Interesting Cases in Echocardiography

***System requirements*:**

- **Operating System—Windows Vista or above**
- **Recommended Web Browsers—Google Chrome & Mozilla Firefox**
- **Essential plugins—Java & Flash Player**
  - Facing problems in viewing content— it may be your system does not have java enabled in it.
  - If videos don't show up—it may be the system requires Flash Player or you need to manage flash settings. To learn more about flash settings click on the link in the 'help' section.
  - You can test java and flash by using the links from the 'help' section of the CD/DVD.

***Accompanying CD/DVD Rom is playable only in Computer and not in DVD player*.**

CD/DVD has Autorun function—it may take a few seconds to load on your computer. If it does not works for you then follow the steps below to access the contents manually:

- Click on 'My Computer'
- Select the CD/DVD drive and click on 'Open/Explore'—this will show a list of files in the CD/DVD
- Find and double click on file—"launch.html"

For more information about troubleshoot of Autorun, click on:
http://support.microsoft.com/kb/330135

Interesting Cases in Echocardiography

Editor

Navin C Nanda MD DSc (Hon) DSc (Med) (Honoris Causa) FACC FAHA FISCU (D)
FSGC FICA FACA FICP (Hon) FIAE FICMU (Hon) FACIP FCSC (S) FIACS FICC (Hon)
Distinguished Professor of
Medicine and Cardiovascular Disease
University of Alabama at Birmingham
Birmingham, Alabama, USA
President
International Society of Cardiovascular Ultrasound
Editor-in-Chief
Echocardiography: A Journal of Cardiovascular Ultrasound
and Allied Techniques

JAYPEE *The Health Sciences Publisher*
New Delhi | London | Panama

Jaypee Brothers Medical Publishers (P) Ltd

Headquarters
Jaypee Brothers Medical Publishers (P) Ltd.
4838/24, Ansari Road, Daryaganj
New Delhi 110 002, India
Phone: +91-11-43574357
Fax: +91-11-43574314
E-mail: jaypee@jaypeebrothers.com

Overseas Offices

JP Medical Ltd.
83, Victoria Street, London
SW1H 0HW (UK)
Phone: +44-20 3170 8910
Fax: +44(0)20 3008 6180
E-mail: info@jpmedpub.com

Jaypee-Highlights Medical Publishers Inc.
City of Knowledge, Bld. 235, 2nd Floor, Clayton
Panama City, Panama
Phone: +1 507-301-0496
Fax: +1 507-301-0499
E-mail: cservice@jphmedical.com

Jaypee Brothers Medical Publishers (P) Ltd.
17/1-B, Babar Road, Block-B, Shaymali
Mohammadpur, Dhaka-1207
Bangladesh
Mobile: +08801912003485
E-mail: jaypeedhaka@gmail.com

Jaypee Brothers Medical Publishers (P) Ltd.
Bhotahity, Kathmandu, Nepal
Phone: +977-9741283608
E-mail: kathmandu@jaypeebrothers.com

Website: www.jaypeebrothers.com
Website: www.jaypeedigital.com

Inquiries for bulk sales may be solicited at: jaypee@jaypeebrothers.com

Interesting Cases in Echocardiography

First Edition: 2017

ISBN: 978-93-86056-94-8

Printed at

Dedicated to

My late parents
Dr Balwant Rai Nanda and Mrs Maya Vati Nanda
My wife
Kanta Nanda MD
Our children
Nitin Nanda, Anita Nanda Wasan MD, and Anil Nanda MD
Their spouses Sanjeev Wasan MD and Seema Tailor Nanda, and
our grandchildren Vinay and Rajesh Wasan, and Nayna and Ria Nanda

Contributors

Elsayed Abo-Salem MD
Assistant Professor of Cardiovascular Medicine
Center for Comprehensive Cardiovascular Care
Saint Louis University Hospital
Saint Louis, Missouri, USA

F Abtahi MD
Echocardiography Laboratory
University of Alabama at Birmingham
Birmingham, Alabama, USA

Ahmed Abuzaid MD
Cardiology Fellowship
Department of Cardiovascular Medicine
Sidney Kimmel Medical College
Thomas Jefferson University/Christiana Care Health System
Newark, Delaware, USA

LG Adarna MD
Echocardiography Laboratory
University of Alabama at Birmingham
Birmingham, Alabama, USA

Olayinka Afolabi-Brown MD
Einstein Medical Center
Division of Cardiovascular Diseases
Philadelphia, Pennsylvania, USA

Aashish Agarwal MD
Echocardiography Laboratory
University of Alabama at Birmingham
Birmingham, Alabama, USA

Kul Aggarwal MD MRCP (UK) FACC
Professor of Clinical Medicine
Division of Cardiology
University of Missouri
Columbia, Missouri, USA
Director
Cardiac Catheterization Laboratory and Chief
Cardiology Section
Harry S Truman Veterans' Hospital
Columbia, Missouri, USA

Masood Ahmad MD
Edward D and Sally M Futch Professor of Cardiology
Director
Echocardiography Laboratory
Division of Cardiology
The University Texas Medical Branch (UTMB)
Galveston, Texas, USA

MI Ahmed MD
Echocardiography Laboratory
University of Alabama at Birmingham
Birmingham, Alabama, USA

Esmat Ahmed AH MD
Echocardiography Laboratory
University of Alabama at Birmingham
Birmingham, Alabama, USA

Ramazan Akdemir MD
Professor
Department of Cardiology
Faculty of Medicine
Sakarya University Training and Research Hospital
Sakarya, Turkey

Murat Aksoy MD
Assistant Professor
Department of Cardiology
Faculty of Medicine
Sakarya University Training and Research Hospital
Sakarya, Turkey

N Alagic MD
Echocardiography Laboratory
University of Alabama at Birmingham
Birmingham, Alabama, USA

Mohsin Alam MD
Senior Cardiologist
Echocardiography Laboratory
Heart and Vascular Institute
Henry Ford Hospital
Detroit, Michigan, USA

Zarina Alam MD
Senior Staff
Department of Internal Medicine
Henry Ford Hospital
Detroit, Michigan, USA

OO Alli MD
Division of Cardiology
University of Alabama at Birmingham
Birmingham, Alabama, USA

Aman M Amanullah MD PhD FACC FASE FASNC FAHA
Section Chief
Noninvasive Cardiology
Albert Einstein Medical Center
Professor of Medicine (Clinical Track)
Sidney Kimmel Medical College of Thomas Jefferson University
Philadelphia, Pennsylvania, USA

Edgar Argulian MD MPH FACC FASE
Assistant Professor of Medicine
Mount Sinai Heart Network
Icahn School of Medicine at Mount Sinai
New York City, New York, USA

José Antonio Arias-Godinez MD
Chief of the Laboratory of Echocardiography
National Institute of Cardiology
Mexico City, Mexico

MJ Arisha MD
Echocardiography Laboratory
University of Alabama at Birmingham
Birmingham, Alabama, USA

Garima Arora MD MRCP
Instructor
Cardiovascular Medicine
University of Alabama at Birmingham
Birmingham, Alabama, USA

Nydia Avila-Vanzzini MD
Physician of the Staff
Laboratory of Echocardiography and Non-Invasive Hemodynamics
National Institute of Cardiologia Ignacio Chavez
Mexico City, Mexico

Mohamed Ayan MD
Resident
Internal Medicine Department
Creighton University School of Medicine
Omaha, Nebraska, USA

Muhammad Soubhi Azzouz MD
Cardiology Fellowship
Cardiovascular Department
Creighton University School of Medicine
Omaha, Nebraska, USA

Sudarshan Balla MD
Assistant Professor of Clinical Medicine
Division of Cardiology
University of Missouri
Columbia, Missouri, USA

Armin Barekatain MD
Cardiology Fellowship
Department of Cardiovascular Medicine
Sidney Kimmel Medical College
Thomas Jefferson University/Christiana Care Health System
Newark, Delaware, USA

K Barssoum MD
Echocardiography Laboratory
University of Alabama at Birmingham
Birmingham, Alabama, USA

Nishchayjit Basra
Fourth-Year Medical Student
Kansas City University of Medicine and Biosciences
Kansas City, Missouri, USA

K Bhagatwala MBBS
Echocardiography Laboratory
University of Alabama at Birmingham
Birmingham, Alabama, USA

Robert WW Biederman MD FACC FAHA FSGC FASA
Professor of Medicine
Director
Cardiovascular Magnetic Resonance Imaging
Temple University School of Medicine
Adjunct Professor of Bioengineering
Carnegie Mellon University and Allegheny Health Network
Allegheny General Hospital
Pittsburgh, Pennsylvania, USA

Francois Bourlon MD
Consultant Cardiologist
Cardiothoracic Centre
Monaco City, Monaco

Christian S Breburda MD PhD FACC FASE FESC
Clinical Professor of Medicine
University of Arizona College of Medicine – Phoenix
Director
Noninvasive Cardiology and Imaging
Maricopa Medical Center
Phoenix, Arizona, USA

Craig Broberg MD
Associate Professor
Cardiovascular Medicine and Radiology
Knight Cardiovascular Institute
Oregon Health and Science University
Portland, Oregon, USA

S Bulur MD
Echocardiography Laboratory
University of Alabama at Birmingham
Birmingham, Alabama, USA

Luke Burchill MBBS PhD
Assistant Professor of Cardiovascular Medicine
Knight Cardiovascular Institute
Oregon Health & Science University
Portland, Oregon, USA

J Burkhart MD
Echocardiography Laboratory
University of Alabama at Birmingham
Birmingham, Alabama, USA

Claudia C Cajas-Morales MD
Physician in Training of Echocardiography
National Institute of Cardiology
Mexico City, Mexico

Maurizio Campaniello MD
Cardiologist
Associate Medical Director
Chest Pain Unit
Cardiology Emergency
University of Bari
Bari, Italy

Angel Lopez Candales MD FACC FASE
Professor of Medicine
Chief
Cardiovascular Medicine
Director
Cardiology Training Program University of Puerto Rico School of Medicine
San Juan, Puerto Rico, USA

Alberto Barón Castañeda MD
Medical Department Director
Clínica de Marly
Bogotá, Colombia

E Celiker MD
Echocardiography Laboratory
University of Alabama at Birmingham
Birmingham, Alabama, USA

Farooq A Chaudhry MD FACP FACC FASE FAHA
Professor of Medicine
Director
Echocardiography Laboratories
Associate Director
Mount Sinai Heart Network
Icahn School of Medicine at Mount Sinai
The Zena and Michael A Wiener Cardiovascular Institute and Marie-Josée and Henry R Kravis Center for Cardiovascular Health
New York City, New York, USA

JR Chahwala MBBS
Echocardiography Laboratory
University of Alabama at Birmingham
Birmingham, Alabama, USA

Soung Ick Cho MD
Fellow
Cardiovascular Disease Fellowship
Echocardiography Laboratory
Heart and Vascular Institute
Henry Ford Hospital
Detroit, Michigan, USA

Rahul Choudhary MD
Senior Resident
Sawai Man Singh Medical College
Jaipur, Rajasthan, India

Jaehoon Chung MD FACC
Cardiologist
Englewood Hospital and Medical Center
Englewood, New Jersey, USA

Marco Matteo Ciccone MD
Professor
Cardiovascular Diseases Section
Department of Emergency and
Organ Transplantation (DETO)
University of Bari
Bari, Italy

Ottavio Di Cillo MD
Cardiologist
Chest Pain Unit
Cardiology Emergency
University of Bari
Bari, Italy

Yudy Miluska Roldan Concha MD
Chief of Cardiology Department
National Hospital Hipolito Unanue
Lima, Peru

WA Crosland MD
Echocardiography Laboratory
University of Alabama at Birmingham
Birmingham, Alabama, USA

