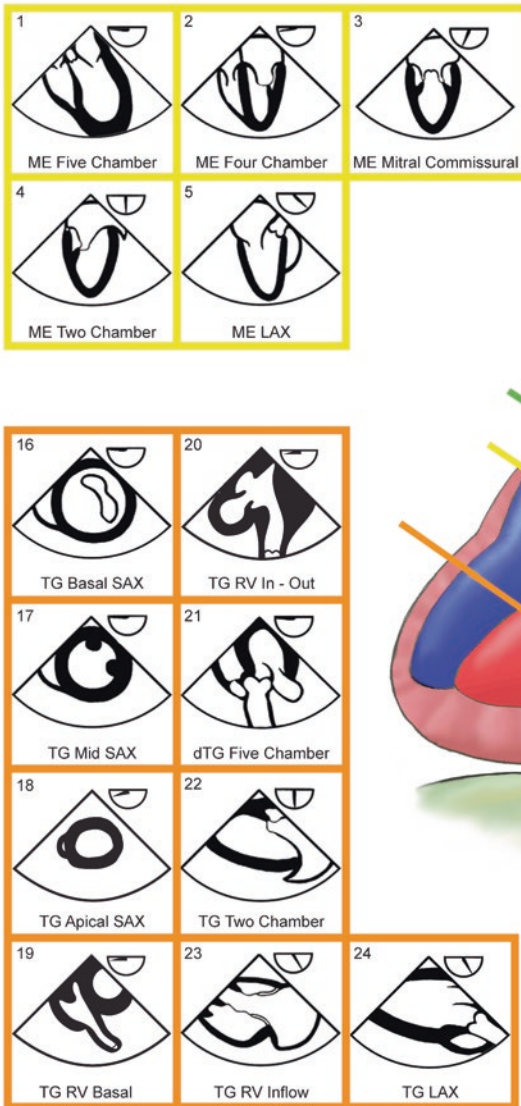
# Contents

1	TEE Views . . . . .	1
2	Doppler and Hemodynamics . . . . .	41
3	Left Ventricle . . . . .	63
4	Right Ventricle . . . . .	85
5	Coronary Artery Disease . . . . .	99
6	Diastology . . . . .	115
7	Native Valves . . . . .	129
8	Prosthetic Valves, Transcatheter Valves, and Valve Repairs . . . . .	173
9	Aorta. . . . .	199
10	Congenital Heart Disease . . . . .	219
11	Variants, Foreign Material, Artifacts, Masses, Endocarditis. . . . .	259
12	Mechanical Support, Heart Transplant . . . . .	287
13	Cardiomyopathies . . . . .	303
14	Pericardium . . . . .	315
	Index . . . . .	333

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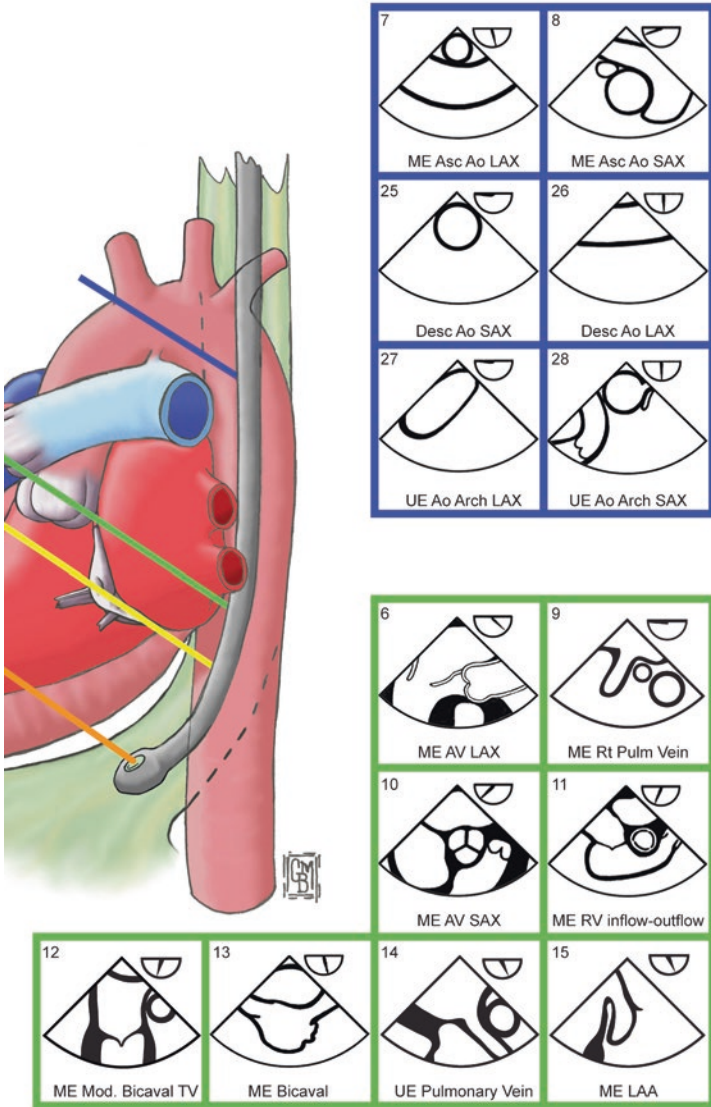
## TEE Views

	Page
Overview 28 Standard TEE Views	2–3
TEE Planes and Display	4
Standard TEE Views Guide	5
Mid-esophageal Five Chamber	6
Mid-esophageal Four Chamber	7
Mid-esophageal Mitral Commissural	8
Mid-esophageal Two Chamber	9
Mid-esophageal Long-Axis	10
Mid-esophageal Aortic Valve Long-Axis	11
Mid-esophageal Ascending Aortic Long-Axis	12
Mid-esophageal Ascending Aortic Short-Axis	13
Mid-esophageal Right Pulmonary Vein	14
Mid-esophageal Aortic Valve Short-Axis	15
Mid-esophageal RV Inflow-Outflow	16
Mid-esophageal Modified Bicaval Tricuspid Valve	17
Mid-esophageal Bicaval	18
Upper-esophageal Right Pulmonary Vein	19
Upper-esophageal Left Pulmonary Vein	20
Mid-esophageal Left Atrial Appendage	21
Transgastric Basal Short-Axis	22
Transgastric Mid-short-Axis	23
Transgastric Apical Short-Axis	24
Transgastric Right Ventricular Basal	25
Transgastric Right Ventricular Inflow-Outflow	26
Deep Transgastric 5 Chamber	27
Transgastric Two Chamber	28
Transgastric Right Ventricular Inflow	29
Transgastric Long-Axis	30
Transgastric Inferior Vena Cava	31
Descending Aortic Short-Axis	32
Descending Aortic Long-Axis	33
Upper-esophageal Aortic Arch Long-Axis	34
Upper-esophageal Aortic Arch Short-Axis	35
Additional TEE Views	36–37
Online TEE Modules	38
TEE Simulators	39



### Standard Views

- The original standard 20 TEE views that comprise a comprehensive TEE exam as described by the SCA/ASE (1999) have been augmented by 8 additional views.
- Conveniently, all views can be grouped together by the probe level in the esophagus and the structures being interrogated as diagrammed here:
  - **Yellow:** mid-esophageal (ME) views that examine the LV and MV
  - **Green:** ME views that examine the AV, TV, bicaval, and pulmonary veins
  - **Blue:** ME and upper-esophageal (UE) views for different regions of the aorta
  - **Orange:** transgastric (TG) views that examine the LV, RV, and AV with good spectral and tissue Doppler alignment



**Sources**

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