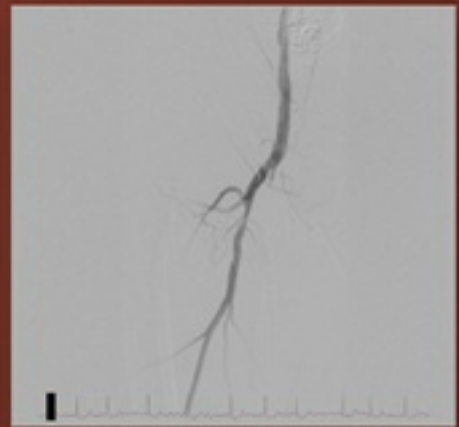
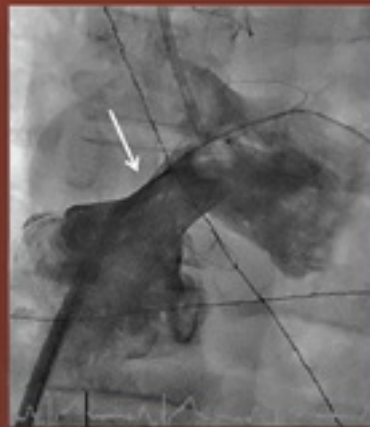
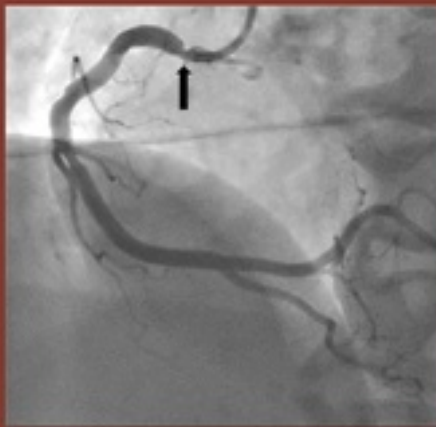


Interventional Cardiology

1133 Questions: An Interventional
Cardiology Board Review

THIRD EDITION



Debabrata Mukherjee | Richard A. Lange | Saurav Chatterjee
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“To interventional fellows and colleagues everywhere for their hard work and dedication to patient care; to my parents for their infinite patience, love, and understanding; and to Suchandra, for her love and support.”

—DEBABRATA MUKHERJEE

“To interventional fellows worldwide who will use this text to expand their knowledge and advance our field ... and to my parents, wife and sons who’ve taught me more about issues of the heart than any cardiology text.”

—RICHARD A. LANGE

“To my parents, my wife and my daughter—who inspire me to keep learning—and to my innumerable mentors over the years.”

—SAURAV CHATTERJEE

“With gratitude to the interventional fellows at Cleveland Clinic past, present, and future for their dedication and hard work.”

—LESLIE CHO

“To our chapter authors and interventional cardiology teachers worldwide; thoughtful questions and thorough answers will continue to advance the field and guide us all in contemporary medical practice.”

—DAVID J. MOLITERNO

Insightful questions have been used throughout the ages as a metric to assess one's knowledge, but when coupled with carefully delivered answers, they can become a powerful teaching tool. This book of questions and annotated answers covering the field of interventional cardiology is meant to serve as a helpful resource for individuals preparing for the interventional cardiovascular medicine board exam, as well as for clinicians who wish to perform an in-depth self-assessment on individual topics or the full spectrum of cardiovascular medicine. The book has many key features, which we believe will make the reader successful in passing the boards and improving clinical practice.

Of foremost importance, the areas covered are relevant not only to the day-to-day practice of interventional cardiology but have also been modified to fit the scope and content of the actual board examination. The book begins with several chapters dedicated to the anatomy and physiology associated with interventional cardiology and the pathobiology of atherosclerosis and inflammation. This corresponds to the 15% of the board examination, which targets material in the basic sciences. The subsequent chapters focus on the essential interventional pharmacotherapy of antiplatelets, anticoagulants, and other commonly used medications in the catheterization laboratory and outpatient setting for patients with atherosclerosis. These chapters correspond to the next 15% of the boards centering on pharmacology. A similar-sized 15% of the board examination is directed toward imaging; this book includes specific chapters on radiation safety, catheterization laboratory equipment and technique, contrast agents, and intravascular ultrasound. The two largest areas of the examination, each covering 25% of the content, include case selection management and procedural techniques. This review book dedicates several chapters to comprehensively cover these areas as well. Finally, we have included chapters for the miscellaneous remaining areas covered by the board examination, including peripheral vascular disease, cerebrovascular and structural heart interventions, ethics, statistics, and epidemiology, as well as a chapter directed at improving test-taking skills.