Michael J Cuttica MD MS
Assistant Professor of Medicine
(Pulmonary and Critical Care)
Northwestern University Feinburg
School of Medicine
Chicago, Illinois, USA

Saadet Demirtaş MD
Cardiologist
Department of Cardiology
Ankara Dişkapi Research and
Training Hospital
Ankara, Turkey

Fiorella Devito MD
Cardiologist
Cardiovascular Diseases Section
Department of Emergency and Organ
Transplantation
University of Bari School of Medicine
Bari, Italy

Andre Dias MD
Einstein Medical Center
Division of Cardiovascular Diseases
Department of Medicine
Philadelphia, Pennsylvania, USA

M Elguindy MD
Echocardiography Laboratory
University of Alabama at Birmingham
Birmingham, Alabama, USA

Ghazwan Elias MD
Maricopa Medical Center
Phoenix, Arizona, USA

A Elkaryoni MD
Echocardiography Laboratory
University of Alabama at Birmingham
Birmingham, Alabama, USA

M Elsayed MBBCh
Echocardiography Laboratory
University of Alabama at Birmingham
Birmingham, Alabama, USA

Sibel Catirli Enar MD FESC FASE
Associate Professor of Cardiology
Department of Cardiology
Turkiye Hospital and
Istanbul Memorial Hospital
Istanbul, Turkey

MGA Escanuela MD
Echocardiography Laboratory
University of Alabama at Birmingham
Birmingham, Alabama, USA

Nilda Gladys Espinola-Zavaleta MD PhD
Physician and Researcher of the Staff
Laboratory of Echocardiography and
Noninvasive Hemodynamics
National Institute of Cardiology
'Ignacio Chávez'
Mexico City, Mexico

Alfredo Sotomayor Estrada MD
Chief of Cardiovascular Surgery
National Hospital Hipolito Unanue
Lima, Peru

José Carlos Armendáriz Ferrari MD
Chief of Echocardiography Lab
National Hospital Hipolito Unanue
Lima, Peru
Professor of Medicine
National University
Federico Villarreal
Lima, Peru

Francesco Fulvio Faletra MD
Division of Cardiology
Fondazione Cardiocentro Ticino
Lugano, Switzerland

Jose Ricardo FP MD
Cardiology Fellow
Allegheny General Hospital
Pittsburgh, Pennsylvania, USA

Luba Frank MD
Associate Professor of Radiology
Department of Radiology
University of Texas Medical Branch (UTMB)
Galveston, Texas, USA

Leon J Frazin MD FACC
Professor of Clinical Medicine
University of Illinois Hospital and
Health Sciences System
Director of Echocardiography
Jesse Brown VA Medical Center
Chicago, Illinois, USA

Juan Francisco Fritche-Salazar MD
Physician of the Staff
National Institute of Cardiology
Mexico City, Mexico

Nicholas Furiasse MD MS
Clinical Instructor
Cardiovascular Diseases
Bluhm Cardiovascular Institute
Northwestern Memorial Hospital
Chicago, Illinois, USA

S Gaba MD
Echocardiography Laboratory
University of Alabama at Birmingham
Birmingham, Alabama, USA

Julius M Gardin MD MBA
Past Chair
Department of Medicine
Hackensack University Medical Center
Hackensack, New Jersey, USA
Professor of Medicine
Rutgers New Jersey Medical School
Rutgers, New Jersey, USA

Naveen Garg MD
Fellow
Noninvasive Cardiology
Badshah Khan Government Hospital
Faridabad, Haryana, India

Dinesh Gautam MD
Senior Resident
Sawai Man Singh Medical College
Jaipur, Rajasthan, India

GC Giove MD
Echocardiography Laboratory
University of Alabama at Birmingham
Birmingham, Alabama, USA

G Gok MD
Echocardiography Laboratory
University of Alabama at Birmingham
Birmingham, Alabama, USA

Mark H Goldberger MD FACC
Columbia University
New York City, New York, USA

John D Groarke MD MSc
Physician in Heart Failure
Brigham and Women's Hospital
Harvard Medical School
Boston, Massachusetts, USA

Daniel W Groves MD
Cardiovascular Disease Fellow
Department of Medicine
Division of Cardiology
University of Colorado Anschutz
Medical Campus
Colorado, Arizona, USA

EC Guler MD
Echocardiography Laboratory
University of Alabama at Birmingham
Birmingham, Alabama, USA

JC Gulotta MD
Echocardiography Laboratory
University of Alabama at Birmingham
Birmingham, Alabama, USA

N Gupta MBBS
Echocardiography Laboratory
University of Alabama at Birmingham
Birmingham, Alabama, USA

T Guvenc MD
Echocardiography Laboratory
University of Alabama at Birmingham
Birmingham, Alabama, USA

Yuchi Han MD MMSc
Assistant Professor
University of Pennsylvania
Philadelphia, Pennsylvania, USA

Robert Hartman MD
Clinical Assistant Professor
Pediatric Cardiology
Department of Cardiovascular Sciences
East Carolina Heart Institute
Brody School of Medicine at East
Carolina University
Greenville, South Carolina, USA

Mohammed Hasoon MD
Maricopa Medical Center
Phoenix, Arizona, USA

Stephen T Helmke RDCS MPH
Research Echocardiographer
Columbia University Medical Center
(CUMC)
Clinical Cardiovascular Research
Laboratory for the Elderly (CCRLE)
Columbia University Medical Center
New York City, New York, USA

MC Hsiung MD
Division of Cardiology
Heart Center
Cheng-Hsin General Hospital
Taipei, Taiwan

Rachel Hughes-Doichev MD FASE
Assistant Professor of Medicine
Temple University School of Medicine
Medical Director
Department of Echocardiography
Allegheny General Hospital
West Penn Hospital
Pittsburgh, Pennsylvania, USA

Dawn Hui MD
Assistant Professor of Surgery
Department of Internal Medicine
Division of Cardiology
St Louis University Medical School and
Cardiac Surgeon
Center for Comprehensive
Cardiovascular Care
SSM Health
Saint Louis University Hospital
Saint Louis, Missouri, USA

Syed Hussain MD
Cardiology Fellow
Allegheny General Hospital
Pittsburgh, Pennsylvania, USA

Laura Iacuzio MD
Consultant Cardiologist
Cardiothoracic Centre
Monaco City, Monaco

Zeina Ibrahim MD
Advanced Imaging Fellow
Northwestern Memorial Hospital
Northwestern University
Chicago, Illinois, USA

Tevfik Fikret Ilgenli MD
Professor of Cardiology
Selçuk University School of Medicine
Department of Cardiology
Konya, Turkey

Omer Iqbal MD FACC FESC
Professor
Department of Pathology and
Ophthalmology
Loyola University Health System
Maywood, Illinois, USA

AKM Monwarul Islam FCPS MD FACC FESC FRCP
Assistant Professor
Department of Cardiology
Jessore Medical College
Jessore, Bangladesh

Valentyna Ivanova MD
Cardiology Fellow
Allegheny General Hospital
Pittsburgh, Pennsylvania, USA

Chisato Izumi MD PhD
Cardiologist
Department of Cardiology
Tenri Hospital
Nara, Japan

Rajesh Janardhanan MD MRCP FACC FASE
Associate Professor of Medicine and
Medical Imaging Director
Noninvasive Cardiac Imaging
Director of Echocardiography
Banner – University Medical Center
Phoenix, Arizona, USA

Madeline Jankowski RDCS
Lead Cardiac Sonographer
Echocardiography Accreditation
Laboratory
Northwestern Memorial Hospital
Chicago, Illinois, USA

Kishan Jasti MD
Former Cardiology Fellow
Allegheny General Hospital
Pittsburgh, Pennsylvania, USA

Leng Jiang MD FACC FAHA FASE
Director
Department of Noninvasive Cardiology
Baystate Medical Center
Springfield, Massachusetts, USA
Professor of Medicine
Tufts University
Medford, Massachusetts, USA

Ajay Jindal MD (Medicine) FIAE
Testamur
National Board of Echocardiography
(NBE)
Raleigh, North Carolina, USA
Director
SND Hospital
Rupnagar, Punjab, India

M Joson MD
Echocardiography Laboratory
University of Alabama at Birmingham
Birmingham, Alabama, USA

Amjad Kabach MD
Resident
Internal Medicine Department
Creighton University School of Medicine
Omaha, Nebraska, USA

A Kalla MD
Echocardiography Laboratory
University of Alabama at Birmingham
Birmingham, Alabama, USA

R Kalra MD
Department of Medicine
University of Alabama at Birmingham
Birmingham, Alabama, USA

Megan Y Kamath MD
Fellow
Cardiovascular Disease
Allegheny Health Network
Pittsburgh, Pennsylvania, USA

Kanwal K Kapur MD
Senior Consultant and
Chief of Noninvasive Cardiology
Indraprastha Apollo Hospital
New Delhi, India

Jaroslaw D Kasprzak MD PhD FESC FACC
Professor of Medicine and Head
Department of Cardiology
Medical University of Lodz
Lodz, Poland

Pudussery Kattalan JJ MBBS
Echocardiography Laboratory
University of Alabama at Birmingham
Birmingham, Alabama, USA

Nurgül Keser MD
Professor
Department of Cardiology
Faculty of Medicine
Sakarya University Training and
Research Hospital
Sakarya, Turkey
Professor
Department of Cardiology Clinic
Umraniye Training and Research Hospital
Istanbul Health Sciences University
Istanbul, Turkey

Amber D Khanna MD
Assistant Professor of Medicine
Department of Medicine and Pediatrics
Division of Cardiology
University of Colorado Anschutz
Medical Campus
Colorado, Arizona, USA

Harun Kiliç MD
Professor
Department of Cardiology
Faculty of Medicine
Sakarya University Training and
Research Hospital
Sakarya, Turkey

B Klas BS
TomTec Corporation
Munich, Germany

Ravi Komatireddy MD
Clinical Assistant Professor
Department of Medicine
University of California
San Diego, California

Smadar Kort MD FACC FASE FAHA
Immediate Past Governor
American College of Cardiology
Downstate New York
Professor of Medicine and Director
Valve Center Ltd.
Palmerston North, New Zealand
Director
Noninvasive Cardiac Imaging and
Echocardiography
Stony Brook University
Stony Brook, New York, USA

Nikoloz Koshkelashvili MD
Einstein Medical Center
Department of Internal Medicine
Philadelphia, Pennsylvania, USA

K Kotti MD
Echocardiography Laboratory
University of Alabama at Birmingham
Birmingham, Alabama, USA

Arnav Kumar MD
Rsearch Fellow
Cardiac Imaging
Cleveland Clinic Foundation
Cleveland, Ohio, USA

Raghuveer Kura MD
Clinical Assistant Professor
Department of Medicine
St Louis University School of Medicine
Chief of Medicine
Medical Director
Division of Nephrology
Poplar Bluff Regional Medical Center
Medical Center, Fresenius Kidney Care
Poplar Bluff, Missouri, USA

Susan T Laing MD MSc CPE
Professor of Medicine and Director
Department of Echocardiography
University of Texas Health Science
Center at Houston
Memorial Hermann Texas Medical Center
Houston, Texas, USA

Meggo-Quiroz LD MD
Division of Cardiology
University of Alabama at Birmingham
Birmingham, Alabama, USA

Tao Yu Lee MD
Director
Echocardiographic Laboratory
Kaohsiung Veterans General Hospital
Assistant Professor
National Yang-Ming University
School of Medicine
Kaohsiung, Taiwan

Marina Leitman MD
Cardiologist
Department of Cardiology
Assaf Harofeh Medical Center
Sackler School of Medicine
Tel Aviv University
Tel Aviv, Israel

Laura Anna Leo MD
Cardiac Imaging Laboratory
Fondazione Cardiocentro Ticino
Lugano, Switzerland

