

Index

- A lines, 18, 74–5, 219–20, 225–6
 A mode, 13
 A2C view. *See* apical 2 chamber view
 A3C view. *See* apical 3 chamber view
 A4C view. *See* apical 4 chamber view
 A5C view. *See* apical 5 chamber view
 AAA. *See* abdominal aortic aneurysm
 abdominal aorta
 abdominal US of, 99–103
 anatomy of, 99
 abdominal aortic aneurysm (AAA), 99–103
 abdominal paracentesis, US guided, 110–11, 195–6
 abdominal ultrasound, 97, 126. *See also* focused assessment with sonography in trauma
 abdominal aorta on, 99–103
 appendicitis on, 121–2
 free fluid identification on, 105–12, 201
 general principles of, 97–8
 hepatobiliary system on, 117–21
 IVC on, 103–5
 liver on, 117–18, 122–6
 probe selection for, 97–8
 renal tract on, 112–17
 scanning methods for, 97–8, 100–5, 113, 117–18, 121–2
 small bowel obstruction on, 121, 195–6
 abscess
 liver, 123
 soft tissue US of, 143–5
 tubo-ovarian, 188
 absorption, 7
 ACA. *See* anterior cerebral artery
 accreditation. *See* training and accreditation
 acetabulum, 159
 Achilles tendon, 162–4
 acoustic enhancement, 17–18
 acoustic impedance, 5–7
 acoustic shadowing, 6, 18
 acromioclavicular joint, 153–4
 acute mountain sickness (AMS), 204–5
 acute respiratory distress syndrome (ARDS)
 COVID-19 with, 223–5
 LUS of, 84–5
 air
 acoustic impedance of, 7
 on LUS, 74–5
 propagation velocity through, 4–5
 air bronchograms, 76–7, 85–7
 all-in-one probes, 2, 11, 200
 altitude related illnesses, 203–5
 alveolar syndrome, 85–8
 Amazon jungle, foreign body removal in, 209–11
 ambient light, US considerations in, 212
 amplitude, sound, 4–5, 12–13
 AMS. *See* acute mountain sickness
 anechoic structures, 5–6
 aneurysm. *See* abdominal aortic aneurysm
 angle of incidence, 7
 ankle, MSKUS of, 162–7
 anterior cerebral artery (ACA), 176–7
 anterior consolidation, lung, 76–7, 95
 anterior talofibular ligament, 164–5
 aorta, 35–6. *See also* abdominal aorta
 aortic aneurysm. *See* abdominal aortic aneurysm
 aortic dissection
 abdominal US of, 99–100
 echo of, 65–7
 aortic regurgitation (AR), 50, 65–7
 aortic stenosis (AS), 49–50
 aortic valve (AV)
 A3C view, 34
 A5C view of, 33–4
 bicuspid, 215
 PLAX view of, 29–30
 PSAX view, 30–2
 apical 2 chamber (A2C) view, 34
 apical 3 chamber (A3C) view, 34
 apical 4 chamber (A4C) view, 32–3, 52–3
 apical 5 chamber (A5C) view, 33–4
 appendicitis, 121–2
 AR. *See* aortic regurgitation
 archive, image, 231–2
 ARDS. *See* acute respiratory distress syndrome
 arm. *See* upper limb
 arrhythmogenic right ventricular cardiomyopathy (ARVC), 49
 artefacts, 17–21. *See also specific artefacts and lung signs*
 lung signs, 68–9
 arterial access, US guided, 136–9, 225
 arteries, 127–8. *See also* vascular ultrasound
 ARVC. *See* arrhythmogenic right ventricular cardiomyopathy
 AS. *See* aortic stenosis
 ascites
 FAST of, 110–11
 US guided paracentesis of, 195–6
 asthma, 95
 atelectasis, lung, 85, 87, 224–5
 attenuation, 7
 augmentation technique, 131
 austere medicine. *See* remote, wilderness and austere medicine
 Australia, training and accreditation pathways in, 237–44
 AV. *See* aortic valve
 axial resolution, 5
 axillary vein, 133–6
 B lines
 COVID-19 with, 219–25, 229–30
 HAPE with, 204
 interstitial syndrome with, 82–5, 229–30
 as lung sign, 76
 as ring down artefact, 18–19
 subpleural consolidation with, 86
 B mode, 13
 backscatter, 7
 Baker's cyst, 148–9, 162
 bar code sign, 75
 basilic vein, 133–6
 bat wing sign, 72–3
 beam width artefact, 20
 biceps muscle, 154–5
 bicuspid aortic valve, 215
 biliary tree. *See* hepatobiliary system
 bladder
 abdominal US of, 114, 116–17
 FAST of, 107–9

Index

- bladder (cont.)
