CAMBRIDGE

Cambridge University Press
978-1-108-85048-3 — Ultrasound for the Generalist with Online Resource
Edited by Sarb Clare , Chris Duncan
Frontmatter
More Information

Ultrasound for the Generalist

© in this web service Cambridge University Press www.cambridge.org

CAMBRIDGE

Cambridge University Press
978-1-108-85048-3 — Ultrasound for the Generalist with Online Resource
Edited by Sarb Clare , Chris Duncan
Frontmatter
More Information

Ultrasound for the Generalist

A Guide to Point-of-Care Imaging

Edited by

Dr Sarb Clare

Consultant Acute Medicine, Deputy Medical Director, Sandwell and West Birmingham Hospitals NHS Trust, United Kingdom.

Dr Chris Duncan

Specialist Registrar in Intensive Care Medicine, London, United Kingdom.

CAMBRIDGE UNIVERSITY PRESS

© in this web service Cambridge University Press www.cambridge.org

CAMBRIDGE

Cambridge University Press
978-1-108-85048-3 — Ultrasound for the Generalist with Online Resource
Edited by Sarb Clare , Chris Duncan
Frontmatter
More Information

CAMBRIDGE
UNIVERSITY PRESS

University Printing House, Cambridge CB2 8BS, United Kingdom

One Liberty Plaza, 20th Floor, New York, NY 10006, USA

477 Williamstown Road, Port Melbourne, VIC 3207, Australia

314–321, 3rd Floor, Plot 3, Splendor Forum, Jasola District Centre,
New Delhi – 110025, India

103 Penang Road, #05–06/07, Visioncrest Commercial, Singapore 238467

Cambridge University Press is part of the University of Cambridge.

It furthers the University's mission by disseminating knowledge in the pursuit of education, learning, and research at the highest international levels of excellence.

www.cambridge.org
Information on this title: www.cambridge.org/9781108850483
DOI: 10.1017/9781108850476

© Cambridge University Press 2022

This publication is in copyright. Subject to statutory exception and to the provisions of relevant collective licensing agreements, no reproduction of any part may take place without the written permission of Cambridge University Press.

First published 2022

Printed in the United Kingdom by TJ Books Limited, Padstow Cornwall

A catalogue record for this publication is available from the British Library.

Library of Congress Cataloging-in-Publication Data
Names: Clare, Sarb, Dr., editor. | Duncan, Chris, Dr., editor.
Title: Ultrasound for the generalist : a guide to point of care imaging / edited by Sarb Clare, Chris Duncan.
Description: Cambridge, United Kingdom : New York, NY : Cambridge University Press, 2022. | Includes bibliographical references and index.
Identifiers: LCCN 2021019839 (print) | LCCN 2021019840 (ebook) | ISBN 9781108850476 (epub) | ISBN 9781108797078 (paperback)
Subjects: | MESH: Ultrasonography–instrumentation | Ultrasonography–methods | Point–of–Care Systems
Classification: LCC RC78.7.U4 (ebook) | LCC RC78.7.U4 (print) | NLM WN 208 | DDC 616.07/543–dc23
LC record available at https://lccn.loc.gov/2021019839

ISBN 978-1-108-79707-8 Paperback
ISBN 978-1-108-85047-6 Cambridge Core
ISBN 978-1-108-85048-3 Print/Online bundle

Cambridge University Press has no responsibility for the persistence or accuracy of URLs for external or third-party internet websites referred to in this publication and does not guarantee that any content on such websites is, or will remain, accurate or appropriate.

Every effort has been made in preparing this book to provide accurate and up-to-date information that is in accord with accepted standards and practice at the time of publication. Although case histories are drawn from actual cases, every effort has been made to disguise the identities of the individuals involved. Nevertheless, the authors, editors, and publishers can make no warranties that the information contained herein is totally free from error, not least because clinical standards are constantly changing through research and regulation. The authors, editors, and publishers therefore disclaim all liability for direct or consequential damages resulting from the use of material contained in this book. Readers are strongly advised to pay careful attention to information provided by the manufacturer of any drugs or equipment that they plan to use.