Shoa-Lin Lin MD FACC FESC
Director
Coronary Care Unit
Yuan's General Hospital
Kaohsiung, Taiwan
Professor of Medicine
National Defense Medical College
Saitama Prefecture, Japan

Patricia Lozano-Rodriguez MD
Fellow
Division of Cardiology
University of Texas Medical Branch
(UTMB)
Galveston, Texas, USA

Kameswari Maganti MD
Associate Professor
Northwestern University Feinberg
School of Medicine
Chicago, Illinois, USA

A Mahajan MD
Echocardiography Laboratory
University of Alabama at Birmingham
Birmingham, Alabama, USA

Tuan V Mai MD
Cardiology Fellow
Knight Cardiovascular Institute
Oregon Health and Science University
Portland, Oregon, USA

Maria Maiello MD
Cardiologist
ASL Brindisi
Cardiology Equipe
Brindisi, Apulia, Italy

Abdullah Al Shafi Majumder MD FACC FESC FRCP FSCAI FCSI
Professor of Cardiology
Popular Medical College
Ex-Director
National Institute of Cardiovascular
Diseases
Dhaka, Bangladesh
Senior Visiting Fellow
Cambridge University
Cambridge, UK
Secretary General
Bangladesh Cardiac Society
Dhaka, Bangladesh

Amgad N Makaryus MD FACC FACP FASE FSCCT
Associate Professor
Hofstra Northwell School of Medicine/
Northwell Health
Chairman
Department of Cardiology NuHealth
Nassau University Medical Center
Nassau County, New York, USA

Judy R Mangion MD FASE
Associate Director
Noninvasive Cardiac Laboratory
Brigham and Women's Hospital
Harvard Medical School
Boston, Massachusetts, USA

C Bogdan Marcu MD
Director
Advanced Cardiac Imaging and
Imaging Education
Department of Cardiovascular Sciences
East Carolina Heart Institute
Brody School of Medicine at East
Carolina University
Greenville, South Carolina, USA

DC McGiffin MD
Cardiac Surgeon
University of Alabama at Birmingham
Birmingham, Alabama, USA

WS McMahon MD
Department of Pediatric Cardiology
University of Alabama at Birmingham
Birmingham, Alabama, USA

Sheridan Meyers MD
Assistant Professor of Medicine
Northwestern University Feinberg
School of Medicine
Bluhm Cardiovascular Institute
Chicago, Illinois, USA

J Mishra MD
Echocardiography Laboratory
University of Alabama at Birmingham
Birmingham, Alabama, USA

Shreyas Modi MD
Associate Professor of Medicine
Division of Cardiology
University of Texas Medical Branch
(UTMB)
Galveston, Texas, USA

A Mohamed MBBCh
Echocardiography Laboratory
University of Alabama at Birmingham
Birmingham, Alabama, USA

AH Mohamed
Echocardiography Laboratory
University of Alabama at Birmingham
Birmingham, Alabama, USA

Mohamed Morsy MD
Associate Professor of Medicine
Division of Cardiology
The University Texas Medical Branch (UTMB)
Galveston, Texas, USA

Romina Murzilli MD
Cardiac Imaging Laboratory
Fondazione Cardiocentro Ticino
Lugano, Switzerland

IA Mustafa MD
Echocardiography Laboratory
University of Alabama at Birmingham
Birmingham, Alabama, USA

Vidya Nadig MBBS MRCP FACC
Assistant Professor
University of Kentucky
Lexington, Kentucky, USA

Navin C Nanda MD DSc (Hon) DSc (Med) (Honoris Causa) FACC FAHA FISCU (D) FSGC FICA FACA FICP (Hon) FIAE FICMU (Hon) FACIP FCSC (S) FIACS FICC (Hon)
Distinguished Professor of Medicine and Cardiovascular Disease
University of Alabama at Birmingham
Birmingham, Alabama, USA
President
International Society of Cardiovascular Ultrasound
Editor-in-Chief
Echocardiography: A Journal of Cardiovascular Ultrasound and Allied Techniques

Aditi Naniwadekar MD
Fellow
Clinical Cardiac Electrophysiology
Mount Sinai Medical Center
Mount Sinai, New York, USA

Sirikarn Napan MD
Cardiovascular MRI Fellow
Allegheny General Hospital
Pittsburgh, Pennsylvania, USA

Rajasekhar Nekkanti MD
Associate Professor of Medicine
Program Director of Cardiology Fellowship
East Carolina University
Greenville, East Carolina, USA
Program Director of Continuing Medical Education (Cardiovascular Series)
Director of Echocardiography Laboratories
Department of Cardiovascular Sciences
East Carolina Heart Institute
Brody School of Medicine at East Carolina University
Greenville, South Carolina, USA

Ashley L Nickerson DO
Advanced Cardiovascular Imaging Fellow
University of Kentucky and the Gill Heart Institute
Lexington, Kentucky, USA

Paul O'Malley MBA MSP
Stritch School of Medicine
Maywood, Illinois, USA

Ahmad S Omran MD FACC FESC FASE
Consultant Cardiologist
Head
Noninvasive Cardiology Laboratory
King Abdulaziz Cardiac Center
Riyadh, Saudi Arabia
Ministry of National Guard-Health Affairs
Kingdom of Saudi Arabia

Maria del Sol Ordaz MD
Physician in Training of Echocardiography
National Institute of Cardiology
Mexico City, Mexico

Boris Orlov MD
Cardiac Surgeon
Sackler School of Medicine
Tel Aviv University
Department of Cardiac Surgery
Sheba Medical Center
Tel Aviv, Israel

Ibrahim Osman MD
Cardiology Fellow
Department of Cardiovascular Sciences
East Carolina Heart Institute
Brody School of Medicine at East Carolina University
Greenville, South Carolina, USA

Kemaloglu Ozkt MD
Echocardiography Laboratory
University of Alabama at Birmingham
Birmingham, Alabama, USA

Türker Pabuçcu MD
Cardiologist
Department of Cardiology
Sakarya University Training and Research Hospital
Sakarya, Turkey

Ramdas G Pai MD FRCP (Edin) FACC
Director of Cardiac Imaging and Cardiology Fellowship Program
UC Riverside School of Medicine
St Bernardine Medical Center
California, USA
Professor of Medicine
University of California Riverside and Loma Linda University School of Medicine
California, USA

Pasquale Palmiero MD
Adjunct Professor of Cardiology
ASL Brindisi
Cardiology Equipe
Brindisi, Apulia, Italy

Jitendra Pandya MD
Cardiology Fellowship
Cardiovascular Department
Creighton University School of Medicine
Omaha, Nebraska, USA

Jayant Patel MD
Medical Director
Non-Invasive Cardiology Services
Hackensack Meridian Health
Hackensack, New Jersey, USA

Rajiv Patel MD
Staff Cardiologist
Hackensack University Medical Center
Hackensack, New Jersey, USA

Eli Peleg MD
Cardiologist
Department of Cardiology
Assaf Harofeh Medical Center
Sackler School of Medicine
Tel Aviv University
Tel Aviv, Israel

William M Pelton MD
Radiologist
Poplar Bluff Regional Medical Center
Poplar Bluff, Missouri, USA

Nelson Pizzano MD FACC
Head
Cardiovascular Health Program
Hospital Evangelico
Montevideo, Uruguay
Former NIH Research Fellow
Heart Station
University of Alabama at Birmingham
Birmingham, Alabama, USA
Past President
Uruguayan Society of Cardiology
Montevideo, Uruguay

Sourabh Prabhakar MD
Cardiology Fellow
Allegheny General Hospital
Pittsburgh, Pennsylvania, USA

Jyothy J Puthumana MD
Associate Professor of Medicine
Division of Cardiology
Department of Medicine
Northwestern University Feinberg
School of Medicine
Chicago, Illinois, USA

Nishath Quader MD
Washington University School of
Medicine
St Louis, Missouri, USA

Robert A Quaife MD
Professor of Medicine
Departments of Medicine and
Radiology
Divisions of Cardiology and
Cardiothoracic Imaging
University of Colorado Anschutz
Medical Campus
Colorado, Arizona, USA

Supawat Ratanapo MD
Cardiology Fellow
Medical College of Georgia
Augusta University
Augusta, Georgia, USA

Hanumanth K Reddy MD FACC
Clinical Adjunct Professor of Medicine
St Louis University Medical School
Medical Director
Cardiovascular Institute of Southern
Missouri
Poplar Bluff, Missouri, USA
President
American Association of Cardiologists of
Indian Origin
Poplar Bluff, Missouri, USA

Vera H Rigolin MD
Professor of Medicine
Northwestern University Feinberg
School of Medicine
Medical Director
Echocardiography Accreditation
Laboratory
Northwestern Memorial Hospital
Chicago, Illinois, USA

Salomon Rivera-Peralta MD
Physician in Training of
Echocardiography
National Institute of Cardiology
Mexico City, Mexico

Hugo Rodriguez-Zanella MD
Physician of the Staff
National Institute of Cardiology
Mexico City, Mexico

Roberta Romito MD
Associate Medical Director
Chest Pain Unit
Cardiology Emergency
University of Bari
Bari, Italy

Asad Ullah Roomi MD MRCP (UK)
FRCP (Edin) Saudi Board Adult Cardiology
NBE (USA)
Consultant Cardiologist
Prince Sultan Cardiac Center
Prince Sultan Military Medical City (PSMMC)
Riyadh, Kingdom of Saudi Arabia

Angel Romero-Cardenas MD
Physician of the Staff
National Institute of Cardiology
Mexico City, Mexico

Maria Eugenia Ruiz-Esparza MD
Physician of the Staff
National Institute of Cardiology
Mexico City, Mexico

Hyde M Russell MD
Surgical Director
Advanced Heart Failure and
Mechanical Circulatory Support
Attending Surgeon
Cardiac Surgery
NorthShore University Health System
Chicago, Illinois, USA
Clinical Professor of Medicine
Pritzker School of Medicine
University of Chicago
Chicago, Illinois, USA

Juliet Ryan BS RDCS FASE
Lead Cardiology Sonographer
Cardiac Graphics-Echo Lab
Northwestern Memorial Hospital
Chicago, Illinois, USA

Anurag Sahu MD FACC
Assistant Professor and Director
Cardiac Intensive Care Unit
Emory University Hospital
Atlanta, Georgia, USA

Sherif Sakr MD
Professor of Medicine
Department of Cardiovascular Medicine
Mansoura University
Mansoura, Egypt

Ernesto E Salcedo MD
Professor of Medicine
Director of Echocardiography
Department of Medicine
Division of Cardiology
University of Colorado Anschutz
Medical Campus
Colorado, Arizona, USA

Mohsin Salih MD MS
Resident
Internal Medicine Department
St Luke's Hospital
Chesterfield, Missouri, USA

P Sankhyan MD
Echocardiography Laboratory
University of Alabama at Birmingham
Birmingham, Alabama, USA

Shelley Sarson BA RDCS FASE
Cardiac Sonographer
Northwestern University
Northwestern Memorial Hospital
Chicago, Illinois, USA

Alok Saurav MD
Cardiology Fellowship
Cardiovascular Department
Creighton University School of Medicine
Omaha, Nebraska, USA

Daniel R Schimmel MD MS
Division of Cardiology
Department of Medicine
Northwestern University Feinberg
School of Medicine
Chicago, Illinois, USA

Roxy Senior MD DM FRCP FESC FACC
Professor of Clinical Cardiology
National Heart and Lung Institute
Imperial College
London, UK
Consultant Cardiologist and
Director of Echocardiography
Royal Brompton Hospital
London, UK
Consultant Cardiologist and
Director of Cardiac Research
Northwick Park Hospital
London, UK

Arash Seratnahaei MD
Advanced Cardiovascular Imaging
Fellow
University of Kentucky and the Gill
Heart Institute
Lexington, Kentucky, USA