 Hospital at Home care for, 190–2
 transabdominal pelvic US of, 180–1
 bladder cancer, 117
 bladder residual volume, 116, 190–2
 blood vessels, 141–3. *See also* vascular ultrasound
 BLUE Protocol, 1–2, 69, 71–3
 bone
 acoustic impedance of, 6–7
 fractures on, 147
 propagation velocity through, 4–5
 US characteristics of, 141–3
 bowel ischaemia, 125–6
 brachial veins, 133–6
 brachiocephalic vein, 133–5
 brightness, image optimisation with, 21–3
 Butterfly IQ, 2, 11, 200
 calcaneofibular ligament, 164
 calculi, renal, 114–15
 calf complex, 162–3
 callipers, 24
 Canada, training and accreditation
 pathways in, 237–44
 capture, image, 24
 cardiac arrest
 focused echo in, 36–8
 prehospital echo in, 202
 cardiac masses, 63–5
 cardiac output (CO), 60–1
 cardiac tamponade, 50–5, 202
 cardiogenic pulmonary oedema, 82–4
 cardiopulmonary resuscitation (CPR),
 echo in, 36–8
 carotid artery, 134–5
 carpal tunnel syndrome, 156
 cartilage, US characteristics of, 141–3
 CBD. *See* common bile duct
 cellulitis, 143–4
 central venous access, US guided,
 136–9
 cerebral oedema, high altitude, 204–5
 cervix, 180–1
 CFM. *See* colour Doppler
 chest anatomy, 69–70
 chest X-ray (CXR), COVID-19
 appearance on, 217–18, 222–4,
 226, 229
 cholecystitis, 117–19
 choledocholithiasis, 119–20
 cholelithiasis, 118–19
 chronic kidney disease (CKD), 116
 chronic pulmonary obstructive disease
 (COPD), 95
 cirrhosis, 123
 CKD. *See* chronic kidney disease
 CO. *See* cardiac output
 cobblestone appearance, cellulitis,
 143–4
 cold temperatures, equipment
 maintenance and considerations
 in, 211
 collapsibility, IVC, 104–5
 Colles' fractures, 147
 colour Doppler (CFM), 15
 blood flow on, 127–8
 soft tissue and musculoskeletal US
 using, 140–1
 comet tail artefact, 18–19, 76, 82–5,
 219–21
 common bile duct (CBD), 117–20
 common extensor tendon, 154–6
 common flexor origin, 156
 complex effusions, 90–3
 compound imaging, 24, 140–1
 compression, probe, 14
 compression, sound, 4–5
 computed tomography (CT), COVID-
 19, 217–18, 226–8
 congenital heart disease, 214–15
 consolidation, lung, 76–8, 84–8, 91–2,
 95, 220–1, 224–5
 continual professional development
 (CPD), 234–5
 continuous wave (CW) Doppler, 17
 control panel, US machine, 8–9
 COPD. *See* chronic pulmonary
 obstructive disease
 Coronavirus disease 2019 (COVID-19),
 218–19, 230
 B lines in, 219–25, 229–30
 case spread of, 217–18
 clinical presentations of, 217
 consolidation in, 220–1, 224–5
 critical care for, 224–5
 CT of, 217–18, 226–8
 CXR of, 217–18, 222–4, 226, 229
 disease progression and
 management pathways in, 222–4
 echo of, 226–8
 general hospital experience with LUS
 use in, 221–2
 Hospital at Home care for, 191–3
 lobar pneumonia in, 222–3
 LUS progression of, 84–5, 217,
 219–26
 LUS scanning method for, 218–20
 myocarditis, 225–7
 patient categorisation by LUS scan
 in, 222
 pericardial effusion after, 227
 PIMS-TS, 229
 pleural effusions in, 221–2
 pleural line thickening in, 219–20
 POCUS role in, 201, 217, 221–5
 prehospital US of, 201
 pulmonary embolism and, 227–8
 pulmonary oedema differentiation
 from, 229–30
 recovery from, 225–6
 virus LUS changes compared to LUS
 changes of, 226
 corpus luteum cysts, 186
 COVID-19. *See* Coronavirus disease