© in this web service Cambridge University Press www.cambridge.org

CAMBRIDGE

Cambridge University Press
978-1-108-85048-3 — Ultrasound for the Generalist with Online Resource
Edited by Sarb Clare , Chris Duncan
Frontmatter
More Information

Contents

Digital media accompanying book can be accessed online via the code printed on the inside of the cover

© in this web service Cambridge University Press www.cambridge.org

CAMBRIDGE
Cambridge University Press
978-1-108-85048-3 — Ultrasound for the Generalist with Online Resource
Edited by Sarb Clare , Chris Duncan
Frontmatter
More Information

Foreword

It is a pleasure and a privilege to write a foreword and contribute to this unique ultrasound field book. From the clinician just starting out on their point-of-care ultrasound (POCUS) journey to those who are already established and well advanced, this book will prove to be an invaluable companion. The increasingly recognised value of POCUS for all clinical decision-making means that this book will appeal to General Practitioners, Family Medicine Physicians, Emergency, Acute and Critical Care Physicians, Paramedics and Prehospital Practitioners, Physiotherapists, Podiatrists and Advanced Nurse Practitioners.

Ultrasound for the Generalist – A Guide to Point-of-Care Imaging provides you with the knowledge and skills to learn the basics and progress to develop more advanced skills. You will understand how ultrasound images are created, how to acquire and interpret them for each organ and to apply them in your daily work. You will learn what is normal and what is abnormal in the context of real cases and appreciate the importance of quality assurance, limitations and accreditation. The combination of digital media and case descriptions brings this book alive and will inspire you to reach for the scanner. This is an ideal book to take out with you in your field of clinical work as a real-time reference guide.

Ultrasound for the Generalist definitely addresses the needs of the generalist as it covers a wide range of organ systems where POCUS informs management decisions. Chapters range from thoracic ultrasound and echocardiography through to gynaecological and musculoskeletal ultrasound and considers new care settings where even experienced POCUS users may not have seen ultrasound at the bedside. The coverage of remote and austere medicine, including prehospital, military and humanitarian medicine, highlights the essential diagnostic role of POCUS in resource-limited settings.

As a senior clinician, POCUS has enabled me to deliver and practice the best clinical medicine of my career. It has empowered me with a skill that provides prompt and accurate information to make decisions wherever I see patients – in the home, care home or in the hospital. It has been a complete 'game changer' in my day-to-day practice as I have been able to deliver more acute care within community settings. This has been critical for the development of Acute Hospital at Home so that patients and families have a more credible choice over where they would like to be treated during an acute illness. POCUS is now a routine part of my assessment of patients.

I have worked alongside the authors Dr Sarb Clare and Dr Chris Duncan for a number of years and am really proud to have them as my colleagues. Their dedication, clinical expertise and passion for POCUS is inspirational and contagious. All clinical cases within this book are original and display the extensive experience of the authors and contributors.

I highly recommend this very special book for all generalists. It is beautifully written for the learner and easy to follow with fantastic illustrations, scans, photos and digital media. This indispensable text will allow you to acquire and apply this increasingly critical skill to provide the highest quality of care to all patients you see and in whatever setting you see them.

Professor Dan Lasserson
MA MD MRCGP FRCP Edin
Professor of Acute Ambulatory Care, Warwick University
Clinical Lead, Hospital at Home, Oxford University Hospitals NHS Foundation Trust, UK
Twitter @DanLasserson
2021

© in this web service Cambridge University Press www.cambridge.org

CAMBRIDGE

Cambridge University Press
978-1-108-85048-3 — Ultrasound for the Generalist with Online Resource
Edited by Sarb Clare , Chris Duncan
Frontmatter
More Information

Preface

Point-of-care ultrasound (POCUS) has become an essential tool within acute specialties to enhance bedside diagnostics, facilitate safe interventional procedures and guide referral to specialist services. It is vital for this tool to be expanded to community and prehospital settings where access to definitive investigations is limited. With the evolution of technology, ultrasound is becoming increasingly available due to reducing costs, machine size and remote image review for quality assurance purposes. This skill is invaluable for clinicians at all levels of training from medical school through to consultancy and allied healthcare professionals in any discipline.