Sabiye Sevinç MD
Cardiologist
Department of Cardiology
Sakarya University Training and
Research Hospital
Sakarya, Turkey

Aijaz Shah MBBS MRCP (UK) FRCP (Edin) NBE (USA)
Consultant Cardiologist Director
Cardiac Imaging
Prince Sultan Military Medical City
(PSMMC)
Riyadh, Kingdom of Saudi Arabia

Moneal Shah MD
Clinical Assistant Professor of Medicine
Co-Director
Cardiovascular MRI
Allegheny General Hospital
Temple University School of Medicine
Pittsburgh, Pennsylvania, USA

Sangeeta B Shah MD FASE FACC
Associate Professor
Ochsner Clinical School
University of Queensland
Director
Cardiovascular MRI
Co-Director
Adult Congenital Heart Disease
New Orleans, Louisiana, USA

Sanjiv J Shah MD
Professor of Medicine
Division of Cardiology
Department of Medicine
Northwestern University Feinberg
School of Medicine
Chicago, Illinois, USA

Gyanendra K Sharma MD FACC FASE
Professor of Medicine and
Radiology
Director
Adult Echocardiography Laboratory
Section of Cardiology
Medical College of Georgia
Augusta University
Augusta, Georgia, USA

Rakesh K Sharma MD FACC FSCAI FSCCT
Interventional Cardiologist
Bay Care Medical Group Cardiology
Clearwater, Florida
Adjunct Clinical Professor of Cardiology
University of Arkansas for Medical
Sciences
Tampa, Florida, USA

Saurabh Sharma MD
Fellow in Cardiology
Albert Einstein Medical Center
Philadelphia, Pennsylvania, USA

Lubna Ibrahim Siddiqui MBBS
Instructor
Medical Education
Prince Sultan Military Medical City
(PSMMC)
Riyadh, Kingdom of Saudi Arabia

Maninder Singh MD (Medicine)
Fellow in Noninvasive Cardiology
Dayanand Medical College & Hospital
Unit: Hero DMC Heart Institute
Ludhiana, Punjab, India

Ravinder Pal Singh MD (Medicine)
Fellow in Noninvasive Cardiology
Dayanand Medical College & Hospital
Unit: Hero DMC Heart Institute
Ludhiana, Punjab, India

Gaurav Singhal MD
Senior Resident
Sawai Man Singh Medical College
Jaipur, Rajasthan, India

I Singla MD
Echocardiography Laboratory
University of Alabama at Birmingham
Birmingham, Alabama, USA

Mara T Slawsky MD PhD
Director
Heart Failure Program
Program Director
Cardiovascular Fellowship
Baystate Medical Center
Springfield, Massachusetts, USA

Aiman Smer MBBCh
Cardiology Fellowship
Cardiovascular Department
Creighton University School of Medicine
Omaha, Nebraska, USA

Beverly Smulevitz BS RDCS
Research Coordinator
Department of Echocardiography
University of Texas Health Science
Center at Houston
Houston, Texas, USA

Vincent L Sorrell MD FACC FASE FACP
Anthony N DeMaria Chair of
Cardiovascular Imaging
Director of Cardiovascular Imaging
University of Kentucky and the Gill
Heart Institute
Lexington, Kentucky, USA

Fabiola B Sozzi MD PhD
Consultant Cardiologist
Ospedale Maggiore Policlinico Instituti
di Ricovero e Cura a Carattere Scientifico
(IRCCS)
Milan, Italy

A Sungur MD
Echocardiography Laboratory
University of Alabama at Birmingham
Birmingham, Alabama, USA

Martin G St John Sutton MBBS
Professor
University of Pennsylvania
Philadelphia, Pennsylvania, USA

M Tageldin MBBCh
Echocardiography Laboratory
University of Alabama at Birmingham
Birmingham, Alabama, USA

A Taher MBBCh
Echocardiography Laboratory
University of Alabama at Birmingham
Birmingham, Alabama, USA

Rohit Tandon MD (Medicine)
Senior Consultant Physician
Dayanand Medical College & Hospital
Unit: Hero DMC Heart Institute
Ludhiana, Punjab, India

Ersan Tatli MD
Professor
Department of Cardiology
Faculty of Medicine
Sakarya University Training and
Research Hospital
Sakarya, Turkey

M Thind MD
Echocardiography Laboratory
University of Alabama at Birmingham
Birmingham, Alabama, USA

MM Townsley MD
Department of Anesthesiology
Division of Critical Care and
Perioperative Medicine
University of Alabama at Birmingham
School of Medicine
Birmingham, Alabama, USA

Alma Tozaj MD RDCS
Cardiac Sonographer
Echocardiography Laboratory Heart and
Vascular Institute
Henry Ford Hospital
Detroit, Michigan, USA

BC Tuck MD
Department of Anesthesiology
University of Alabama at Birmingham
Birmingham, Alabama, USA

NSN Turaga MBBS
Echocardiography Laboratory
University of Alabama at Birmingham
Birmingham, Alabama, USA

B Uygur MD
Echocardiography Laboratory
University of Alabama at Birmingham
Birmingham, Alabama, USA

Inga Vaitenas RCS RCCS
Lead Sonographer
Northwestern Memorial Hospital
Northwestern University
Chicago, Illinois, USA

Anastasia Vamvakidou MBBS MRCP (UK)
Cardiology Specialty Registrar
Northwick Park Hospital
Harrow, UK

Padmini Varadarajan MD
Professor of Medicine
Loma Linda University Medical Center
Loma Linda, California, USA

Archana Vasudevan MD
Resident Physician
Department of Medicine
University of Missouri
Columbia, Missouri, USA

Virginia Michelis Vázquez MD
Former Assistant Professor
National Armed Forces Hospital and
Medical Center
Montevideo, Uruguay

Sridhar Venkatachalam MD
Senior Fellow
Division of Cardiology
The University Texas Medical Branch
(UTMB)
Galveston, Texas, USA

Zvi Vered MD FACC FESC
Cardiologist and Professor
Department of Cardiology
Assaf Harofeh Medical Center
Sackler School of Medicine
Tel Aviv University
Tel Aviv, Israel

Mustafa Gökhan Vural MD
Cardiologist
Department of Cardiology
Faculty of Medicine
University of Sakarya
Sakarya, Turkey

Ronald B Williams BA RT(R) (MR)
Cardiovascular MRI Technologist
Cardiac MRI Center
Allegheny General Hospital
Pittsburgh, Pennsylvania, USA

June A Yamrozik RT
Cardiovascular MRI Technologist
Cardiac MRI Center
Allegheny General Hospital
Pittsburgh, Pennsylvania, USA

Desiree M Younes MD FACC
Cardiologist
Princeton Healthcare System
A New Jersey Non-profit Corporation
Robert Wood Johnson University Hospital
New Jersey, USA

B Yuzbas MD
Echocardiography Laboratory
University of Alabama at Birmingham
Birmingham, Alabama, USA

Annapaola Zito MD
Cardiologist
Cardiovascular Diseases Section
Department of Emergency and
Organ Transplantation
University of Bari School of Medicine
Bari, Italy

Preface

Despite many path-breaking advances in cardiology, echocardiography remains the most cost-effective noninvasive technique in the assessment of various cardiac disease entities. It serves as a valuable tool in the armamentarium of a practicing cardiologist. Throughout the past several decades, various national and international conferences dealing with echocardiography and allied techniques, such as magnetic resonance imaging and computed tomography scans have been held in different countries and many cities of USA. They have served as a forum for exchange of information and have provided updates on the current status and recent advances in echocardiography not only to the practicing echocardiographers and cardiologists, but also to the physicians of various other specialties, such as internists, general physicians, anesthesiologists, emergency room physicians, critical care specialists, and cardiac surgeons as well as technologists and other paramedical personnel. The International Society of Cardiovascular Ultrasound as well as the Echocardiography Laboratory of the University of Alabama, Birmingham, Alabama in co-operation with other organizations have also been in the forefront in conducting these conferences. World Conferences on Echocardiography have been successfully organized practically every year for the past 22 years, and International Conferences on Echocardiography and Allied Techniques have been held at the annual meetings of the American Heart Association and the American College of Cardiology for over three decades. The latter conferences have taken the format of brief interesting and instructive case presentations by a large number of faculties. These case presentations have proven very popular and it was felt by many of us that an effort should be made to publish some of these cases in a book format in both print and internet versions. With this in mind, invitations were sent to the faculty, who had presented cases previously at these meetings and to others to submit their cases for publication. This book, therefore, represents a compilation of more than 280 interesting and instructive cases submitted by several echocardiographers, cardiologists and other physicians from many different parts of the world. The book should prove useful to all physicians, ultrasound technologists and paramedical personnel, who already have some background in cardiac ultrasound, but are interested in learning its usefulness in day-to-day clinical practice.

The book is organized into 11 sections, all of which consist of case presentations. The pattern followed in many cases consists of a brief patient history and relevant clinical findings, echocardiographic images/movie clips, one or more multiple-choice questions with correct answers provided and a short relevant discussion. Pertinent references are also given in some cases. The first three sections of the book deal with the mitral, aortic, tricuspid and pulmonary valves as well as the aorta and pulmonary hypertension. The next two sections cover prosthetic valves, rings, plugs and clips, and infection and endocarditis respectively. These are followed by coronary artery disease, and left/right ventricles and cardiomyopathies. Pericardial disorders, tumors and masses, and congenital heart disease are dealt with next. The last section consists of miscellaneous cases plus a few cases which were submitted late and, hence, could not be accommodated in the relevant sections. Almost all cases predominantly deal with echocardiography with some showing comparisons with other techniques, mainly magnetic resonance imaging and computed tomographic scans. Only magnetic resonance images are shown in a couple of cases.

Navin C Nanda MD

Acknowledgments

I am most grateful to all the contributors who took time off from their busy schedule to send their interesting/instructive cases for publication in this book. I also need to express my heartfelt gratitude to all the current and past echocardiography fellows, researchers, residents and trainees, who helped me edit and, in many cases, labeled the images and movies sent by others as well as those from our Echo Laboratory and Dr Ming Chon Hsiung's Echo Laboratory in Taipei, Taiwan. They are Drs Mohamed Elsayed, Serkan Bulur, Ahmed Taher, Nermina Alagic, Lani Adarna, Emel, Ahmed Mohamed, Neelesh Gupta, Begum Uygur, Tugba Kemaloglu Oz, Jugal Chahwala, Kunal Bhagatwala, Turaga Naga, Pudussery Kattalan, Garima Arora, Burcu Gol, Mustafa Vural, Akhilesh Mahajan, Nurgul Keser, Pratayaksha Sankhyan, Rajat Kalra, Mustafa Ahmed, and Mathew Joson. I am also most appreciative of Dr Ming Hsuing's enormous and heartfelt co-operation in this endeavor. Mr Jitendar P Vij and his team at Jaypee Brothers, which include Ms Chetna Malhotra Vohra, Nedup Denka Bhutia, Saima Rashid and Geetanjali Singh, and their audio-visual team, deserve my deep gratitude for helping publish this book in a timely manner. I am particularly grateful to Mr Jitendar P Vij for his constant encouragement and full support in completing this project. Last but not least, it would not have been possible for me to undertake this work without the enormous support of my wife, Kanta Nanda, who also helped me with editing.