 2019
 CPD. *See* continual professional
 development
 CPR. *See* cardiopulmonary
 resuscitation
 crown-rump length (CRL), 183–4
 CT. *See* computed tomography
 curtain sign, 80
 curvilinear probe, 9–10
 abdominal US using, 97–8
 LUS using, 68
 CW Doppler. *See* continuous wave
 Doppler
 CXR. *See* chest X-ray
 cysts
 Baker's, 148–9, 162
 ganglion, 146, 157
 labral, 152–3
 liver, 123–4
 ovarian, 186–7
 renal, 115–16
 sebaceous, 146
 DCM. *See* dilated cardiomyopathy
 decompression sickness, 206
 deep vein thrombosis (DVT), 127, 139
 lower limb assessment for, 128–33
 lymphoedema differentiation from,
 196–7
 remote, wilderness and austere
 medicine assessment of, 205–6
 upper limb assessment for, 133–6
 depth, image optimisation with, 21
 diaphragm
 FAST of, 105–7
 LUS of, 79–81
 diastolic dysfunction, 39
 Digital Imaging and Communications
 in Medicine (DICOM), 231–2
 dilated cardiomyopathy (DCM), 42–5
 disaster relief medicine. *See*
 humanitarian and disaster relief
 medicine
 display marker, 11–12
 distal biceps tendon, 154–5
 Doppler effect, 14–15
 double barrel shotgun, 120
 double decidual sac sign, 182–3
 DVT. *See* deep vein thrombosis
 dyspnoea
 BLUE Protocol for, 1–2, 69, 71–3

- remote, wilderness and austere medicine assessment of, 203–4
- early pregnancy ultrasound. *See* obstetric and gynaecological ultrasound
- ECG. *See* electrocardiogram
- Echo in Africa* project, 214–15
- echocardiography (echo), 67
- A2C view, 34
 - A3C view, 34
 - A4C view, 32–3, 52–3
 - A5C view, 33–4
 - of acute MR, 41–2
 - of aortic dissection, 65–7
 - of ARVC, 49
 - during cardiac arrest, 36–8
 - of cardiac masses, 63–5
 - of cardiac tamponade, 50–5
 - clinical questions answered by, 26
 - congenital heart disease detection on, 214–15
 - COVID-19 on, 226–8
 - of global LV dysfunction, 42–6
 - of HCM, 33–4, 46–8
 - heart block on, 193
 - of hypertension, 45–7
 - indications for, 26–7
 - of ischaemic LV dysfunction, 39–42
 - IVC view, 35–6
 - LV function assessment with, 38–9
 - of LV thrombus, 42–3
 - of LVH, 33–4, 45–8
 - of LVNCC, 48–9
 - modified parasternal windows, 30–1
 - normal useful reference ranges for, 67
 - of pericardial effusion, 50–5, 227
 - PLAX view, 29–30, 52–3, 56–7, 78
 - pleural and pericardial fluid on, 29–30, 52–3, 78
 - in post ROSC care, 37–8
 - post-MI assessment with, 39–43
 - prehospital, 202
 - of proximal septal hypertrophy, 46–7
 - PSAX view, 30–2, 52–3, 57–8
 - of pulmonary embolism, 56–9, 205–6
 - remote, wilderness and austere medicine use of, 204–6
 - rheumatic heart disease detection using, 214–15
 - of RV dilatation, 56–7, 59
 - RV function assessment with, 55–6
 - SC view, 34–5, 52, 54
 - scanning method for, 27–8
 - shock, hypovolaemia, fluid responsiveness and fluid overload assessment with, 59–63
 - SSN view, 35–6
 - of valvular heart disease, 49–51
 - of ventricular septal rupture, 41–3
 - windows used for, 28–9
- echogenicity, 5–7
- ectopic pregnancy, 110, 184–5
- edge shadowing, 20
- education. *See* training and accreditation
- EF. *See* ejection fraction
- e-FAST. *See* extended FAST
- ejection fraction (EF), 38–9, 46–7, 55–6
- elbow, MSKUS of, 154–6
- electrical alternans, 51–2
- electrocardiogram (ECG)
- in cardiac tamponade, 51–2
