# Heart in Yours

# Heart in Fours

## CARDIOLOGY

for Residents and Practitioners

**Third Edition**

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*Foreword*
**IV Rao**

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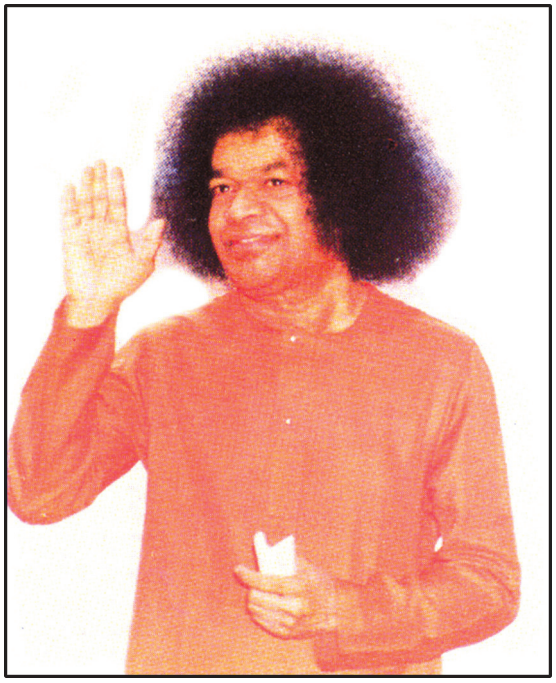

**'Heart in Fours'**

is humbly and reverentially dedicated to Bhagawan

*Sri Sri Sri Satya Sai Baba*

# Foreword

డా॥ ఎన్.టి.ఆర్. ఆరోగ్య విజ్ఞాన విశ్వవిద్యాలయము, ఆంధ్రప్రదేశ్
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Dr Pothuri Radha Krishna Murthy is a family physician who has been practicing medicine, surgery, obstetrics and gynecology and taking good care of the health needs of the people in Krishna district, Andhra Pradesh, India. He graduated from Guntur Medical College and obtained DNB qualification in family medicine, the first in Andhra Pradesh to gain this distinction and the first few in the country.

He devotes his time in teaching general practitioners for FCGP examination in medicine, surgery, obstetrics and gynecology and preventive medicine. In spite of his busy schedule in family practice, he still takes time to give Guest lectures and orations to teach students, general practitioners and members of IMA in topics related to medicine, cardiology and ECG.

Though he is not a cardiologist himself, he acquired a thorough knowledge of the subject and his interpretation of ECG was appreciated by one and all including the noted cardiologists. His analysis and approach to ECG became a big hit and he is being approached by several student communities for taking regular training classes. In short, he has a passion for cardiology.

He is the author of *'Heart in Fours' Cardiology*, which won many accolades from students, specialists and teachers. Presently, he is bringing out the third edition and I had the opportunity to scan through the chapters of Hypertension and Cardiac Arrhythmias. I am thoroughly impressed by his work particularly, the subject being dealt in "Fours" meaning four salient points for every aspect of the topic concerned.

I greatly appreciated his vision, knowledge and style of presentation and I hope this edition turns out to be the most sought-after book in cardiology by students, practitioners, physicians and cardiologists alike as was the case with his previous work.

I wish him all success in his future endeavors.

**IV Rao** MD (General Medicine)
Vice Chancellor
NTR University of Health Sciences
Vijayawada, Andhra Pradesh, India

# Preface to the Third Edition

By the grace of God and blessings of my well-wishers, I have been able to bring out this third edition, which is a stupendous task. I am extremely happy to bring this third edition of *Heart in Fours: Cardiology for Residents and Practitioners*. It is indeed, heartening to note the overwhelming response given to this by the students, practitioners as well as the consultants.

*A picture is worth ten thousand words --- Chinese proverb*

Many additional pictures are added in this edition.

*The value of experience is not in seeing much but in seeing wisely --- William Osler*

Immense popularity and wide acceptability of this book among the students, family physicians and consultants have encouraged me to prepare this third edition.

Readers have appreciated that this is the only of its kind in the medical literature, which can help to remember it easily and to reproduce it easily in 'Fours'. It is easy for the teachers to teach and more easy for the students to remember in 'Fours'.

This book has been updated and a new chapter on 'Pregnancy and Cardiovascular Disease' is an addition.

I did not elaborate the subjects on cardiac catheterization, interventions in cardiology and surgery as they are beyond the scope of this book and they are mostly for the superspecialists.

**Pothuri Radha Krishna Murthy**

# Preface to the First Edition

This book is the outcome of my curious but significant observation of both the theoretical and practical aspects concerning heart as a four-dimensional system. Incidentally, the idea surfaced at the time of preparing myself for Diplomate of National Board (DNB) Final Examination in Family Medicine, in 1983, a couple of decades after leaving the teaching institution as a practicing physician and surgeon. I have discovered this fact after making sufficient headway in the process of writing this book. Now, I am convinced that the idea of number 4, which I have picked up is workable and stable all through my writing. Hence, the title *Heart in Fours*. Surprisingly, in the process, I have found out that all the points (more than 2,000) included herein, have suitably teamed and arranged themselves into four each, and here and there occasionally in multiples of four too! This pattern eventually facilitates a student, a teacher and a physician to recall to his memory, any piece of information without much effort.