Contents

Section 3: Tricuspid and Pulmonary Valves, Pulmonary Hypertension

Section 4: Prostheses, Rings and Clips

Section 8: Pericardial Disorders

Section 9: Tumors and Masses

Section 10: Congenital Heart Disease

Section 11: Miscellaneous

Abbreviations

- 99m Tc DPD : Technetium diphosphonopropanodicarboxylic acid
- 99m Tc PYP : Technetium pyrophosphate
- 2D : Two-dimensional
- 3D : Three-dimensional
- ABD : Abdomen
- ABG : Arterial blood gases
- ACEI : Angiotensinogen converting enzyme inhibitor
- ACLS : Advanced cardiovascular life support
- AF : Atrial fibrillation
- AICD : Automatic implantable cardioverter-defibrillator
- AML : Anterior mitral leaflet
- Anti CMV : Antibody against cytomegalovirus
- AO : Aorta/aortic
- AR : Aortic regurgitation
- ARB : Angiotensin receptor blocker
- AS : Aortic stenosis
- ASD : Atrial septal defect
- ATVL : Anterior tricuspid valve leaflet
- AV : Aortic valve
- AVR : Aortic valve replacement
- BNP : Brain natriuretic peptide
- BP : Blood pressure
- BSA : Body surface area
- BUN : Blood urea nitrogen
- C/W : Consistent with
- CA : Coronary artery
- CABG : Coronary artery bypass graft
- CAD : Coronary artery disease
- Cath : Catheterization
- CBC : Complete blood count
- CECT : Contrast enhanced computed tomography
- CK : Creatine kinase
- CKD : Chronic kidney disease
- CKMB : Serum creatine kinase MB isoenzyme
- CMRI : Cardiac magnetic resonance imaging
- CO : Cardiac output
- COPD : Chronic obstructive pulmonary disease
- CPK : Creatinine phosphokinase
- CPR : Cardiopulmonary resuscitation
- Cr : Creatinine
- CS : Coronary sinus
- CSA : Cross-sectional surface area
- CT : Computed tomography
- CTA : Clear to auscultation
- CTA : Computed tomography angiography
- CTn : Cardiac troponin
- CV : Cardiovascular
- CVE : Cerebrovascular embolism
- CVP : Central venous pressure
- CVS : Cardiovascular system
- CXR : Chest X-ray
- DA : Descending thoracic aorta
- DCM : Dilated cardiomyopathy
- DD : Diastolic dysfunction
- DM : Diabetes mellitus
- DP : Diastolic pressure
- DTGA : Dextro-transposition of the great arteries
- DTI : Doppler tissue imaging
- DVT : Deep venous thrombosis
- E : Eosinophil
- ECG/EKG : Electrocardiogram
- ED : Emergency department
- EF : Ejection fraction
- EOA : Effective orifice area
- ER : Emergency room
- ESR : Erythrocyte sedimentation rate
- EV : Eustachian valve
- F/U : Follow up
- FAC : Fractional area change
- FHx : Family history
- HB : Hemoglobin
- HCM : Hypertrophic cardiomyopathy
- HCT : Hematocrit
- HF : Heart failure
- HR : Heart rate
- HTN : Hypertension
- HV : Hepatic vein
- Hx : History
- IAS : Inter-atrial septum
- ICD : Intracardiac defibrillator
- ICU : Intensive care unit
- INR : International normalized ratio
- IV : Intravenous
- IVC : Inferior vena cava
- IVRT : Isovolemic relaxation time
- IVS : Interventricular septum
- JVD : Jugular venous distension
- K : Potassium
- KFT : Kidney function test
- L : Left
- L : Liters
- L : Liver
- L : Lymphocyte

- L : Pacemaker lead
- LA : Left atrium
- LAD : Left anterior descending coronary artery
- LCX/CX : Left circumflex coronary artery
- LDL : Low density lipoprotein
- LFT : Liver function test
- Li : Liver
- LTGA : Levo-transposition of the great arteries
- LV : Left ventricle
- LVEF : Left ventricular ejection fraction
- LVH : Left ventricular hypertrophy
- LVO : Left ventricular outflow
- LVOT : Left ventricular outflow tract
- MAP : Mean arterial pressure
- MI : Myocardial infarction
- ML : Mitral valve leaflet
- MPI : Myocardial perfusion imaging
- MR : Mitral regurgitation
- MRI : Magnetic resonance imaging
- MS : Mitral stenosis
- MV : Mitral valve
- MVOA : Mitral valve orifice area
- MVP : Mitral valve prolapse
- N : Neutrophil
- Na : Sodium
- NICM : Non-ischemic cardiomyopathy
- NL : Normal
- NSR : Normal sinus rhythm
- NSTEMI : Non-ST segment elevation myocardial infarction
- NT-Pro BNP: N-terminal pro B-type natriuretic peptide
- NYHA : New York Heart Association
- O_2 : Oxygen
- OA : Orifice area
- OM : Obtuse marginal coronary artery
- OR : Operating room
- PA : Pulmonary artery
- PASP : Pulmonary artery systolic pressure
- PDA : Patent ductus arteriosus
- PE : Pulmonary embolism
- PE : Physical examination
- PE : Pericardial effusion
- PEA : Pulseless electrical activity
- PFO : Patent foramen ovale
- PG : Pressure gradient
- PH : Pulmonary hypertension
- PHT : Pressure half time, Pulmonary hypertension
- PHTN : Pulmonary hypertension
- PISA : Proximal isovelocity surface area
- PL : Pleural effusion
- PLT : Platelet
- PMBV : Percutaneous mitral balloon valvuloplasty
- PML : Posterior mitral valve leaflet
- PP : Pulse pressure
- PR : Pulmonary regurgitation
- PS : Pulmonary stenosis
- Pts : Patients
- PTT : Partial thromboplastin time
- PV : Pulmonary valve
- R : Right
- RA : Right atrium
- RBS : Random blood sugar
- RCA : Right coronary artery
- RCM : Restrictive cardiomyopathy
- Reg Vol : Regurgitation (regurgitant) volume
- RHC : Right heart catheterization
- ROSC : Return of spontaneous circulation
- RRR : Regular rate and rhythm
- RV : Right ventricle
- RVE : Right ventricular enlargement
- RVH : Right ventricular hypertrophy
- RVO : Right ventricular outflow
- RVOT : Right ventricular outflow tract
- RVSF : Right ventricular systolic failure
- RVSP : Right ventricular systolic pressure
- S/P : Status post
- S1 : First heart sound
- S2 : Second heart sound
- S3 : Third heart sound
- SAM : Systolic anterior motion of the mitral valve
- SAX : Short axis view
- SBP : Systolic blood pressure
- SC : Subclavian artery
- SHX : Social history
- SOB : Shortness of breath
- SPECT : Single photon emission computed tomography
- STE : Speckle tracking echocardiography
- STEMI : ST segment elevation myocardial infarction
- STVL : Septal tricuspid valve leaflet
- SV : Stroke volume
- SVC : Superior vena cava
- SVG : Saphenous venous graft
- SVR : Systemic vascular resistance
- T : Temperature
- TAPSE : Tricuspid annulus planar systolic excursion
- TDI : Tissue Doppler imaging
- TEE : Transesophageal echocardiography
- TIA : Transient ischemic attack
- TLC : Total leucocyte count
- TGA : Transposition of the great arteries
- toF : Tetralogy of Fallot
- TPA : Tissue plasminogen activator
- TR : Tricuspid regurgitation
- Trop-T : Troponin T

- TTE : Transthoracic echocardiography
- TV : Tricuspid valve
- UTI : Urinary tract infection
- VC : Vena contracta
- VMAX : Maximum velocity
- V/Q : Ventilation/perfusion
- VS : Ventricular septum
- VSD : Ventricular septal defect
- VTI : Velocity time integral
- WBC : White blood cell
- WMA : Wall motion abnormality

SECTION 3

Tricuspid and Pulmonary Valves, Pulmonary Hypertension

CASE 38

Chahwala JR, Elsayed M, Alagic N, Uygur B, Turaga NSN, Adarna LG, Mohamed A, Gupta N, Bulur S, Nanda NC

This is an adult patient with a cardiac murmur on physical examination. 2D TTE was done.

1. **What does the arrow show (120)?**
   (a) Mouth of the coronary sinus (CS)
   (b) Body of the CS
   (c) A portion of the TR jet entering CS

Ans.(c)

TR jet extending into the CS is considered a sign of severe regurgitation.