With extensive experience using POCUS and seeing the uncountable benefits from swift diagnoses, streamlining the patient journey, carrying out safe procedures and ultimately saving lives, we are both hugely passionate about sharing this skill with all generalist colleagues. We were inspired to write *Ultrasound for the Generalist – A Guide to Point-of-Care Imaging* to provide a field handbook with the fundamentals and foundation of knowledge for clinicians to apply to whatever their normal practice may be.

It is only once you start using ultrasound in day-to-day practice that you will see and appreciate its true utility. US is a simple skill to acquire and yet it confers huge benefits for patients. It will enhance your clinical decision-making and identify pathology you would previously wait days or weeks to confirm. We are very keen to hear from you when you scan the cardinal case where ultrasound makes the difference!

This book will teach you how to use the machine, acquire images, recognise key anatomical landmarks and the appearance of pathology. You will learn to scan all systems and how to achieve competency and accreditation. It starts with the basics and progresses beyond conventional POCUS accreditation pathways. We have complemented the chapters with examples from our extensive library of real-life patient cases.

Key areas of inclusion are the application of US within 'Hospital at Home', Palliative Care, Soft tissue and Musculoskeletal, COVID-19 and Remote, Austere, Military and Humanitarian medicine. US does not 'belong' to any one specialty and clinicians should identify and incorporate the techniques applicable to their daily practice.

We would like to thank all our mentors and the POCUS enthusiasts championing this skill. A massive thanks to our contributing authors and the publishers at Cambridge University Press, in particular Catherine Barnes and Kim Ingram, for believing in us and our vision. Final thanks to our family and friends for their relentless support!

Enjoy the read and please spread the Power of POCUS!

Dr Sarb Clare and Dr Chris Duncan
2021
www.GeneralistUltrasound.com

This book provides access to an online version on Cambridge Core, which can be accessed via the code printed on the inside of the cover.

© in this web service Cambridge University Press www.cambridge.org

CAMBRIDGE

Cambridge University Press
978-1-108-85048-3 — Ultrasound for the Generalist with Online Resource
Edited by Sarb Clare , Chris Duncan
Frontmatter
More Information

Abbreviations

A2C apical two-chamber view

A3C apical three-chamber view

A4C apical four-chamber view

A5C apical five-chamber view

AAA abdominal aortic aneurysm

ACA anterior cerebral artery

AF atrial fibrillation

AFB acid fast bacilli

AIM acute internal medicine

ALI acute lung injury

AMVL anterior mitral valve leaflet

Ao aorta

AP anterior-posterior

AMS acute mountain sickness

AR aortic regurgitation

ARDS acute respiratory distress syndrome

ARVC arrhythmogenic right ventricular cardiomyopathy

AS aortic stenosis

ASD atrial septal defect

ASE American Society of Echocardiography

ATT anti tubercular treatment

AV aortic valve

AXR abdominal X-ray

BLUE basic lung ultrasound examination

BP blood pressure

BSE British Society Of Echocardiography

CAP community-acquired pneumonia

CBD common bile duct

CFM colour flow mode

CKD chronic kidney disease

CO cardiac output

COPD chronic pulmonary obstructive disease

CPAP continuous positive airway pressure

CPD continual professional development

CPR cardiopulmonary resuscitation

CRP C-reactive protein

CRL crown rump length

CT computed tomography

CTPA computed tomography pulmonary angiogram

CW continuous wave

CWD continuous wave Doppler

CXR chest X-ray

dBs decibels

DC direct current

DCM dilated cardiomyopathy

DCS decompression stress

DICOM digital imaging and communications in medicine

DVT deep vein thrombosis

EBV Epstein–Barr virus

ECG electrocardiogram

Echo echocardiogram

ECMO extracorporeal membrane oxygenation

ED emergency department

EF ejection fraction

EM emergency medicine

© in this web service Cambridge University Press www.cambridge.org

CAMBRIDGE
Cambridge University Press
978-1-108-85048-3 — Ultrasound for the Generalist with Online Resource
Edited by Sarb Clare , Chris Duncan
Frontmatter
More Information