My number 'Four' indicates definite parameters in various contexts. In the selection of drugs, drugs may change but the parameters do not. Their number may grow, but the existing parameters do not change. In other places, the number 4 remains as an indomitable classification of symptom complex or complications of heart diseases. This book is written not as a textbook of heart and heart disease. It is aimed at simplicity and practical use rather than theory. I have strained every nerve to make the subject more concise and to the point and to serve as a typical ready reckoner. One can understand the subject with ease and can remember it with greater ease. The causes, diagnosis, treatment, and prevention of various cardiac complaints relevant to the topic are discussed in every chapter and a little overlapping could not be avoided. Diagnostic cardiology has made great strides and its use has become imperative. Care is taken to reach the students and practitioners the knowledge in roentgenology, electrocardiography, echocardiography and cardiac catheterization chapters. Since the chapter on ECG requires pictorial explanation, a good number of diagrams are added. Medicine is an ever-changing subject. The drug schedules given are in accord with the standard accepted at the time of publication. However, changes can be brought after continuous research and clinical experience. Therefore, the readers are advised to check the product information supplied with the drug, so that they can notice the changes that are brought in the dosage and complications, etc. This is of particular importance with newer and infrequently used drugs. The newer drugs need not be better than previous ones. Medical science has undergone revolutionary changes, particularly in the field of cardiac surgery. What was thought impossible is now made possible. An attempt is made to throw open a window on interventional cardiology, surgery in ischemic heart diseases, valvular diseases and congenital heart diseases. However, it is suggested that an appraisal is a must at every stage of management.

**Pothuri Radha Krishna Murthy**

# Acknowledgments

I thank innumerable students, colleagues, general physicians and cardiologists throughout the country who have inspired me with encouragement and suggestions. I should like to place on record in expressing my deep sense of gratitude to the great medical luminaries of national and international repute like *Padmabhushan* Dr MS Valiathan, *Padmas*ri Dr Kakarla Subbarao and Dr R Alagappan and many others for their letters of appreciation.

I thank once again to Dr KP Mishra and Dr S Thanikachalam, renowned cardiologists who wrote foreword to the first and second editions.

I thank Dr IV Rao, Vice-Chancellor of NTR University of Health Sciences, Vijayawada, Andhra Pradesh, who has immediately accepted to write foreword to the third edition.

I thank IMA, Vijayawada branch, where good number of lectures are arranged in various subjects, from which I learned much and also IMA College of General Practitioners and other branches of IMA who arranged my ECG lectures.

I thank the organizers of Sri Satya Sai Temple, Vijayawada, where I have been serving the poor and needy at the free medical camp on every Sunday since two decades where I have the benefit of attending many cardiac patients. Bhagawan Sri Satya Sai Baba gave me the opportunity by appointing me as Chief Medical Officer-in-Charge of postoperative care of patients in Krishna district who underwent heart operations at Sri Satya Sai Institute of Higher Medical Sciences at Puttaparthi and Bengaluru. I have learned much in postoperative follow-up care with satisfaction of free service.

I thank Mr Kotha Durga Prasad, Potti Subramanian, Mr Sanjeev, medical students and Dr P Adinarayana for typing the manuscript.

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My thanks are due to Dr P Sudharani for proofreading and P Sridhar for computer help.

Finally, I thank my wife Dr P Raja Rajeswary, BAMS, who is the source of motivation to bring out the third edition.

I like to thank Shri Jitendar P Vij (Group Chairman), Mr Ankit Vij (Managing Director) and Mr Tarun Duneja (Director-Publishing) of M/s Jaypee Brothers Medical Publishers (P) Ltd, New Delhi, India, for accepting to bring out the third edition in a beautiful way with color photographs. I thank Mr Suresh of Hyderabad branch, Mr Venugopal of Bangalore branch, Ms Sunita Katla and Mr Rajesh Sharma of Delhi branch, and other staff of Jaypee Brothers for bringing out this stupendous work in time.

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# Abbreviations

| | |
|---|---|
| + | Positive |
| – | Negative |
| ↓ | Decreased or Depressed |
| | Increased or Elevated |
| > | More or greater |
| < | Less or smaller |
| 2D | Echo two-dimensional echocardiography |

## A

| | |
|---|---|
| ABG | Arterial blood gases |
| ACEI | Angiotensin converting enzyme inhibitors |
| ACS | Acute coronary syndrome |
| AF | Atrial flutter/fibrillation |
| AICD | Automatic implantable cardioverter/ defibrillator |
| AMI | Acute myocardial infarction |
| AR | Aortic regurgitation |
| AS | Aortic stenosis |
| ASD | Atrial septal defect |
| ASO | Antistreptolysin O |
| AV | Atrioventricular node |

## B

| | |
|---|---|
| BB | Beta blocker |
| bid | bid in die (Twice in a day) |
| BMI | Body mass index |
| BP | Blood pressure |
| BPH | Benin prostatic hypertrophy |
| BPM | Beats per minute |

## C

| | |
|---|---|
| CABG | Coronary artery bypass graft |
| CAD | Coronary artery disease |
| CBC | Complete blood counts |
| C/I | Contraindications |
| CCB | Calcium channel blocker |
| CCF | Congestive cardiac failure |
| CI | Cardiac index |
| CK,CPK | Creatine phosphokinase |
| CO | Cardiac output |
| COPD | Chronic obstructive pulmonary disease |
| CPB | Cardiopulmonary bypass |
| CPKMB | Creatine phosphokinase-MB isoenzyme |
| CT | Computerized tomography |
| CVD | Cardiovascular diseases |
| CVP | Central venous pressure |
| CVS | Cardiovascular system |

## D

| | |
|---|---|
| DBP | Diastolic blood pressure |
| DCM | Dilated cardiomyopathy |

## E

| | |
|---|---|
| e.g. | For example |
| ECG | Electrocardiography |
| Echo | Echocardiogram |
| EDRF | Endothelial derived relaxing factor |
| EF | Ejection fraction |
| EMS | Emergency medical services |
| EPS | Electrophysiological studies |
| ESR | Erythrocyte sedimentation rate |

## F

| | |
|---|---|
| FA | Fatty acids |
| FBC | Full blood count |

## G

| | |
|---|---|
| g | Gram |
| GFR | Glomerular filtration rate |

| | |
|---|---|
| GIT | Gastrointestinal tract |
| GP | General practitioner |

## H

| | |
|---|---|
| h | Hour |
| H/O | History of |
| Hb | Hemoglobin |
| HF | Heart failure |
| HOCM | Hypertrophic obstructive cardiomyopathy |
| HR | Heart rate |