Also essential to the quality and appropriateness of the questions and annotated answers is the expertise of the chapter authors. We are fortunate to have assembled the "who's who" of academic interventional cardiology. The contributing authors from leading medical centers around the world have over 8,000 articles cited in PubMed. We are greatly indebted to these authors who are recognized both for their interventional expertise and for their teaching skills. In the end, the true value of this textbook is not only the relevance of the questions and the outstanding quality of the authors but also the value of the annotated answers. The text includes more than 1,000 questions and over 400 figures and tables. The corresponding answers have been appropriately detailed to provide relevant facts, information, and up-to-date journal citations.

The practice of interventional cardiology is exciting, rewarding, and a privilege each of us enjoys. Likewise, it has been our privilege to work with the superb contributors, our colleagues in interventional cardiology, and Ms. Nadia Whitehead at Texas Tech University Health Sciences Center El Paso and Ms. Mary Goodman at Wolters Kluwer for their editorial assistance. It is our personal hope that you will enjoy this book and that it will be a valuable resource to you in passing the board examination and providing the highest quality care possible to your patients

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ABBREVIATIONS

AAA	abdominal aortic aneurysm
ABI	ankle–brachial index
ABIM	American Board of Internal Medicine
ACAS	Asymptomatic Carotid Atherosclerosis Study
ACC	American College of Cardiology
ACCF	American College of Cardiology Foundation
ACE	angiotensin-converting enzyme
ACEI	angiotensin-converting enzyme inhibitor
ACGME	Accredited Council for Graduate Medical Education
ACLS	Advanced Cardiac Life Support
ACP	American College of Physicians
ACS	acute coronary syndrome
ACT	Acetylcysteine for Contrast-induced Nephropathy Trial
ACT	activated clotting time
ACUITY	Acute Catheterization and Urgent Intervention Triage strategy
AD	advance directive
ADP	adenosine diphosphate
AHA	American Heart Association
AIVR	accelerated idioventricular rhythm
AL	Amplatz left
ALARA	as low as reasonably achievable
ALI	acute limb ischemia
AMI	acute myocardial infarction
ANA	antinuclear antibody
ApoE	apolipoprotein E
aPTT	activated partial thromboplastin time
APV	average peak velocity
AR	Amplatz right

ARC	Academic Research Consortium
ARFD	acute renal failure requiring dialysis
ART	allRight™
AS	aortic stenosis
ASA	acetylsalicylic acid
ASD	atrial septal defect
ATP III	Adult Treatment Panel III
AV	atrioventricular
AVM	arteriovenous malformation
AVR	aortic valve replacement
AYMYDA	atorvastatin for reduction of myocardial damage during angioplasty
BARI	bypass versus angioplasty revascularization investigation
BE	balloon expandable
BMI	body mass index
BMS	bare-metal stent
BNP	brain natriuretic peptide
BP	blood pressure
BSA	body surface area
BVS	bioresorbable vascular scaffold
CABG	coronary artery bypass graft
CAD	coronary artery disease
cAMP	cyclic adenosine monophosphate
CAS	carotid artery stenting
CBC	complete blood count
CCA	common carotid artery
CCD	charge-coupled device
CCS	Canadian Cardiovascular Society
CCU	coronary care unit
CEA	carotid endarterectomy
CFR	coronary flow reserve
CHD	coronary heart disease
CHF	congestive heart failure
CI	confidence interval

CKD	chronic kidney disease
CK-MB	creatine kinase-MB
CME	continuing medical education
CMR	cardiovascular magnetic resonance
CNS	central nervous system
CO	cardiac output
COPD	chronic obstructive pulmonary disease
COX	cyclooxygenase
CPO	cardiac power output
CREDO	clopidogrel for the reduction of events during observation
CREST	Carotid Revascularization Endarterectomy versus Stenting Trial
CRP	C-reactive protein
CSA	cross-sectional area
CT	computed tomography
CTA	computed tomography angiography
cTFC	corrected TIMI frame count
CTO	chronic total occlusion
CVA	cerebrovascular accident
CVD	comorbid cardiovascular disease
2D	two-dimensional
D2B	door-to-balloon
DAP	dose area product
DAPT	dual antiplatelet therapy
DCA	directional coronary atherectomy
DES	drug-eluting stent
DM	diabetes mellitus
DNA	deoxyribonucleic acid
DNR	do not resuscitate
DREAM	Dutch Endovascular Aneurysm Management
DSA	digital subtraction angiography
DVT	deep vein thrombosis
EAST	Emory Angioplasty versus Surgery Trial
EBU	extra back-up