MOVIE 120

CASE 39

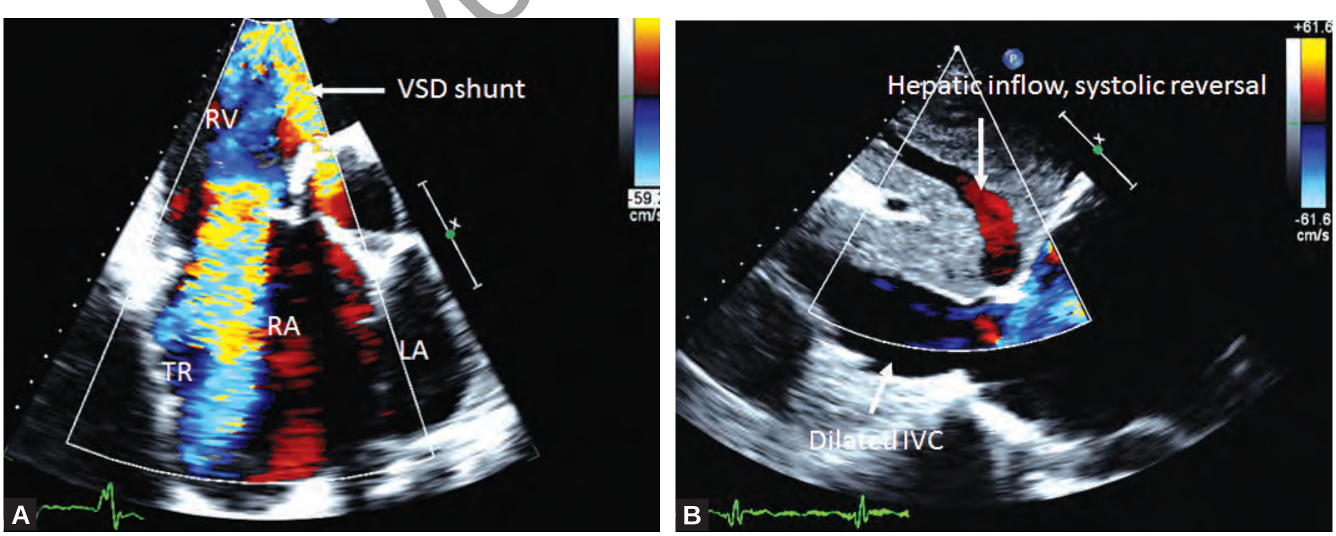
Ahmad S Omran

SEVERE SECONDARY TRICUSPID REGURGITATION

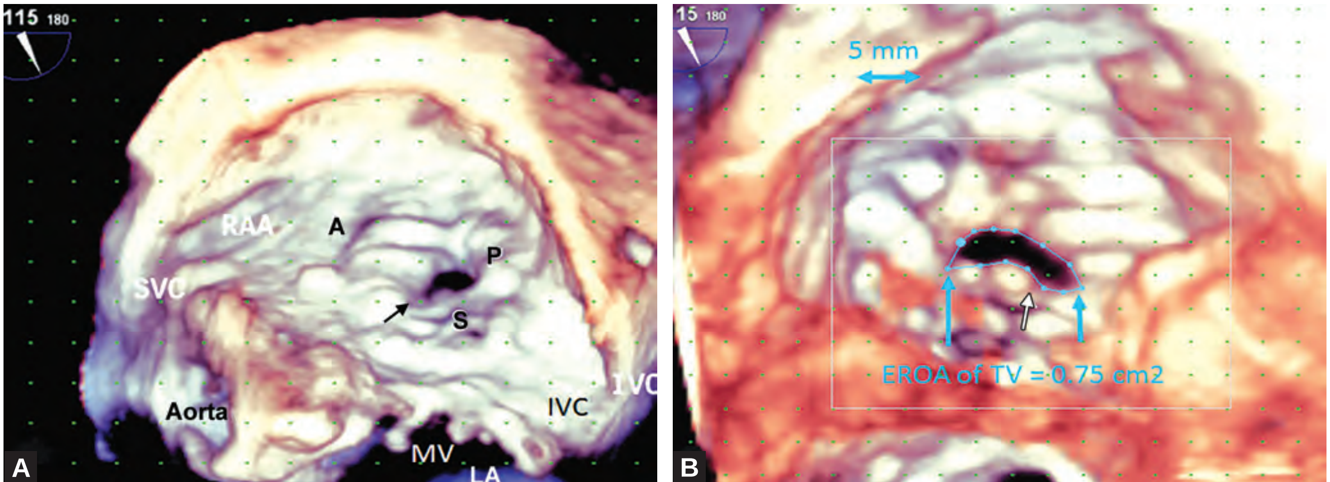
This 34-year-old man with a known history of congenital heart disease presented to our center due to shortness of breath and easy fatigability. He had a history of cardiac surgery to repair Tetralogy of Fallot (TOF) 15 years ago in another hospital. Transthoracic echocardiography (TTE) showed severe pulmonary regurgitation, and previous ventricular septal defect (VSD) patch repair dehiscence with a large shunt. Right ventricle was severely dilated. Severe tricuspid valve regurgitation (TR) was present with hepatic vein inflow systolic reversal (Figs. 39.1A and B). Patient was investigated for possible infective endocarditis as a cause for VSD patch dehiscence which was negative. Patient was taken to the operating room for redo-surgery. Preoperative 3D transesophageal echocardiography (3DTEE) confirmed the diagnosis of severe TR due to lack of leaflet coaptation (Figs. 39.2A and B, 121 and 122). Patient underwent redo VSD patch repair, tricuspid valve repair and pulmonic valve replacement (Figs. 39.3A and B, 123 and 124). Tricuspid valve was repaired with a size 34 Medtronic contour annuloplasty ring with only trace postoperative TR. Pulmonic valve was replaced with a size 27 Magna bioprosthetic valve. Patient was discharged home in good condition.

1. **In echocardiographic assessment of patient with tricuspid valve regurgitation (TR), all of the followings are correct *except*:**
   (a) A small degree of TR is present in approximately 70% of normal adults.
   (b) 90% of patients with moderate to severe TR have primary tricuspid valve pathology.
   (c) Ebstein's anomaly is the most common form of congenital heart disease affecting the tricuspid valve.
   (d) Risk of post-operative TR is lower with a prosthetic ring than with suture repair procedures.

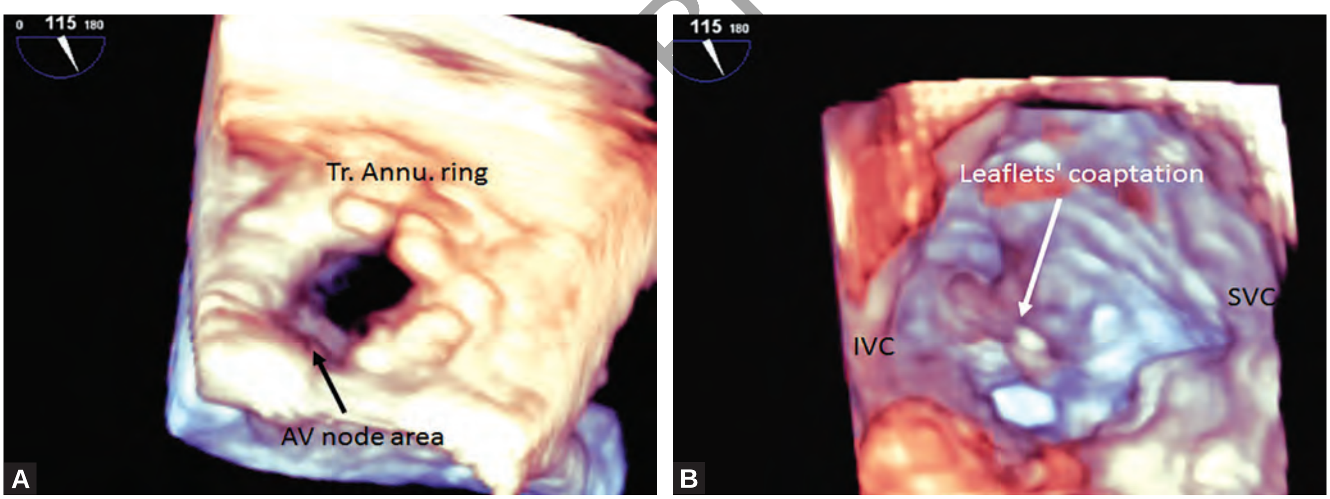
Ans. (b)



Figs. 39.1A and B: Initial transthoracic echocardiography (TTE). (A) Parasternal short-axis view shows a large VSD shunt through the dehisced previous patch. Severe tricuspid valve regurgitation (TR) is noted as well. (B) Subcostal view shows severely dilated hepatic vein with reduced respiratory collapsibility. Hepatic vein inflow color Doppler shows severe systolic reversal flow (red color) supporting diagnosis of severe TR. (RA: Right atrium; LA: Left atrium; RV: Right ventricle).



Figs. 39.2A and B: Preoperative 3D transesophageal echocardiography (3DTEE). (A) 3D zoom mode acquisition of the tricuspid valve in surgical view showing severely dilated tricuspid annulus, all 3 leaflets of the tricuspid valve and a large gap during systole. This large gap (lack of leaflet coaptation) is the cause for severe tricuspid regurgitation. Internal landmark for identification of the tricuspid septal leaflet (S) is interatrial septum, ostium of the coronary sinus. Landmark for tricuspid anterior leaflet (A) is aortic root and right atrial appendage (RAA), and landmark for tricuspid posterior leaflet (P) is inferior vena cava (IVC). (B) 3D zoom mode of tricuspid valve from right ventricular (RV) aspect showing three leaflets with a large coaptation gap. Effective regurgitation orifice area (EROA) by 3D planimetry calibrated with 3D grid was calculated as 0.75 cm^2. This EROA is consistent with very severe TR. (MV: Mitral valve).



Figs. 39.3A and B: Postoperative 3D TEE in the operating room. (A) 3D TEE zoom mode acquisition in surgical view of the tricuspid valve showing the annuloplasty ring (Tr. Annu. Ring) seated well. Note: these rings are C-shaped and the open part of the ring should be towards the area of the atrioventricular node (AV node) to decrease the risk of AV block. (B) 3D TEE of the tricuspid valve from right ventricular side showing good coaptation of the three leaflets consistent with no residual TR. (IVC: Inferior vena cava; SVC: Superior vena cava).

MOVIE LEGENDS

121: Preoperative 3D TEE, surgical view of the tricuspid valve showing a large systolic gap (white arrow) resulting in severe TR.

122: Preoperative 3D TEE showing tricuspid valve from right ventricular aspect (white arrow shows large systolic gap).

123: 3D TEE immediately after tricuspid valve repair showing tricuspid valve from RV side with good leaflet coaptation.

124: Pulmonic valve replacement with a Magna bioprosthetic valve viewed from pulmonary artery side.

CASE 40

Chahwala JR, Elsayed M, Alagic N, Uygur B, Turaga NSN, Adarna LG, Mohamed A, Gupta N, Bulur S, Nanda NC

This is an adult patient who underwent cardiac transplantation a few years ago. 2D TTE was done.

1. **What does the arrow in 🎥 125 show?**
   (a) Flail anterior TV leaflet
   (b) Flail septal TV leaflet
   (c) Flail posterior (inferior) TV leaflet

Ans. (b)

The septal leaflet clearly prolapses below the anterior leaflet with noncoaptation. The mobile component on the septal leaflet represents a ruptured chord. These patients with cardiac transplantation undergo several ventricular septal biopsies with a bioptome inserted intravenously which can damage the TV and the subvalvular apparatus.

2. **What is the severity of TR in this patient (🎥 126)?**
   (a) Severe
   (b) Moderately severe
   (c) Moderate
   (d) Mild to moderate

Ans. (a)

The turbulent TR jet is eccentric, loses its high velocity when it strikes the lateral wall of the RA (Coanda effect) and takes on red color as it swirls around the RA. Red color occurs because the velocity of the TR jet has now decreased below the Nyquist limit of 54.2 cm/s. Therefore, it is important to take into account both the turbulent and the non-turbulent color flow signals moving in the same phase in systole when assessing regurgitation severity, fully realizing that a part of those low-velocity signals will be due to SVC and IVC inflow and entrainment. In this patient, the combined turbulent and non-turbulent laminar red flow signals occupy a large portion (>33%) of the RA indicative of severe TR.

MOVIES 125 AND 126 🎥

CASE 41

Gupta N, Mohamed A, Elsayed M, Nanda NC

This is a 66-year-old male who had cardiac transplantation 20 years ago. He is asymptomatic and came for a routine follow up. 2D (Fig. 41.1 and 127 and 128) and 3D TTE were done (129 to 131).

1. **What does the arrow in 127 show?**
   (a) Flail anterior TV leaflet
   (b) Flail posterior TV leaflet
   (c) Flail septal TV leaflet
   (d) TV vegetation

Ans. (c)

Generally, in the RV inflow view, anterior and posterior (inferior) TV leaflets are detected. However, 3D cropping (130) in which the blue cursor line is passing through the flail TV leaflet (both upper panels) shows the cut section of this leaflet located adjacent to the VS and MV (lower left panel) identifying it as the septal TV leaflet. Both the anterior and posterior TV leaflets in the left lower panel do not show any evidence of chordae rupture.

2. **What is the etiology of flail TV leaflet in this patient?**
   (a) It is fairly common in cardiac transplantation patients and may be related to the operative technique used.
   (b) May be related to the trauma caused to TV by frequent right-sided biopsies done to assess cardiac rejection.
   (c) The patient may have subclinical TV endocarditis.
   (d) May be related to cardiac rejection which can cause damage to all three TV leaflets.

Ans. (b)

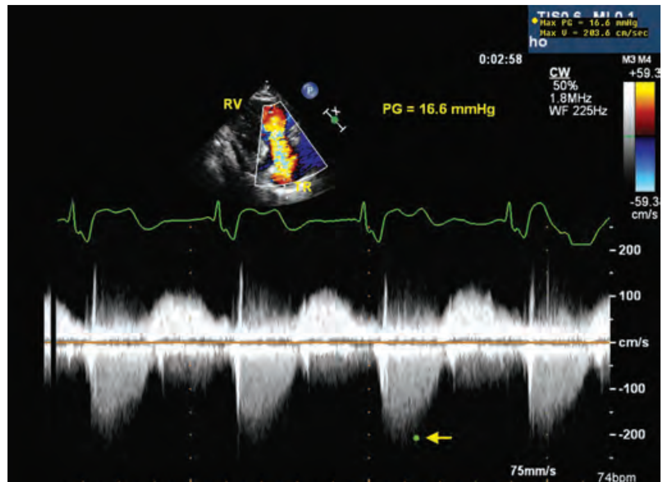


Fig. 41.1: Color Doppler guided continuous wave recording shows a low gradient across the TV consistent with normal PA pressure.

In this patient, the TR jet occupies most of the RA shown, indicating severe TR. Also TR jet is seen entering the coronary sinus (CS), another reported sign of severe TR (128). In addition, TR vena contracta (VC) area by 3D echo is large measuring 0.85 cm^2 consistent with very significant regurgitation. RV/PA systolic pressure is normal suggesting that TR is not secondary to pulmonary hypertension (PHT) but is related to primary TV pathology (Fig. 41.1).

MOVIES 127 TO 131

CASE 42*

Elsayed M, Thind M, Nanda NC

This is a 64-year-old female with previously diagnosed gastric adenocarcinoma, MVP and severe MR who was referred for a follow up echocardiogram. She complained of worsening shortness of breath but denied chest pain or any other symptoms. Physical examination was normal except for an apical pansystolic murmur of MR. 2DTTE was done and showed as before prominent MVP and severe MR.