## I

| | |
|---|---|
| ICCU | Intensive coronary care unit |
| IE | Infective endocarditis |
| IHD | Ischemic heart disease |
| IM | Intramuscular |
| IMA graft | Internal mammary artery graft |
| IMR | Infant mortality rate |
| ICA | Intensive care unit |
| IU | International unit |
| IV | Intravenous |
| IVI | Intravenous infusion |
| IWMI | Inferior wall myocardial infarction |

## J

| | |
|---|---|
| JVP | Jugular venous pressure |

## K

| | |
|---|---|
| kg | Kilogram |

## L

| | |
|---|---|
| L | Left |
| L | Liter |
| LA | Left atrium |
| LAFB | Left anterior fascicular block |
| LAH | Left atrial hypertrophy |
| LAHB | Left anterior hemiblock |
| LBB | Left bundle branch |
| LBBB | Left bundle branch block |
| LDH | Lactic dehydrogenase |
| LFT | Liver function test |
| LPFB | Left posterior fascicular block |
| LPHB | Left posterior hemiblock |
| LV | Left ventricle |
| LVEDP | Left ventricular end-diastolic pressure |
| LVF | Left ventricular failure |
| LVH | Left ventricular hypertrophy |
| LVSWI | Left ventricular stroke work index |

## M

| | |
|---|---|
| MAP | Mean arterial pressure |
| MCCU | Mobile coronary care unit |
| mg | Milligram |
| MI | Myocardial infarction |
| min | Minute(s) |
| mL | Milliliter |
| mm Hg | Millimeters of mercury |
| M-mode Echo | M-mode echocardiography |
| MMR | Maternal mortality rate |
| MR | Mitral regurgitation |
| MS | Mitral stenosis |
| $MVO_2$ | Myocardial oxygen consumption |
| mcg/μg | Microgram |

## N

| | |
|---|---|
| NSAIDs | Nonsteroidal anti-inflammatory drugs |
| NSTEMI | Non-ST elevated myocardial infarction |
| NTG | Nitroglycerin |

## O

| | |
|---|---|
| OD | Once a day |

## P

| | |
|---|---|
| $PaCO_2$ | Partial pressure of $CO_2$ in arterial blood |
| $PaO_2$ | Partial pressure of $O_2$ in arterial blood |
| PAI | Plasminogen activator inhibitor |
| PCI | Percutaneous coronary intervention |
| PCWP | Pulmonary capillary wedge pressure |
| PDA | Patent ductus arteriosus |
| PIH | Pregnancy induced hypertension |
| PMBV | Percutaneous mitral balloon valvuloplasty |
| PO | Per orem (by mouth) |
| PS | Pulmonary stenosis |
| PTCA | Percutaneous transluminal coronary angioplasty |
| PVBs/PVCs | Premature ventricular beats/premature ventricular contractions |
| PVR | Pulmonary vascular resistance |

## R

| | |
|---|---|
| R | Right |
| RA | Right atrium |
| RAAS | Renin angiotensin aldosterone system |
| RBB | Right bundle branch |
| RBBB | Right bundle branch block |
| RBC | Red blood cell |
| RCM | Restrictive cardiomyopathy |
| RF | Rheumatic fever |
| RHD | Rheumatic heart disease |
| rt-PA | Recombinant tissue plasminogen activator |
| RUD | Rashkind umbrella device |
| RV | Right ventricle |
| RVF | Right ventricular failure |
| RVH | Right ventricular hypertrophy |
| RVMI | Right ventricular myocardial infarction |

## S

| | |
|---|---|
| S/E | Side effects |
| SA | Sinoatrial node |
| SBE | Subacute bacterial endocarditis |
| SBP | Systolic blood pressure |
| SC | Subcutaneous |
| SL | Sublingual |
| SS | Statum summendum (To be taken immediately) |
| STEMI | ST elevated myocardial infarction |
| Stratum | Stratum (Immediately) |
| Stk | Streptokinase |
| SV | Stroke volume |
| SVR | Systemic vascular resistance |

## T

| | |
|---|---|
| TC | Total white blood cell count |
| Tds | Tes die summendum (To be taken thrice a day) |
| TG | Triglycerides |
| Tid | Tes in die (To be taken thrice a day) |
| TPA | Tissue plasminogen activator |
| TPR | Temperature, pulse and respirations |
| TS | Tricuspid stenosis |
| TR | Tricuspid regurgitation |

## U

| | |
|---|---|
| U/S | Ultrasound |
| Uk | Urokinase |

## V

| | |
|---|---|
| VSD | Ventricular septal defect |

## W

| | |
|---|---|
| WBC | White blood cell |
| wk | Week(s) |

## Y

| | |
|---|---|
| y | Year(s) |

# Common Hematologic Values

**Common hematologic values** if outside this range, consult;

| | | |
|---|---|---|
| Hemoglobin | Men: | 13–18 g/dL |
| | Women: | 11.5–16 g/dL |
| Mean cell volume, MCV | | 76–96 fL |
| Platelets | | 150–400 × $10^9$/L |
| White cells (total) | | 4–11 × $10^9$/L |
| Neutrophils | | 40–75% |
| Lymphocytes | | 20–45% |
| Eosinophils | | 1–6% |

| **Blood gases** | κPa | mm Hg |
|---|---|---|
| pH | 7.35–7.45 | |
| $PaO_2$ | > 10.6 | 75–100 |
| $PaO_2$ | 4.7–6 | 35–54 |
| Base excess | ± 2 mmol/L | |

**U and E (urea and electrolytes)** if outside this range, consult;

| | |
|---|---|
| Sodium | 135–145 mmol/L |
| Potassium | 3.5–5 mmol/L |
| Creatinine | 70–150 µmol/L |
| Urea | 2.5–6.7 mmol/L |
| Calcium | 2.12–2.65 mmol/L |
| Albumin | 35–50 g/L |
| Proteins | 60–81 g/L |