 - echo with, 27
 - heart block on, 193
 - in massive PE, 56–7
- emergency medicine, prehospital. *See* prehospital ultrasound
- empyema, 90–3
- end of life care. *See* palliative and end of life care
- endocarditis, 64–5
- endometrium, 180–1
- endotracheal intubation, 202
- epidermis, 141–3
- Europe, training and accreditation pathways in, 237–44
- extended FAST (e-FAST), 201
- extensor tendons, 157–8
- FAC. *See* fractional area change
- fallopian tubes, 188
- fascia, 141–3
- FASH. *See* focused assessment with sonography for HIV-associated tuberculosis
- FAST. *See* focused assessment with sonography in trauma
- fat
- acoustic impedance of, 7
 - propagation velocity through, 4–5
- fatty liver, 123
- FBs. *See* foreign bodies
- femoral acetabular impingement, 159
- femoral artery, DVT assessment in, 129–30
- femoral head, 159
- femoral nerve block, 208–10
- femoral vein, DVT assessment in, 129–33
- FH. *See* frank hypovolaemia
- fibroids, uterine, 185
- field of view, probe, 9
- flexor hallucis longus tendon, 166–7
- flexor tendons, 158
- fluid bronchograms, 76–7, 85–7
- fluid overload
- echo assessment of, 59–63
 - TTE assessment of, 213
- fluid responsiveness, echo assessment of, 59–63
- fluid tolerance, 60–1
- focus, image optimisation with, 23–4
- focused assessment with sonography for HIV-associated tuberculosis (FASH), 207
- focused assessment with sonography in trauma (FAST)
- abdominal free fluid identification on, 105–12, 201
 - ascites on, 110–11
 - extended, 201
 - general principles and scanning methods for, 105–9
 - protocol of, 109–10
 - rupture on, 110
- foetal pole, 183–4
- foot, MSKUS of, 162–7
- footprint, probe, 9
- foreign bodies (FBs)
- remote, wilderness and austere medicine, 206, 209–11
 - soft tissue US of, 148–9
- fractional area change (FAC), 55–6
- fractures
- soft tissue US of, 147
 - South Pole diagnosis and management of, 208–10
- frame rate, 13
- frank hypovolaemia (FH), 59–60
- free fluid
- abdominal, 105–12, 201
 - pelvic cavity, 181–5, 188–9
- freeze, image, 24
- frequency, 4–5, 7
- fundoscopy, 168–70
- gain, image optimisation with, 21–3
- gallbladder. *See* hepatobiliary system
- gallstones
- abdominal US of, 118–20
 - acoustic shadowing by, 6
- ganglion cysts
- dorsal wrist, 157
 - soft tissue US of, 146
- gastric perforation, 112
- GCA. *See* giant cell arteritis
- gel, US, 12, 70–1, 141, 169, 211
- gestational sac, 182–3
- gestational trophoblastic disease, 185
- giant cell arteritis (GCA), 174–6
- glenohumeral joint, 152–3
- gluteal medius tendinopathy, 159–60

Index

- governance, 231–2, 235. *See also* quality assurance
 education, training and continual professional development, 234–5
 equipment, 231
 image archive, 231–2
 image optimisation, 232–3
 reports, 233–4
 great saphenous vein, 129–32
 greater trochanteric pain syndrome, 159–60
 gynaecological ultrasound. *See* obstetric and gynaecological ultrasound
- HACE. *See* high altitude cerebral oedema
- haematocrit sign, 93–4
 haematoma, soft tissue US of, 147–8
 haemodynamics
 echo assessment of, 60–1
 TTE assessment of, 213
 haemopericardium, 201–2
 haemorrhage, FAST protocol for, 109–10
 haemorrhagic ovarian cysts, 187
 haemothorax
 e-FAST of, 201
 LUS of, 93–4
 halo sign, 174–5