ESR erythrocyte sedimentation rate

EtCO2 end tidal carbon dioxide

ETT endotracheal tube

FAC fractional area change

FASH focused assessment sonography HIV-associated tuberculosis

FAST focused assessment with sonography in trauma

e-FAST extended focused assessment with sonography in trauma

FB foreign body

FH frank hypovolaemia

FUSIC focused intensive care echocardiography

GB gallbladder

GCA giant cell arteritis

GCS Glasgow Coma Scale

GP general practitioner

HACE high altitude cerebral oedema

HAPE high altitude pulmonary oedema

HAPH high altitude pulmonary hypertension

HCG human chorionic gonadotropin

HCM hypertrophic obstructive cardiomyopathy

HIV human immunodeficiency virus

HPB hepatobiliary

HRCT high resolution computed tomography

HTN hypertension

Hz Hertz

IAS interatrial septum

ICD intercostal drain

ICP intracranial pressure

ICU intensive care unit

IIH idiopathic intracranial hypertension

ITU intensive therapy unit

IVC inferior vena cava

IV intravenous

IVDU intravenous drug user

IVS interventricular septum

IUD intrauterine device

IUP intrauterine pregnancy

IVF in vitro fertilisation

IVSd interventricular septum diastole

JVP jugular venous pressure

KHz Kilohertz

LA left atrium

LBBB left bundle branch block

LP lumbar puncture

LUQ left upper quadrant

LUS lung ultrasound

LV left ventricle

LVAS left ventricular assist system

LVEDP left ventricular end diastolic pressure

LVIDd left ventricle internal diameter in diastole

LVIDs left ventricle internal diameter in systole

LVH left ventricular hypertrophy

LVNCC left ventricular non compaction cardiomyopathy

LVOT left ventricular outflow tract

LVOTO left ventricular outflow tract obstruction

LVPWd left ventricle posterior wall in diastole

m/s metres per second

MAPSE mitral annular plane systolic excursion

MCA middle cerebral artery

MDR TB multi drug resistant tuberculosis

MERT medical emergency response team

MHz Megahertz

MI myocardial infarction

M-Mode motion mode

MPA main pulmonary artery

MR mitral regurgitation

MRI magnetic resonance imaging

MS mitral stenosis

© in this web service Cambridge University Press www.cambridge.org

CAMBRIDGE

Cambridge University Press
978-1-108-85048-3 — Ultrasound for the Generalist with Online Resource
Edited by Sarb Clare , Chris Duncan
Frontmatter
More Information