**LETs (liver function tests)**

| | |
|---|---|
| Bilirubin | 3–17 µmol/L |
| Alanine aminotransferase, ALT | 3–35 IU/L |
| Aspartate transaminase, AST | 3–35 IU/L |
| Alkaline phosphatase | 30–300 IU/L (adults) |

**Cardiac enzymes**

| | |
|---|---|
| Creatine kinase 2 | 5–195 IU/L |
| Lactate dehydrogenase, LDH | 70–250 IU/L |

**Lipids and other biochemical values**

| | |
|---|---|
| Cholesterol | 4–6 mmol/L desired |
| Triglycerides | 0.5–1.9 mmol/L |
| Amylase | 0–180 somogyi IU/dL |
| C-reactive protein, CRP | < 10 mg/L |
| Glucose, fasting | 3.5–5.5 mmol/L |
| Prostate specific antigen, PSA | 0–4 mg/mL |
| T4 (total thyroxin) | 70–140 mmol/L |
| TSH | 0.5–5 mU/L |

# Normal Values

**Normal hemodynamics**

| | |
|---|---|
| Right atrial pressure | 0–8 mm Hg |
| Right ventricular | 15–30 mm Hg |
| systolic and diastolic | 0–8 mm Hg |
| Pulmonary artery | 15–30/4–12 mm Hg |
| systolic/diastolic | 9–16 mm Hg |
| mean | |
| PCWP | 2–10 mm Hg |
| LVEDP | 8–12 mm Hg |
| Cardiac output | 5–9 L/min |
| Cardiac index | 2.8–4.2 L/min/$m^2$ |
| Systemic vascular resistance | 770–1500 dyne.s/$cm^5$ |
| Pulmonary vascular resistance | 100–250 dyne.s/$cm^5$ |
| Left ventricular ejection fraction | 55–75% |

**ATP III classification of LDL, total, and HDL cholesterol**

**LDL cholesterol, mg/dL (mmol/L)**

| | |
|---|---|
| < 100 (2.58) | Optimal |
| 100–129 (2.58–3.33) | Near or above optimal |
| 130–159 (3.36–4.11) | Borderline high |
| 160–189 (4.13–4.88) | High |
| ≥ 190 (4.91) | Very high |

**Total cholesterol, mg/dL (mmol/L)**

| | |
|---|---|
| < 200 (5.17) | Desirable |
| 200–239 (5.17–6.18) | Borderline |
| ≥ 240 (6.20) | High |

**HDL cholesterol, mg/dL (mmol/L)**

| | |
|---|---|
| < 40 (1.03) | Low |
| ≥ 60 (1.55) | High |

**ATP III criteria for diagnosis of the metabolic syndrome**

≥ 3 out of 5 criteria must be satisfied for diagnosis

| **Variable** | **Threshold** |
|---|---|
| Waist circumference | > 40 inch (men)<br>> 35 inch (women) |
| Fasting glucose | > 100 mg/dL |
| Blood pressure | > 130/> 85 mm Hg |
| HDL cholesterol | < 40 mg/dL in men<br>< 50 mg/dL in women |
| Triglycerides | > 150 mg/dL |

# Note

Our knowledge in clinical medicine is constantly changing. As the clinical experience and research are growing, new information is obtained, which may change the treatment and the use of drugs. The drug schedules given are in accordance with the standard accepted at the time of publication. While every step is taken to check drug dosage in this book, it is still possible that errors have been missed. Furthermore, dosage schedules are being continually revised and new side effects identified. Therefore, the readers are advised to check the printed instructions supplied by the drug companies for dosage, complications, etc., before administering any of the drugs recommended in this book. This is of particular importance with newer and rarely used drugs.

# Reviews

**Padmabhushan Dr MS Valiathan** MCh FRCS FRCS FRCP DSc
(Formerly, Director, Chitra Tirunal Institute, Thiruvananthapuram)
Honorary Advisor, Manipal Academy of Higher Education
Madhav Nagar, Manipal, Karnataka, India

I have now had the pleasure of going through many chapters of your *Heart in Fours*. Yours is an amazing, perhaps unique, book on cardiology. Far from preparing a mere aid to examiners, you have compressed all the clinically useful information in cardiology in remarkable series of quartets. I should not have thought such a feet possible.

I have no doubt your book will be of much interest and value to medical students and general physicians. Its mine of information and uniqueness of presentation would have an enduring appeal.

I have placed your book in our Kasturba Medical College Library to bring it to the attention of a large academic community.

**Padmasri Kakarla Subbarao** MBBS MS FRCR FACR
Director, NIMS, Hyderabad
Former Advisor, Ministry of Health, Medical and Family Welfare, Andhra Pradesh, India

I wish to profusely congratulate you for having brought the concise and informative book on cardiology. Unfortunately in this country, we have specialists and super specialists but their interest in spreading their knowledge to the general practitioner or a student is very little. No doubt, they can address their colleagues and specialists and enrich them with their experience but that is not adequate in the present situation in our country. Please keep it up in other areas also such as "Radiology for General Practitioners".

**Dr S Thanikachalam** MD DM (Cardiology)
Director, Cardiac Care Center
Professor and Head, Department of Cardiology
Sri Ramachandra Medical College and Research Institute
Chennai, Tamil Nadu, India

Foreword to the second edition:

I had the opportunity to go through the manuscript of *Heart in Fours: Cardiology for Residents and Practitioners* in-depth and enjoyed every chapter for exemplenary way it is written. It is presented in simple fashion avoiding ambiguity. I have no doubt that this creation is useful, not only to medical practioners but also for consultants.

I appreciate the mammoth efforts taken by Dr Pothuri Radha Krishna Murthy in completing this stupendous task of crating this voluminous book.