 hamstring tendinopathy, 160
 hand, MSKUS of, 156–8
 hand-held probes, 2, 11, 200
 handlebar palsy, 157
 HAPE. *See* high altitude pulmonary oedema
 HAPH. *See* high altitude pulmonary hypertension
 happy hypoxia, 221–2
 HCM. *See* hypertrophic cardiomyopathy
 headache, 169–71, 173–6
 heart block, 193
 heart failure
 COVID-19, 225–7
 at high altitude, 204
 palliative and end of life care for, 196–8
 heart failure with preserved ejection fraction (HFpEF), 39
 hepatic artery, 117–18, 120
 hepatic veins
 abdominal US of, 123–5
 echo assessment of, 62–3
 flow within, 124–5
 hepatised lung, 77–8, 87
 hepatitis, 123
 hepatobiliary (HPB) system
 abdominal US of, 117–21
 cholecystitis of, 117–19
 choledocholithiasis of, 119–20
 cholelithiasis of, 118–19
 scanning method for, 117–18
 HFpEF. *See* heart failure with preserved ejection fraction
 high altitude cerebral oedema (HACE), 204–5
 high altitude pulmonary hypertension (HAPH), 204
 high altitude pulmonary oedema (HAPE), 204
 hip
 fracture diagnosis and management, 208–10
 MSKUS of, 159–61
 Hospital at Home, 190, 194
 COVID-19 case, 191–3
 heart block case, 193
 nephrotoxicity case, 190–2
 urinary retention case, 190–2
 hot temperatures, equipment maintenance and considerations in, 212
 HPB system. *See* hepatobiliary system
 humanitarian and disaster relief medicine, 200, 214–16
 humidity, equipment maintenance and considerations in, 212
 hydronephrosis, 112–15
 hydropneumothorax, 94
 hydrosalpinx, 188
 hyperechoic structures, 6
 hypertension, 45–7
 hypertrophic cardiomyopathy (HCM), 33–4, 46–8
 hypervolaemia, 61–3
 hypodermis, 141–3
 hypoechoic structures, 6
 hypovolaemia
 echo assessment of, 59–63
 TTE assessment of, 213
- ICP. *See* intracranial pressure
 idiopathic intracranial hypertension (IIH), 171, 173–4
 iliopsoas, 159
 iliotibial band, 161–3
 image
 acquisition of, 12–21
 generation of, 12–13
 optimisation of, 21–4, 232–3
 saving of, 24, 231–2
 imaging modes, 12–17
 imaging planes, 12
 India, training and accreditation pathways in, 237–44
 inferior vena cava (IVC)
 abdominal US of, 103–5
 anatomy of, 103–4
 in cardiac tamponade, 54
 echo view of, 35–6
 in frank hypovolaemia, 59–60
 in pulmonary embolism, 58–9
 right atrial pressure and, 62
 internal jugular vein, 133–5
 intersection syndrome, 157
 interstitial syndrome
 COVID-19, 191–3, 229–30
 LUS of, 76, 82–5, 191–3, 229–30
 intracranial pressure (ICP)
 papilloedema with raised, 168–71
 TCD estimation of, 178
 intracranial vasospasm, TCD of, 177–8
 intrauterine device (IUD), malposition or displacement of, 186
 intrauterine pregnancy (IUP), 182–4
 ischaemic LV dysfunction, 39–42
 ischaemic stroke, 177, 205
 ischial bursitis, 160–1
 isoechoic structures, 6
 IUD. *See* intrauterine device
 IUP. *See* intrauterine pregnancy
 IVC. *See* inferior vena cava
- jellyfish sign, 83–4, 88–9
 joints, US characteristics of, 141–3
- keyboard sign, 121, 195–6
 kidney
 abdominal US of, 112–17
 acoustic impedance of, 6–7
 anatomy of, 112–13
 cancer of, 116
 CKD of, 116
 cysts of, 115–16
 FAST of, 105–6
 Hospital at Home care for, 190–2
 hydronephrosis of, 112–15
 propagation velocity through, 4–5
 pyelonephritis of, 116
 renal calculi of, 114–15
 scanning methods for, 113
 knee, MSKUS of, 160–3