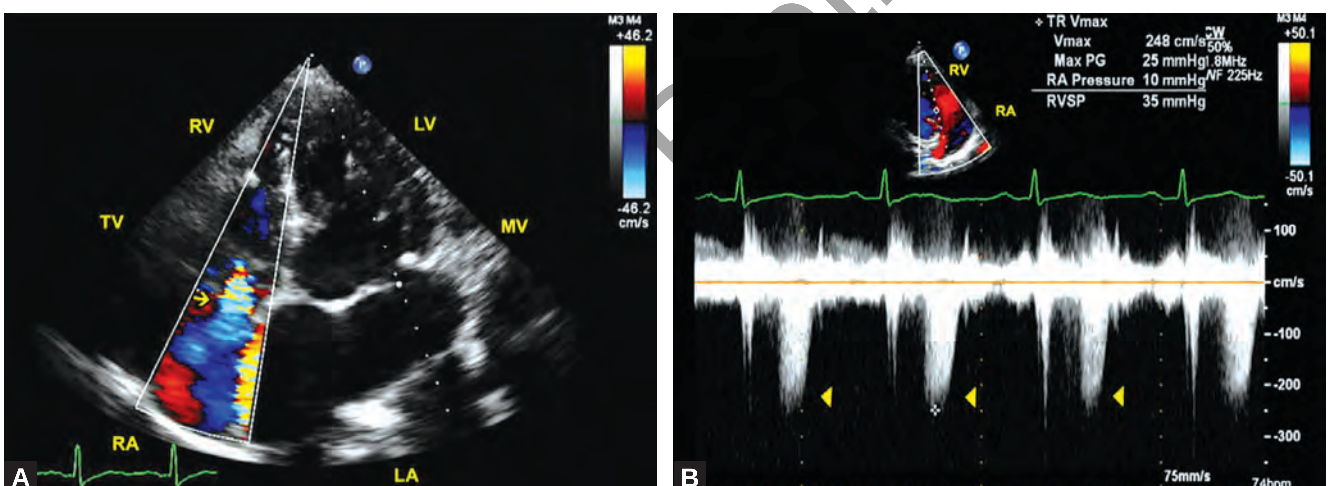
1. What does 2D TTE show (Figs. 42.1A to C and 132)?

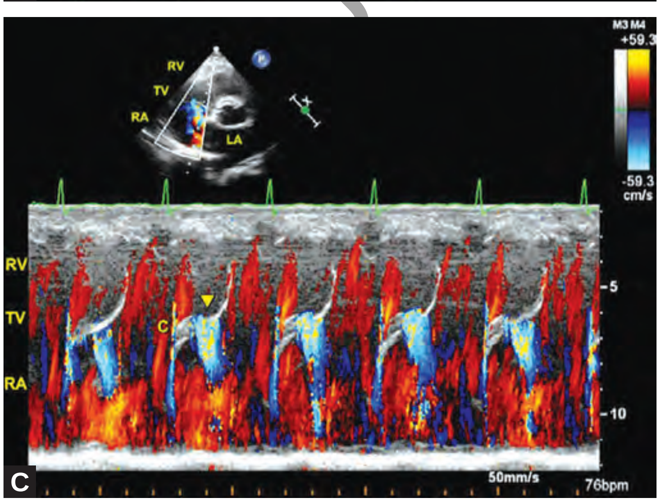
(a) Minimal TR (b) Severe TR
(c) TVP (d) MVP

Ans. (c)

Mid to late systolic TR on color M-mode and also mid to late systolic CW Doppler of TR jet is highly suggestive of mid to late systolic TVP.

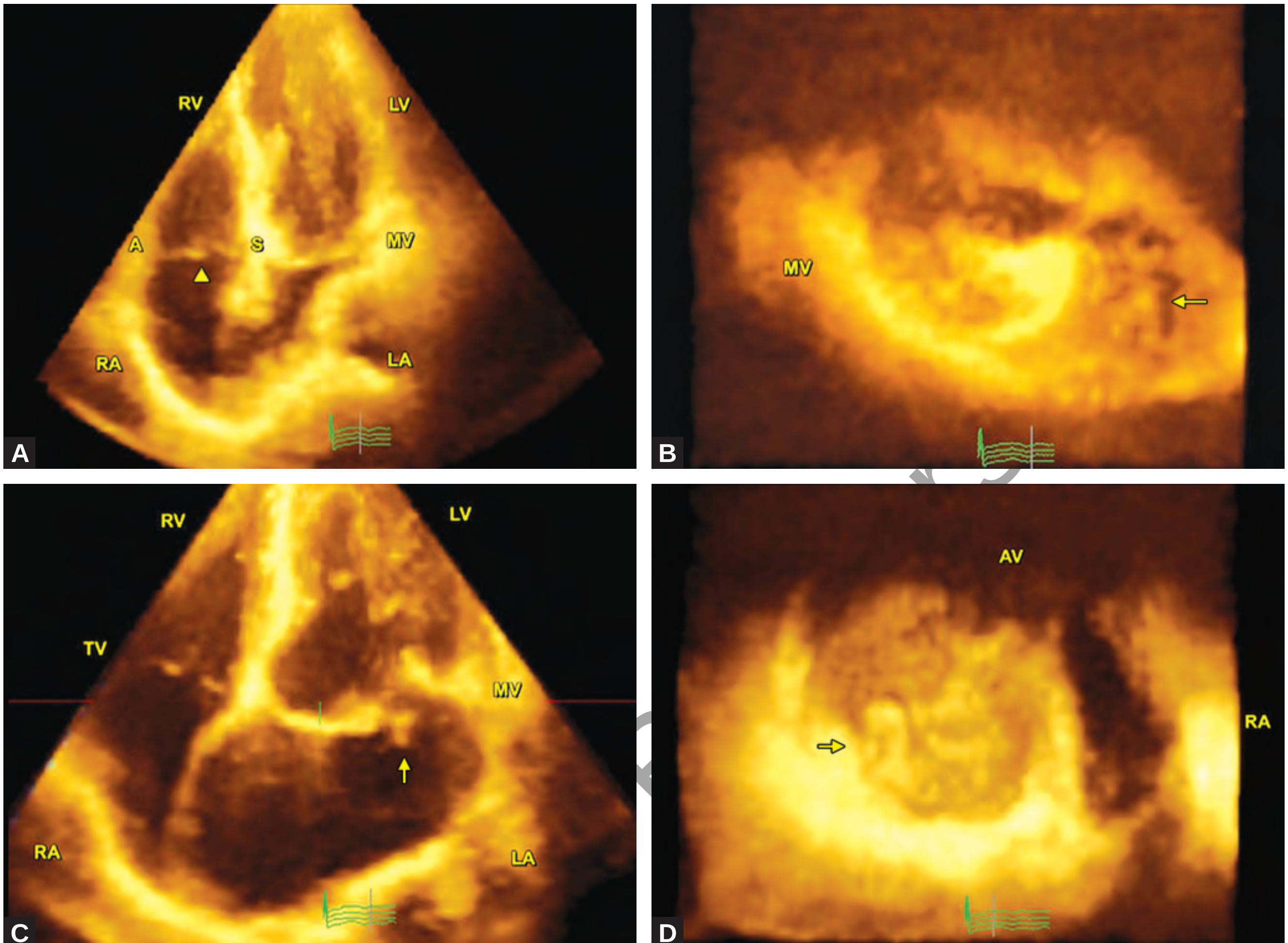
The maximum TR jet area occupies 20.5% of the RA area taken in the same frame where the maximum TR was found which is consistent with mild-to-moderate TR. However, since TR does not occur throughout systole, TR would be expected to be less severe than found by color Doppler. 3D TTE would be ideal for quantification of TR. This was subsequently done (Figs. 42.2A to D and 133A to D) and the TR vena contracta (VC) by 3D TTE measured 0.50 cm^2. TR volume was calculated by multiplying the





Figs. 42.1A to C: Two-dimensional transthoracic echocardiography in tricuspid valve prolapse with mid-to-late systolic regurgitation. (A) Apical four-chamber view. Arrow points to tricuspid regurgitation jet from right ventricle (RV) into right atrium (RA). Tricuspid valve (TV), left atrium (LA), mitral valve (MV), and left ventricle (LV) are also seen. (B) Color Doppler-guided continuous wave Doppler. Arrowhead points to mid-to-late tricuspid regurgitation jet velocity waveform. (C) Color M-Mode. Arrowhead points to tricuspid regurgitation jet confined to mid-to-late systole. C points to tricuspid valve closure. 132.

*This case is reproduced with permission from: Elsayed M, Thind M, Nanda NC. Two- and Three-dimensional Transthoracic Echocardiographic Assessment of Tricuspid Valve Prolapse with Mid-to-Late Systolic Tricuspid Regurgitation. Echocardiography. 2015 Jun;32(6):1022–5.



Figs. 42.2A to D: Live/real-time three-dimensional transthoracic echocardiography in tricuspid valve prolapse with mid-to-late systolic regurgitation. (A) Apical four-chamber view. Arrowhead points to anterior leaflet (A) of tricuspid valve prolapsing into right atrium behind the septal leaflet (S). (B) En face view of tricuspid valve. Arrow points to prolapsed mid-segment of anterior leaflet of tricuspid valve. (C) Apical four-chamber view. Arrow points to a flail segment of posterior leaflet of mitral valve with chordae rupture. (D) En face view of mitral valve. Arrow points to prolapsed mid (P2) segment of posterior leaflet of mitral valve with chordae rupture. Aortic valve (AV) is also seen. 133A to D. Abbreviations as in Figures 5.1A to C.

3D VC with TR VTI (35.7 cm) obtained by CW Doppler. This was found to be only 17 cc, indicative of only mild TR.

The TR volume was small because TR occurred only in mid-to-late systole. If we were to extend the TR waveform to include all of systole assuming TR to be pansystolic, the TR VTI would have been much higher (94.6 cm) leading to more than double the TR volume (47.3 cc) consistent with severe TR.

2. What did 3D TTE add to 2D TTE in this patient (Figs. 42.2A to D and 133A to D)?

(a) Showed the exact segment of anterior TV leaflet which was prolapsing
(b) Showed the exact scallop/segment of prolapsing MV
(c) Only B is correct
(d) Only A is correct
(e) Both A and B are correct

Ans. (e)

MOVIES 132 AND 133A TO D

REFERENCE

1. Lancellotti P, Moura L, Pierard LA, et al: European Association of Echocardiography recommendations for the assessment of valvular regurgitation. Part 2: Mitral and tricuspid regurgitation (native valve disease). Eur J Echocardiogr J Work Group Echocardiogr Eur Soc Cardiol 2010;11: 307–332.

CASE 43

Adarna LG, Elsayed M, Alagic N, Uygur B, Turaga NSN, Chahwala JR, Mohamed A, Gupta N, Bulur S, Nanda NC

Color M-mode and CW Doppler in an adult with TR.

1. **What do movies 134 and 135 show?**
   (a) Pansystolic TR
   (b) Pansystolic plus late diastolic TR
   (c) Normal PA pressure
   (d) Normal EKG

Ans. (b)

This patient has a prolonged PR interval (heart block, seen well on the EKG tracing in 134) which causes the TV to close in late diastole resulting in lower velocity late diastolic TR (#1 in 134 and arrow in 135). The patient also has pansystolic TR (#2 in 134) and a high-peak gradient of 71 mm Hg indicative of high RV systolic pressure, which will be the same as PA systolic pressure in the absence of obstruction in RV or RVOT.

MOVIES 134 AND 135

CASE 44

Adarna LG, Elsayed M, Alagic N, Uygur B, Turaga NSN, Chahwala JR, Bulur S, Nanda NC

CW Doppler velocity waveform was obtained in a patient with TR (136).