**Dr KP Misra** MD FACC FCCP FISE
Consultant Cardiologist, Director Medical Education
Apollo Hospitals, Chennai, Tamil Nadu, India

Foreword to the first edition:

…… In his unusual interest in pursuing academic growth, he came with a novel idea of writing a book on "Cardiology in Fours". This book gives entire subject of cardiology very comprehensively in a simple and unusual format—all items

arranged in 4s. Four is a very auspicious number in our country—from Vedas to the paths to salvation—all are actually in 4. Dr Pothuri Radha Krishna Murthy has been inspired by the fact that in cardiology most of the things are all four types or can be expressed in four. This is a delightful way of learning cardiology. He has more than succeeded in presenting the entire subject in this manner. I have gone through the manuscript and enjoyed it thoroughly. I have also presented many times various topics in cardiology emphasizing this role of four. I have no doubts that the readers will find it interesting at the same time comprehensive and simple enough to learn cardiology…….

**Dr PC Bhatla** BSc MBBS FCGP FRCGP (Australia) FIAMS FAMS
Formerly, National President, IMA
Director, IMACGP, Chairman
Health Care Promotion Trust and National Institute of Primary Health Care
New Delhi, India

I have great pleasure in greeting Dr Pothuri Radha Krishna Murthy as a crusader in initiating and following an innovative approach in presenting cardiology as a condensed capsule. Only through in depth study and understanding could this extensive facts be compiled in such a manner that exhibits extraordinary style of compilation as almost a 'ready reckoner' and useful also for self-assessment.

The presentation is distillate of medical facts, easy-to-grasp and easy-to-remember and apply. There is fluency in description and the comprehensive contents make easy readability by the students of cardiology. The book would meet the needs of the teachers as well who could guide the teacher—learning process as a SYSTEM. I recommend the book to find its place on the desks of all doctors, which in itself will be a tribute to the author for his scholarship.

**Professor R Alagappan** MD FICP
Director, Professor and Head of Department, Institute of Internal Medicine, Madras Medical College
Senior Civil Surgeon and Physician, Government General Hospital, Chennai, Tamil Nadu, India

I went through the book and found your unique presentation of clustering the points in fours or its multiple very interesting. This approach gives a bird's eye view of the various disciplines in cardiology and at the same time is presented in a simple and easy-to-remember format. I am sure that your book, with its comprehensive text, will serve as a practical guide in the field of cardiology for students and practitioners alike.

**Professor CS Bhaskaran** MD FRC PATH (LOND) FAMS
Vice Chancellor, University of Health Sciences, Vijayawada, Andhra Pradesh, India

……. I have gone through several of the chapters on different aspects in cardiology and I am much impressed with the presentation. You have chosen the title of the book in most appropriate manner by projecting the day-to-day problems that are encountered by a general practitioner dealing the cardiac ailments. The subject has been dealt extensively and in a simple manner with the presentation of differential points in Fours.

I am confident that this book will serve as a useful practical guide for not only general practitioners but also to other specialists. I once again congratulate you for the excellent work you have done in bringing out this book.

**Professor BM Hegde** MD FRCP (Lond) FRCP (Edin) FRCP (Glasg) FRCP (Dublin) FACC
Vice Chancellor, Manipal Academy of Higher Education (Deemed University), Manipal, Karnataka, India

Your book is an excellent compilation of present knowledge in the field of heart diseases.

This would be a ready reckoner for students preparing for the examinations and also practicing doctors dealing with cardiovascular problems.

I hope that in the next edition you would give a very strong Indian bias to the text.

I wish your book all success.

**Book Review**
**JIMA (Journal of the Indian Medical Association)—Volume 94, Number 9, September 1996**

…….This is a good manual with a practical bedside approach. Particularly the tips on clinical cardiology are going to be helpful for aspiring general practitioners with a cardiological bias as many will desire benefit from indexed approach. I am sure it will gain acceptance from those for whom it is intended….. Mantosh Panja

**AP Journal of Practical Paediatrics—Volume 5, Number 2, April to June 1997**

**….**This unique book on cardiology *Heart in Fours* has probably evolved from the fact that it is easier to recall to memory a topic, which is systematically read and registered in our mind. The author has utilized the number "four" in an obsessive style and has approached the relevant topics in clinical cardiology from congenital heart disease to coronary artery disease in a rather simplified manner. Other topics relating to diagnostic and therapeutic cardiology have also been included in similar vein. Though this book is not recommended as regular textbook, it will serve as 'ready reckoner' for the students especially preparing for their practical and viva. The practical aspects of the book is also a good reference for general practitioners.

## Review on Second Edition

**JIMA (Journal of the Indian Medical Association)—Volume 101, Number 08, August 2003, Page 1999**

It is a great pleasure to see that the second edition of *Heart in Fours*: *Cardiology for Students and Practitioners* has been published. It reflects the wide acceptance of the first edition of the book to the readers, for whom the book has been prepared with meticulous efforts and utmost care. The author has expressed his own realization and experience rather than just compiling information from several textbooks.

The book is really an example of the simplest way of presentation of a tough subject in the face of rapid advances in the field. However, there is scope of improving the book in certain places.

……..

……

In spite of few limitations, the second edition of the book is excellent and I hope it will be very useful for the practitioners and the students in their day-to-day practice. This book will inspire consultants of cardiology for reproducing their assimilated knowledge in a different way—Mantosh Panja

# A Heart Functions in Health and Disease

**1. There are only 4 chambers in the heart.**

1. Right atrium
2. Left atrium
3. Right ventricle
4. Left ventricle

**2. There are only 4 valves in the heart.**

1. Mitral
2. Tricuspid
3. Aortic
4. Pulmonary

**3. There are only 4 heart sounds.**

1. 1st sound
2. 2nd sound
3. 3rd sound
4. 4th sound

**4. There are only 4 types of murmurs.**

1. Systolic
2. Diastolic
3. To and fro
4. Continuous

**5. There are 4 main causes of diseases affecting the heart.**

1. Congenital (Balyam—Childhood)
2. Rheumatic (Kaumaram—Adolescent age)
3. Hypertensive (Yavvanam—Middle age)
4. Ischemic (Vardhakyam—Old age)

Like 4 stages of man, Balyam, Kaumaram, Yavvanam and Vardhakym. There can be overlapping. Congenital heart diseases mainly affect the right side of the heart as the strain is more on the right side during intrauterine life. Acquired heart diseases mainly affect the left heart chambers as they are subjected to ten times the pressure compared to the right heart chambers since the left ventricle has to pump the blood into the greater circulation. Majority of chronic valvular diseases upto middle age are of rheumatic origin. Though rheumatic fever affects in childhood, the valvular affection is seen in young age. Hypertension commonly is the disease of middle age, and ischemic heart disease commonly is of old age.