 knobology, 8–9
- LA. *See* left atrium
 labrum, 152–3
 lateral collateral ligament, 161–2
 lateral femoral cutaneous nerve, 159
 lateral meniscus, 161–3
 lawnmower scanning technique, 121, 121
 lawnmower technique, 69–71
 left atrial pressure, 62

- left atrium (LA)
 A4C view, 33
 PSAX view, 30–2
- left upper quadrant (LUQ), 105–8, 182–3
- left ventricle (LV)
 A2C view, 34
 A3C view, 34
 A4C view, 33
 echo assessment of function of, 38–9
 global dysfunction of, 42–6
 in hypovolaemia, 59–60
 ischaemic dysfunction of, 39–42
 PLAX view of, 29–30
 post-MI complications of, 39–43
 PSAX view, 30–2
 SC view, 34–5
 thrombus formation in, 42–3
- left ventricle end diastolic pressure (LVEDP), 62
- left ventricular assist system (LVAS), 127–8
- left ventricular hypertrophy (LVH), 33–4, 45–8
- left ventricular non-compaction cardiomyopathy (LVNCC), 48–9
- left ventricular outflow tract (LVOT), 33–4, 47–8
- leg. *See* lower limb
- leiomyoma, 185
- ligament, US characteristics of, 141–3
- Lindegaard Ratio, 177–8
- linear probe, 9–10
 LUS using, 68
 soft tissue and musculoskeletal US using, 140–1
 vascular US using, 127
- lipoma, 146
- liver. *See also* hepatobiliary system
 abdominal US of, 117–18, 122–6
 abscess of, 123
 acoustic impedance of, 7
 acute hepatitis of, 123
 cirrhosis of, 123
 cysts of, 123–4
 FAST of, 105–7
 fatty disease of, 123
 masses of, 123
 measurements of, 123
 propagation velocity through, 4–5
 vasculature of, 123–6
- lobar pneumonia, COVID-19 with, 222–3
- long axis, 12
- long COVID, 226
- long head of biceps tendon, 150–2
- lower limb
 DVT assessment in, 128–33
 MSKUS of, 159–67
 vascular anatomy of, 129–31
- lumbar puncture, US guided, 170–4
- lung cancer, 89–90
- lung hepatisation, 77–8, 87
- lung point, 75, 81–3
- lung pulse, 75, 81
- lung sliding
 in BLUE protocol, 72
 endotracheal intubation confirmation using, 202
 LUS sign of, 73–4, 219–20
 pneumothorax absence of, 75, 80–3, 201–2
 sea-shore sign of, 74
- lung ultrasound (LUS), 96
 A lines on, 18, 74–5, 219–20, 225–6
 alveolar syndrome on, 85–8
 anatomy seen on, 69–70
 asthma and COPD on, 95
 B lines and comet tails as lung sign on, 76
 basic views of, 68–9
 BLUE Protocol, 1–2, 69, 71–3
 consolidation on, 76–8, 84–8, 91–2, 95, 220–1, 224–5
 COVID-19 compared with pulmonary oedema on, 229–30
 COVID-19 hospital experiences with, 221–2
 COVID-19 progression on, 84–5, 217, 219–26
 COVID-19 role of, 201, 217, 221–5
 diaphragm on, 79–81
 heart block on, 193
 indications for, 68
 interstitial syndrome on, 76, 82–5, 191–3, 229–30
 lung point on, 75, 81–3
 normal lung on, 219–20
 pleural effusion on, 78–9, 83–4, 87–94, 221–2
 pleural fluid on, 78–9
 pleural line thickening and irregularity on, 79–80, 84–5, 219–20
 pneumothorax on, 75, 80–3, 201–2
 prehospital, 201–2
 probe selection for, 68
 pulmonary embolism on, 95
 quad sign on, 78–9
 remote, wilderness and austere medicine use of, 203–4
 rib shadows/bat wing sign on, 72–3
 scanning methods for, 69–73, 218–20
 sea-shore sign on, 74
 shred and tissue signs on, 76–8, 86–7
 signs interpreted in, 68–9
 sinusoid sign on, 78–9
 sliding sign on, 73–4, 219–20
 spine sign on, 78–9
 stratosphere sign/bar code sign on, 75
 thoracocentesis guidance by, 95
- LUQ. *See* left upper quadrant