ECA	external carotid artery
ECG	electrocardiogram
ECST	European Carotid Surgery Trial
ED	emergency department
EDRF	endothelial-derived relaxing factor
EEM	external elastic media
EEOC	Equal Employment Opportunity Commission
EES	everolimus-eluting stent
EF	ejection fraction
EKG	electrocardiogram
EMERALD	enhanced myocardial efficacy and recovery by aspiration of liberated debris
EMS	emergency medical services
EP	electrophysiologic
EPC	endothelial progenitor cell
EPD	emboli protection device
ER	emergency room
ERBAC	excimer laser, rotational atherectomy, and balloon angioplasty comparison
ESSENCE	efficacy and safety of subcutaneous enoxaparin in non-q-wave coronary events
EVAR	endovascular aneurysm repair
FDA	Food and Drug Administration
FFR	fractional flow reserve
FIRE	FilterWire EX Randomized Evaluation
FMD	fibromuscular dysplasia
FPS	frames per second
Fr	French
GERD	gastroesophageal reflux disease
GFR	glomerular filtration rate
GIK	glucose–insulin–potassium
GP	glycoprotein
GPI	glycoprotein IIb/IIIa inhibitor
GRACE	Global Registry of Acute Coronary Events
Gy	gray
HCM	hypertrophic cardiomyopathy

HDL	high-density lipoprotein
HF	heart failure
HIT	heparin-induced thrombocytopenia
HMG-CoA	hydroxymethylglutaryl coenzyme A
HORIZONS	Harmonizing Outcomes with Revascularization and Stents in Acute Myocardial Infarction
HPS	Heart Protection Study
HR	hazard ratio
HR	heart rate
HS	hockey stick
HTN	hypertension
IABP	intra-aortic balloon pump
IC	intracoronary
ICA	internal carotid artery
ICAM	intercellular cell adhesion molecule
ICD	implantable cardioverter defibrillator
ICE	intracardiac echocardiography
ICU	intensive care unit
IgE	immunoglobulin E
IL	interleukin
IM	internal mammary
IMA	inferior mesenteric artery
IMA	internal mammary artery
IPA	inhibition of platelet aggregation
IRA	infarct-related artery
IRB	Institutional Review Board
ITT	intention-to-treat
IV	intravenous
IVC	inferior vena cava
IVUS	intravascular ultrasound
J	joule
JL	Judkins left
JR	Judkins right
KERMA	kinetic energy released to matter

keV	kiloelectron volt
kg	kilogram
kVp	peak kilovoltage
LA	left atrium
LAD	left anterior descending
LAD	leukocyte adhesion deficiency
LAO	left anterior oblique
LBBB	left bundle-branch block
LCB	left coronary bypass or left graft seeker
LCx	left circumflex
LDH	lactate dehydrogenase
LDL	low-density lipoprotein
LDL-C	low-density lipoprotein cholesterol
LIMA	left internal mammary artery
LM	left main
LMCA	left main coronary artery
LMT	left main trunk
LSVC	left-sided vena cava
LTA	light transmission aggregometry
LV	Left ventricular
LVEDP	left ventricular end-diastolic pressure
LVEF	left ventricular ejection fraction
LVH	left ventricular hypertrophy
LVOT	left ventricular outflow tract
mA	milliampere
MA	malignant arrhythmias
MACE	major adverse cardiac events
MAP	mean arterial pressure
MBG	myocardial blush grade
MCA	middle cerebral artery
MCE	myocardial contrast echocardiography
MDR	multidrug resistance
MERLIN	Middlesbrough Early Revascularization to Limit Infarction

mg	milligram
mGy	milligray
MI	myocardial infarction
mL	milliliter
MLA	minimum lumen area
MLD	minimal lumen diameter
mm	millimeter
MONA	morphine, oxygen, nitroglycerin, and aspirin
MP	multipurpose
MPA	maximal platelet aggregation
MR	mitral regurgitation
MRA	magnetic resonance angiography
MS	mitral stenosis
mSv	millisievert
MVD	multivessel disease
MVP	mitral valve leaflet prolapse
NASCET	North American Symptomatic Carotid Endarterectomy Trial
NCEP	National Cholesterol Education Program
ng	nanogram
NNT	number needed to treat
NO	nitric oxide
NPH	neutral protamine Hagedorn
NSAID	nonsteroidal anti-inflammatory drug
NSTEMI	non–ST-segment elevation myocardial infarction
NSVT	nonsustained ventricular tachycardia
NTG	nitroglycerine
NTR	no-torque right
NYHA	New York Heart Association
OCT	optical coherence tomography
OM	obtuse marginal
OR	odds ratio
PA	plasminogen activator
PA	pulmonary arterial