**6. There are 4 steps in clinical examination.**

1. Inspection
2. Palpation
3. Percussion
4. Auscultation

**7. There are 4 main investigations.**

1. X-ray
2. ECG
3. Echocardiography
4. Cardiac catheterization

1, 2, 3, are noninvasive, 4 is an invasive procedure.

**8. There are 4 groups of drugs to treat heart diseases.**

1. Anticongestive (Digoxin and Diuretics)
2. Antihypertensive
3. Antiischemic
4. Antiarrhythmic

**9. There are 4 steps in the management of a disease.**

1. Etiology
2. Pathology
3. Diagnosis
4. Treatment

**10. There are 4 steps in clinical approach of cardiovascular system for correct and complete diagnosis.**

1. *First step:* Physiological disturbances.
   Recognize:
   i. Whether there is any overload or strain or hypertrophy?
   ii. Whether there is any heart failure?
   iii. Whether there is any arrhythmia?
   iv. Whether there is any myocardial infarction or ischemic changes?

   Recognise first whether there is any heart failure or not. Whatever may be the cause, the end result of cardiovascular disease may culminate in heart failure. More than 75% of cardiovascular diseases need management of heart failure. So, it is very essential

either for the general practitioner or specialist to recognize heart failure in the early stages so as to give the best results.

2. *Second step:* Physical anomalies if any.
   Recognize the anatomical abnormalities:
   i. Endocardium—Affection of the valve
   ii. Myocardium—Enlargement of chambers, Cardiomyopathies
   iii. Pericardium—Pericarditis
   iv. Vascular—Myocardial ischemia or infarction.

   These physical anomalies can be corrected in some cases by surgery. For example mitral stenosis, aortic stenosis, pulmonary stenosis, coarctation of aorta, constrictive pericarditis, coronary artery stenosis, etc.
3. *Third step:* Elicit the etiology; when it could be recognized in the early stage or in its acute (active) stage, something can be done to prevent the causative factor that leads to the heart failure. Most often, the etiological factor has already damaged the heart. Is it
   i. Congenital
   ii. Rheumatic
   iii. Hypertensive
   iv. Arteriosclerotic (Ischemic)
4. *Fourth step:* Elicit the extent of functional disability. The amount of strenuous activity required to elicit the symptoms helps in rehabilitation of the patient. Is he or she
   i. Not aware, no subjective symptoms
   ii. Unable to exert
   iii. Uncomfortable even at rest
   iv. Completely bedridden (impending death)
   (see New York Heart Association (NYHA) functional and objective classification E 52 and 53)

**11. Normal Heart.**

1. Heart is a mere fist-sized organ weighing around 350 g.
2. It is among the most powerful muscles in the body.
3. Every heart beat pumps blood through 1,50,000 km of vascular bed in the body against the 120 mm Hg pressure.
4. Beats 2,869,776,000 times over an average life span of 75 years.

**12. It seems to be marvel. If anything could go wrong?**

1. Congenital heart disease—defects since birth.
2. Acquired diseases—rheumatic heart disease where heart valves turn narrow or leak.
3. Coronary artery disease (CAD)/Ischemic heart diseases (IHD)—where heart muscle is deprived of oxygen.
4. Rhythm disorders—where heart rhythm is affected.

CAD/IHD has the highest morbidity and mortality of them.

**13. There are 4 important symptoms in the history.**

1. Dyspnea/Breathlessness
2. Precordial pain or distress
3. Palpitation
4. Symptoms of general venous congestion, e.g. swelling of feet, cough, digestive disturbance, etc.

One of the symptoms may come earlier than other and may be prominent than other symptom depending on the cause. For example—

Breathlessness is the main symptom wherever there is raise in pulmonary capillary pressure as in left ventricular failure, mitral stenosis, pulmonary hypertension, etc.

Pain is the main symptom of myocardial infarction or in any ischemic heart disease such as angina. (See Chapter E—IHD/CAD, Chapter F—AMI)

Palpitation is the main symptom in arrhythmias such as paroxysmal atrial tachycardia (PAT), premature ventricular beats, etc. (See Chapter D—Cardiac Arrhythmias)

Edema feet or symptoms of systemic venous congestion are prominent in right sided heart failure or in both left and right sided (combined) heart failure besides breathlessness. (See Chapter C—Heart Failure)

Other symptoms like syncope may be seen in diseases where the cardiac output is very less, e.g. aortic stenosis.

## DYSPNEA

**14. Dyspnea is defined as an abnormally uncomfortable awareness of breathing. It is one of the main symptoms of cardiac and pulmonary disease. Dyspnea is mainly due to the lung becoming stiff as blood accumulates in the pulmonary vasculature behind the failing ventricle. As a result, the work performed and the tension developed by the respiratory muscles increases which leads to the sensation described as breathlessness.**

The following terminology is used for describing various types of breathlessness.