Abbreviations

MSK musculoskeletal

MSKUS musculoskeletal ultrasound

MSSA methicillin susceptible staphylococcus aureus

MV mitral valve

NF necrotising fasciitis

NHS National Health Service

NICE National Institute of Clinical Excellence

NSTEMI non ST elevation myocardial infarction

NYHA New York Health Association

ON optic nerve

ONSD optic nerve sheath diameter

PA pulmonary artery

PACS picture archive and communication systems

PCA posterior cerebral artery

PCI percutaneous coronary intervention

PD power Doppler

PE pulmonary embolism

PEA pulseless electrical activity

PEEP positive end expiratory pressure

PG porcelain gallbladder

PHEM prehospital emergency medicine

PHT pulmonary hypertension

PHUS prehospital ultrasound

PIMS paediatric multisystem inflammatory syndrome

PLAPS posterolateral alveolar and/or pleural syndrome

PLAX parasternal long-axis view

PMVL posterior mitral valve leaflet

POCUS point-of-care ultrasound

POD Pouch of Douglas

PSAX parasternal short-axis view

PSS Paget-Schroetter syndrome

PV pulmonary valve

PW pulse wave

PWD pulse wave Doppler

QA quality assurance

RA right atrium

RBBB right bundle branch block

RCEM Royal College of Emergency Medicine

RCR Royal College of Radiologists

REBOA resuscitative endovascular balloon occlusion of the aorta

RHD rheumatic heart disease

ROSC return of spontaneous circulation

RUQ right upper quadrant

RV right ventricle

RVESA right ventricular end systolic area

RVID right ventricular internal dimension

RVOT right ventricular outflow tract

RWMA regional wall abnormalities

SAH subarachnoid haemorrhage

SAM systolic anterior motion

SBE subacute bacterial endocarditis

SC subcostal view

SFJ saphenofemoral junction

SLE systemic lupus erythematosus

SMA superior mesenteric artery

SOB shortness of breath

SS suprasternal view

STIs sexually transmitted infections

STEMI ST elevation myocardial infarction

SV stroke volume

TAB temporal artery biopsy

TAP transversus abdominis plane

TAPSE tricuspid annular plane systolic excursion

TAUS temporal artery ultrasound

TB tuberculosis

TCD transcranial Doppler

© in this web service Cambridge University Press www.cambridge.org

CAMBRIDGE

Cambridge University Press
978-1-108-85048-3 — Ultrasound for the Generalist with Online Resource
Edited by Sarb Clare , Chris Duncan
Frontmatter
More Information

TDI tissue Doppler imaging
THI tissue harmonic imaging
TGC time gain compensation
TOE transoesophageal echocardiography
TR tricuspid regurgitation
TTE transthoracic echocardiography
TV tricuspid valve
TVUS transvaginal ultrasound
UGRA ultrasound guided regional anaesthesia
US ultrasound
USS ultrasound scan
UTI urinary tract infection
VATS video assisted thoracoscopic surgery
VEXUS venous excess ultrasound
VGE venous gas emboli
V/Q ventilation and perfusion
VSD ventricular septum defect
VTE venous thromboembolism
VTI velocity time integral
VUJ vesicoureteric junction
WES wall echo shadow
WHO World Health Organization

© in this web service Cambridge University Press www.cambridge.org

CAMBRIDGE

Cambridge University Press
978-1-108-85048-3 — Ultrasound for the Generalist with Online Resource
Edited by Sarb Clare , Chris Duncan
Frontmatter
More Information

Editors and Contributing Authors

Editors and Lead Authors

Dr Sarb Clare MBE
Consultant Acute Medicine, Deputy Medical Director, Sandwell and West Birmingham Hospitals NHS Trust, United Kingdom.

Dr Chris Duncan
Specialist Registrar in Intensive Care Medicine, London, United Kingdom.

All ultrasound images and online videos are originals of Authors and Contributors unless otherwise stated.

Graphic design and image annotation by **Dr Chris Duncan**.

Contributors

Front cover artwork by **Miss Samantha Allwood**.

Mr Carl Bellamy
Medical Photographer, Sandwell and West Birmingham NHS Trust, United Kingdom.

Dr Jonathan Benham
Consultant Radiologist, Sandwell and West Birmingham NHS Trust, United Kingdom.

Miss Alice Corbett
Specialist Musculoskeletal Podiatrist, London, United Kingdom.

Dr Paramjeet Singh Deol
Consultant in Emergency Medicine and General Practitioner, Urgent Care General Practice Lead, Chelsea and Westminster Hospital, United Kingdom.

Dr Alex Hackney
Foundation Year Doctor, West Midlands, United Kingdom.

Dr Vesna Homar MD
General Practitioner and Consultant in Emergency Medicine, Ljubljana, Slovenia. Assistant Lecturer, Faculty of Medicine, University of Ljubljana.

Dr Sam Hutchings OBE
Surgeon Commander Royal Navy, Consultant in Intensive Care Medicine, Department of Military Anaesthesia and Critical Care, Royal Centre for Defence Medicine and King's College Hospital London.

Professor Daniel Lasserson
Professor of Ambulatory Care. University of Warwick, United Kingdom
Clinical Lead, Hospital At Home, Oxford University Hospital NHS Foundation Trust, United Kingdom.

Dr Catherine Lester
Consultant in Sports and Exercise Medicine, London, United Kingdom.

Dr Gaynor Prince
Consultant Emergency Physician, FACEM, DDU, Committee Member Emergency Medicine Ultrasound Group (EMUGs) New Zealand, ACEM and EMUGs Collaboration Working Group. World Extreme Medicine Faculty.

Mr Naveed Saeed
Consultant Echocardiographer, Sandwell and West Birmingham Hospitals NHS Trust, United Kingdom

Dr Maheshwari Srinivasan
Consultant Obstetrician and Gynaecologist, Sandwell and West Birmingham Hospitals NHS Trust, United Kingdom.

© in this web service Cambridge University Press www.cambridge.org