1. **How would you assess the PA systolic pressure assuming there is no obstruction to flow in the RV?**
   (a) Add the estimated RA pressure by imaging IVC
   (b) Add the actual RA pressure obtained by right heart catheterization.

Ans. (a)

IVC can be imaged noninvasively in most patients using the subcostal approach. On the other hand, cardiac catheterization is an invasive procedure.

2. **The maximum TR gradient in this patient was 49 mm Hg. RA pressure would need to be added to this to obtain the PA systolic pressure. There is no obstruction in the RV or PV. How would you assess RA pressure by inspecting the IVC? All statements below are correct except:**
   (a) If the internal diameter of IVC is 2.1 cm or less (at least 1 cm upstream from IVC-RA junction) and it collapses > 50% during respirations or sniff, add 3 mm Hg
   (b) Same as above but if IVC collapses less than 50%, add 8 mm Hg
   (c) If IVC is large (> 2.1 cm) and collapses > 35%, add 13 mm Hg
   (d) Same as C but collapses 0–35%, the actual number could not be determined but it will be more than 13 mm Hg
   (e) All of the above statements are highly accurate

Ans. (e)

These statements are only a rough guide to measure RA systolic pressure in day-to-day clinical practice. Caveats include congenital and acquired abnormalities of IVC and patients on ventilators. Young athletes may also have a dilated IVC, even though the RA pressure is normal. There are also problems in correctly estimating PA pressures during cardiac catheterization.

MOVIE 136

CASE 45

Bulur S, Nanda NC

The patient is a 65-year-old female with suspected pulmonary hypertension. 2D TTE was done.

1. **Regarding Figure 45.1:**
   (a) Both peak (Max G) and mean (Mean G) TR gradients are correct
   (b) Both peak (Max G) and mean (Mean G) TR gradients are incorrect
   (c) Only mean TR gradient is incorrect
   (d) Only peak TR gradient is incorrect

Ans. (c)

Peak TR velocity appears to be measured correctly but the tracing does not follow the TR velocity waveform faithfully. Hence, the TR mean velocity and, therefore, the TR mean gradient have been overestimated.

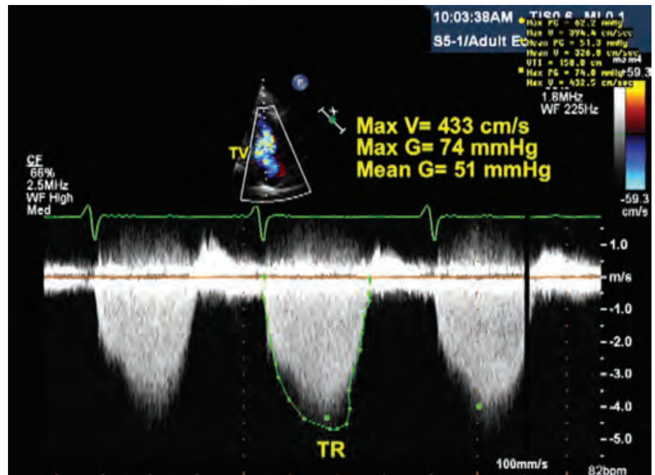


Fig. 45.1: Tricuspid regurgitation (TR) waveform.

CASE 46

Bulur S, Nanda NC

This is an adult patient with suspected pulmonary hypertension.

1. **How severe is TR in this patient (🎥 137)?**
   (a) Moderately severe to severe TR
   (b) Moderate TR
   (c) Severe TR
   (d) TR severity cannot be estimated because no attention is given to color gain and Nyquist limit.

Ans. (c)

Even though the Nyquist limit is rather high at 59 cm/s (should ideally be around 50 cm/s), the TR jet occupies more than 33% of the RA indicating severe TR. We cannot be sure whether the color gain was optimized. The color gain should be increased until one visualizes stationary artifactual echoes and then decreased till they just disappear.

2. **What is the PA systolic pressure in this patient (🎥 138A and B)?**
   (a) PA systolic pressure is 68 mm Hg
   (b) Both PA systolic and mean pressures are less than 68 mm Hg because Doppler generally overestimates
   (c) PA systolic pressure is 83 (68+15) mm Hg because the IVC is dilated to 3.0 cm (normal 2.1 cm) and collapses very little during respiration. This means RA pressure is 15 mm Hg and, therefore, you have to add this number to the peak Doppler gradient.
   (d) PA systolic pressure is at least 83 mm Hg.

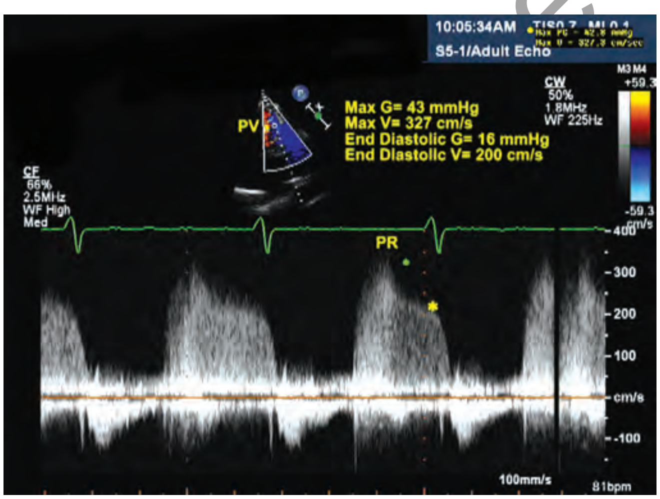


Fig. 46.1: Pulmonary regurgitation (PR) waveform. Maximum (Max) and end diastolic gradients (G) and velocities (V) are shown.

Ans. (d)

When the IVC is dilated and does not collapse, or collapses only minimally as in this patient, the RA pressure is more than 15 mm Hg but an exact number cannot be determined which may be very high. Therefore, PA systolic pressure could be higher than 83 mm Hg.

Estimation of mean PA pressure by adding the RA pressure obtained from inspection of IVC to the mean TR gradient or the peak PR diastolic gradient can be done but may need further validation. Peak end diastolic PR gradient plus RA pressure gives PA end diastolic pressure. The technique for measuring peak (maximum) and end diastolic velocities and gradients of the PR jet is shown in Figure 46.1 from a different patient. Pulmonary hypertension is diagnosed if the mean PA is 25 mm Hg or more at rest. Mild pulmonary hypertension is categorized by mean PA pressures of 30–40 mm Hg, moderate 40–70 mm Hg and severe t>70 mm Hg. This patient, therefore has moderate pulmonary hypertension.

MOVIES 137 AND 138 🎥

REFERENCE

1. Chopra HK, Nanda NC, Fan P, et al. Can two-dimensional echocardiography and Doppler color flow mapping identify the need for tricuspid valve repair? J Am Coll Cardiol. 1989 Nov 1;14(5):1266-74.

CASE 47

Taher A, Elsayed M, Nanda NC

A 42-year-old male was referred for an echocardiogram prior to renal transplantation. PV prolapse was noted as an incidental finding (139 A-C).

1. **Which of the following is correct?**
   (a) PV prolapse is always isolated.
   (b) Only one leaflet of the PV can prolapse in any given patient.
   (c) All these leaflets of the PV can never be identified by 2D echo. You need 3D echo to do this.
   (d) PV prolapse may be isolated or may be associated with prolapse of other cardiac valves.

Ans. (d)

It is very difficult to visualize all three leaflets of the PV in a normal adult. However, if the PA is enlarged and in children, all three leaflets can be detected. More than one leaflet may be noted to prolapse in some patients and PV prolapse may occur in association with prolapse of other valves as a manifestation of myxomatous disease. This patient also has MV prolapse.

2. **How are the three leaflets of the PV named?**
   (a) Right, left and anterior leaflets.
   (b) Right left and noncoronary leaflets.
   (c) There are no specific names except the left leaflet, which is imaged next to the aortic root.
   (d) Right anterior, posterior and left anterior leaflets.
   (e) Right, left and septal leaflets.

Ans. (a) and (d)

(a) is based on the location of the leaflets in the fetus and (d) is based on their location in the adult. Both the terminologies are given in Gray's Anatomy but (a) is more commonly used.

MOVIE LEGENDS

139A: Aortic short axis view demonstrating all three leaflets of the AV and the PV which does not appear to prolapse.

139B: Aortic short axis view with long axis of the PA (reverse orientation). Arrow points to prominent prolapse of one leaflet of PV into the RVO. The other leaflet does not show prolapse.

139C: Color Doppler examination shows trivial PR (reverse orientation).

CASE 48

Bulur S, Nanda NC

The patient is a 74-year-old female with ischemic heart disease and chronic renal failure. 2D TTE was done (140).

1. **What does the arrow point to?**
   (a) Normal flow signals in the RVO
   (b) Small patent ductus arteriosus
   (c) Mild PR
   (d) Eccentric mild PR jet

Ans. (d)

Normally PR jets are red in color (arrowhead) since they are directed to the transducer. There is an additional PR jet which is eccentric and directed somewhat away from the transducer. Therefore, it appears blue in color. The jet is very small in proximal width, indicative of mild PR.

MOVIE 140

CASE 49

Adarna LG, Elsayed M, Alagic N, Uygur B, Turaga NSN, Chahwala JR, Mohamed A, Gupta N, Bulur S, Nanda NC

This is an adult patient who underwent left ventricular assist device (LVAD) placement for dilated cardiomyopathy and heart failure.

1. **What does 🎥 141 (P = pacing lead) show?**
   (a) Mild/mild to moderate PR
   (b) Severe PR
   (c) Moderate AR
   (d) PDA
   (e) Anomalous left coronary artery origin from PA (ALCAPA)

Ans. (a)

The PR jet width at its origin occupies 25–30% of RVOT diameter measured at the same point. A ratio of < 25% signifies mild PR, > 65% severe PR, intermediate values moderate PR. Also, PR jet extending to within 1 cm of TV signifies severe TR. This patient also has mild AR.

MOVIE 141 🎥

CASE 50

Mohamed A, Gupta N, Elsayed M, Nanda NC

The patient is an 18-year-old male complaining of vague chest pain. 2D TTE was done. All valves appeared to be structurally normal and both ventricles showed normal function.

1. **What is the severity of PR in this patient (Fig. 50.1 and 142)?**
   (a) Mild
   (b) Moderate
   (c) Severe

Ans. (c)

The width of the PR jet at its exit from PV occupies 73% of the RVOT inner diameter measured in the same frame. This is suggestive of severe PR.

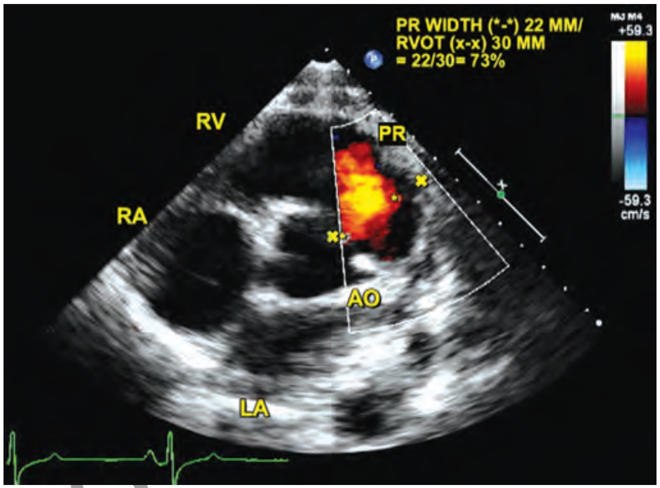


Fig. 50.1: The pulmonary regurgitation (PR,+--+) jet at its origin occupies 73% of the right ventricular outflow tract (RVOT) width (x-x) taken in the same frame indicative of severe PR.

MOVIE 142