**Table A-1**

| | |
|---|---|
| 1. Dyspnea | Uncomfortable breathing |
| 2. Tachypnea | Rapid breathing |
| 3. Hyperpnea | Increased ventilation due to increased metabolic needs |
| 4. Hyperventilation | Ventilation in excess of metabolic needs |
| 5. Platypnea | Dyspnea related to upright position |
| 6. Trepopnea | Dyspnea related to lateral position |
| 7. Orthopnea | Dyspnea related to supine position |
| 8. Paroxysmal nocturnal dyspnea | Dyspnea related to sleep—wakes up from sleep with shortness of breath |

**15. There are 4 grades of dyspnea.**

**Table A-2**

| *Grade* | *Degree of exertion* | *PVP (mm Hg)* |
|---|---|---|
| Grade I | Dyspnea on severe exertion | <12 (normal) |
| Grade II | Dyspnea on moderate exertion | 12–18 |
| Grade III | Dyspnea on mild exertion | 19–24 |
| Grade IV | Dyspnea at rest | >25 |

(PVP = Pulmonary venous pressure)

It is important to ask specially about nocturnal breathlessness which patients often forget to mention this.

It may be a symptom of cardiac failure although more commonly it is a symptom of bronchial asthma.

**16. The pattern of breathlessness associated with left ventricular failure can be described under 4 stages.**

1. Breathlessness on exertion.
2. Orthopnea: It is due to pulmonary congestion occurring as a result of redistribution of fluid from the periphery to the pulmonary circulation in recumbent position and also in part due to abdominal organs pushing on the diaphragm.
3. Paroxysmal nocturnal dyspnea (PND): It is associated with patient waking from sleep and fighting for breath. It is possibly due to venospasm of capacitance vessels during the REM (rapid eye movement) sleep causing blood to move to the pulmonary circulation from areas of pooling in the veins of the limbs and gut.
4. Acute pulmonary edema occurs when the hydrostatic pressure within the pulmonary capillaries rising to more than 25 mm Hg and is sufficiently greater than oncotic pressure exerted by the plasma proteins to cause marked interstitial edema and the accumulation of free fluid in the alveoli. The mucosal edema and bronchospasm give rise to wheeze.

Wheeze is due to narrowing of the airways due to mucosal edema and bronchospasm commonly seen in bronchial asthma.

The presence of orthopnea and paroxysmal nocturnal dyspnea (PND) strongly suggests pulmonary venous hypertension in contrast to other causes of dyspnea.

## Cheyne-Stokes Respiration

It is a disturbance of respiratory rhythm characterized by gradually increasing depth of respiration, till a maximum is attained then followed by gradually diminishing respiratory effort, until a pause of apnea occurs for few seconds to a minute to be followed again by another wave of gradually deepening and then diminishing. It is seen in severely ill patient with very low cardiac output due to heart failure. Neurologist commonly sees in cerebrovascular disease with increased intracranial pressure, narcotic drug poisoning. It is exaggerated when dozing, the hyperpneic phase causes cerebral stimulation to prevent sleep.

It causes insomnia in a patient with heart failure.

Also seen in renal failure, severe pneumonia, alkalosis, after severe vomiting.

Kussmaul's breathing: Deeping singing, rapid breathing at a regular rate should immediately suggest metabolic acidosis commonly seen in diabetic ketoacidosis or uremia.

**17. Dyspnea in supine position is due to following mechanism:**

1. Increased venous return
2. Increased end-diastolic volume of ventricles
3. Increased wall tension
4. Increased myocardial oxygen requirement

**18. Cardiac causes of dyspnea are:**

1. *Heart failure of any cause:* Start as dyspnea on exertion (DOE) followed by classic orthopnea, paroxysmal nocturnal dyspnea, cough and wheeze on exertion or on assuming supine position. Dyspnea precedes the cough
2. *Acute myocardial infarction:* It can present as acute shortness of breath (SOB) associated with chest pain.
3. *Ischemic heart disease:* Angina equivalent can present with shortness of breath instead of pain. Paroxysmal nocturnal dyspnea can occur with nocturnal angina with dyspnea as angina equivalent.
4. *Arrhythmias:* Dyspnea begins suddenly with or without palpitation.

Sudden development of dyspnea while sitting rather than lying or whenever a particular position is assumed, suggests the possibility of a myxoma or ball-valve thrombus. When dyspnea is relieved by squatting in children, the most common cause is 'tetralogy of Fallot'.

**19. Noncardiac causes of dyspnea are:**

1. Pulmonary disease or dysfunction
   a. Associated with much weight gain/obesity
   b. Bronchial asthma associated with cough and wheeze
   c. Chronic obstructive pulmonary disease (COPD): H/o chronic cough with sputum, smoking—easier to breath on bending forward
   Inspiratory dyspnea suggests obstruction of the upper airways whereas expiratory dyspnea suggests obstruction of the lower airways. Cough precedes the dyspnea.

   d. Pneumothorax—dyspnea at rest
   e. Pulmonary embolism—sudden onset associated with faintness or syncope, hemoptysis or pleuritic chest pain
   f. Pulmonary edema
   g. Post nasal discharge when attendant with severe cough
   h. Sleep apnea with arousal
2. Severe anemia
3. Compression of pulmonary artery or bronchi, e.g. lung tumor
4. Anxiety neurosis or unknown cause: H/o 'nervous breakdown'

Dyspnea associated with numbness, tingling, dizziness, pain at apex, cold perspiration or palpitations. This is suggestive of Da Costa's syndrome or neurocirculatory asthenia. It becomes worse when the patient is upset and is helped by sedatives/tranquilizers.

Dyspnea that occurs only at rest and is absent on exertion is almost always functional.

Dyspnea in patients with panic attacks is usually accompanied by hyperventilation.

**20. Whenever there is h/o paroxysmal nocturnal dyspnea (PND), the severity of left ventricular failure/left atrial pressure can be assessed by asking the following 4 questions.**

1. When did it first begin?
2. How frequent it is? (number of times per night, week, month or year)
3. Lowest and shortest time between attacks?
4. How it is relieved?

Dyspnea may begin within a minute of lying flat. It may appear whether the patient lies on the back, left side or right side. Sometimes, it appears when the patient slips of pillows accidentally. Usually, it takes about 2 to 4 hours for tissue fluid to fill the intravascular space enough to rise the left atrial pressure to a high level. If fluid accumulates rapidly the patient will be awaken within 2 to 4 hours and may have a recurrence in the same night. If fluid accumulates slowly, the patient may awake after 4 to 6 hours. It takes at least 10 to 30 minutes for fluid to be redistributed into the extravascular space.

The patient must dangle, get out of bed or take a rapid-acting nitrate. It is improved by digitalis or diuretics.

When there is cough—cough precedes the dyspnea in asthma, chronic obstructive pulmonary disease, bronchitis – with frothy or pink sputum.

**21. The paroxysmal nocturnal dyspnea may manifest by the following mechanisms:**

1. Absorption of edema fluid with increase in right ventricular output overfilling the lungs
2. Diminished sympathetic drive of sleep decreasing left ventricular contractility
3. Sleep induced dreams with the attendant increase in emotional activity with increased catecholamine release
4. Nocturnal arrhythmias

## Chest Pain

(*See Chapter E Table E-2 and Chapter F-15 to 18)

Chest pain can originate not only in heart but also in other intrathoracic organs, tissues of the thoracic wall and neck, and from subdiaphragmatic organs.

It is the main symptom in ischemic heart disease/coronary artery disease.

Several terms are used by the patient to describe the chest pain such as discomfort, squeezing, tightness, gripping, compression, burning, gases, acidity, uneasiness, inconvenient feeling, etc.

**22. There are 4 steps in evaluation of chest pain.**

1. First differentiate the cardiac from noncardiac causes. If the patient voluntarily points with one finger, it suggests non-anginal chest pain. If the patient shows with fist or sweeps across the chest, it is suggestive of angina.
2. If it is cardiac, is it due to
   a. Ischemic heart disease/coronary artery disease
   b. Hypertrophic cardiomyopathy
   c. Aortic stenosis
   d. Aortic dissection
   e. Mitral valve prolapse
   f. Pericarditis
3. If it is due to coronary artery disease, is it
   a. Stable angina
   b. Unstable angina
   c. Printzmetal angina
   d. Variant angina
   e. Acute myocardial infarction
4. If it is noncardiac, is it due to
   a. Pulmonary: Pneumothorax, pulmonary embolism, pluritis.
   b. Esophageal: Reflex esophagitis, acute esophageal tear.
   c. Chest wall: Osteoarthritis, osteochondritis, costochondritis
   d. Gastritis
   e. Pancreatitis
   f. Cholecystitis
   g. Herpes zoster
   h. Functional—anxiety/depression

**23. Table of differentiation between cardiac and noncardiac chest pain.**

**Table A-3**

| *Feature* | *Favoring ischemic origin (cardiac)* | *Against ischemic origin (noncardiac)* |
|---|---|---|
| 1. Site | Diffuse, substernal across mid-thorax anteriorly<br>In left arm, shoulders<br>In the left forearm, fingers<br>In the neck, lower jaw, teeth<br>Patient shows with fist or sweeps across the chest | Localized<br>left inframamary area,<br>left hemithorax<br>Patient points with one finger |
| 2. Nature | Chest discomfort, tightness, squeezing, crushing, choking, burning, heaviness, heavy feeling, pressing. Sudden onset with acute myocardial infarction, gradual onset with angina "I think I am going to die" particularly if the patient says with a clichéd fist placed over the sternum (LeVeen sign positive) | Dull ache<br>'Knife-like' sharp<br>Stabbing<br>Shooting |
| 3. Intensity | Mild to moderate with gradual fluctuation | Rapidly fluctuating |
| 4. Duration | Minutes to hours | less than 5 sec, split of a second |
| 5. Radiation | Left arm, left shoulder, medial side of the left forearm, little finger, lower jaw | No typical radiation |
| 6. Precipitating or provoking factors | Exercise, excitement,<br>Any stress<br>Cold weather or changing weather<br>After heavy meal<br>Sexual activity | Pain after completion of exercise<br>Specific body movement<br>Deep respiration, worse on inspiration with restriction of movement. The patient may "catch his breath", it implies the inflammation of the pleura and localizes the lesion |
| 7. Relieved by | Rest,<br>Nitroglycerin | Lengthy rest and most other measures–antacids for gastritis, analgesics for chest wall pain |
| 8. Accompanying symptoms | a. Related to loss of contracting myocardium and conducting tissue<br>Dyspnea, palpitation, syncope<br>b. Symptoms of autonomic excess<br>Sympathetic excess–Tachycardia, sweating<br>Parasympathetic excess–Bradycardia, vomiting | Hyperventilation |

## SYNCOPE

Syncope is a common medical problem that accounts for approximately 6% of medical admissions and 3% of causality room visits. Syncope is defined as a sudden transient loss of consciousness associated with decrease in cerebral blood flow and loss of postural tone. Recovery is spontaneous, without neurological deficits and without requiring electrical or chemical cardioversion.

Cerebral blood flow usually decreases with aging, making the elderly at higher risk for syncope.

Differentiating true syncope from other "nonsyncopal" conditions that cause loss of consciousness is important because the mechanism of syncope ranges from nearly normal (physiological) to abnormal and life-threatening.

**24. The patient describes syncope or faintness in several ways in his own terms as dizziness, loss of balance, light-headedness, blurred vision, sinking feeling, floating, unsteadiness, swaying, giddiness and vertigo. It results most commonly from reduced perfusion of the brain.**

Cardiac causes of syncope can be described under 4 groups.

1. *Acute myocardial infarction:* Massive AMI or myocardial infarction associated with arrhythmias. It is usually preceded by chest pain, dyspnea or palpitation. The patient is immediately taken to hospital with 'heart attack' diagnosis after. Cardiac syncope is associated with increased mortality and may lead to sudden death.
2. *Obstruction of flow through the heart:* Fixed aortic stenosis, pulmonary arterial hypertension, hypertrophic obstructive cardiomyopathy, Takayasu's arteritis mitral stenosis, etc. Aortic stenosis and mitral stenosis are most common.
   Atrial myxoma or ball-valve thrombus is suggested by embolic phenomena or dyspnea with change of posture.