- LUS. *See* lung ultrasound
- LV. *See* left ventricle
- LVAS. *See* left ventricular assist system
- LVEDP. *See* left ventricle end diastolic pressure
- LVH. *See* left ventricular hypertrophy
- LVNCC. *See* left ventricular non-compaction cardiomyopathy
- LVOT. *See* left ventricular outflow tract
- lymph nodes, US appearance of, 145–6
- lymphoedema, 196–7
- M mode, 13
 lung sliding in, 74
 PLAX view, 30
 PSAX view, 32
 sinusoid sign in, 78–9
 stratosphere sign/bar code sign in, 75
- machine. *See* ultrasound machine
- Malaysia, training and accreditation pathways in, 237–44
- MAPSE. *See* mitral annular plane of systolic excursion
- marker, probe and display, 11–12
- MCA. *See* middle cerebral artery
- McConnell's sign, 57
- measurements, image, 24
- mechanical ventilation, for COVID-19, 224–5
- medial collateral ligament, 161–2
- medial meniscus, 161–2
- median nerve, 156
- medium
 acoustic impedance of, 5–7
 propagation velocity through, 4–5
- metacarpophalangeal joints, 157–8
- metastatic lymph nodes, 145
- metatarsal phalangeal joints, 166–7
- MI. *See* myocardial infarction
- Mickey Mouse sign, 120, 129
- middle cerebral artery (MCA), 176–7
 infarct of, 205
 vasospasm of, 177–8
- military medicine, 200, 212–13, 216
- mirror image artefact, 19
- mitral annular plane of systolic excursion (MAPSE), 38–9
- mitral regurgitation (MR), 41–2, 49–51
- mitral stenosis (MS), 50–1

Index

- mitral valve (MV)
 A4C view, 33
 exaggerated inflow variability of, 54–5
 PLAX view of, 29–30
 PSAX view, 30–2
 rheumatic heart disease of, 215
 SC view, 34–5
 systolic anterior motion of, 47–8
 modes, imaging, 12–17
 modified parasternal windows, 30–1
 moisture, equipment maintenance and considerations in, 212
 molar pregnancy, 185
 Morison's pouch, 105–7, 184–5, 201
 MR. *See* mitral regurgitation
 MS. *See* mitral stenosis
 MSKUS. *See* musculoskeletal ultrasound
 Murphy's sign, 118–19
 muscle
 acoustic impedance of, 7
 propagation velocity through, 4–5
 US characteristics of, 141–3
 musculoskeletal ultrasound (MSKUS), 140, 149–50, 167
 beginner's approach to, 150
 of elbow, 154–6
 of foot and ankle, 162–7
 of hand and wrist, 156–8
 of hip, 159–61
 interventions using, 150
 of knee, 160–3
 normal anatomical structures on, 141–3
 probe selection for, 140–1
 remote, wilderness and austere medicine use of, 206
 scanning methods for, 140–2
 of shoulder, 150–4
 MV. *See* mitral valve
 myocardial infarction (MI)
 acute MR after, 41–2
 ischaemic LV dysfunction and RWMA's after, 39–42
 thrombus formation after, 42–3
 ventricular septal rupture after, 41–3
 myocarditis
 COVID-19, 225–7
 global LV dysfunction in, 42–6
 myometrium, 180–1
 necrotising fasciitis (NF), 145
 nephrotoxicity, 190–2
 nerves, US characteristics of, 141–3
 neurology, 168, 178–9. *See also* transcranial Doppler
 GCA, 174–6
 lumbar puncture, 170–4
 papilloedema, 168–71, 173–4
 remote, wilderness and austere medicine, 204–5
 scanning methods in, 169–73
 New Zealand, training and accreditation pathways in, 237–44
 NF. *See* necrotising fasciitis
 non-cardiogenic pulmonary oedema, 84–5
 obstetric and gynaecological (O&G) ultrasound, 180, 189
 ectopic pregnancy, 110, 184–5
 free fluid in pelvic cavity, 181–5, 188–9
 hydrosalpinx on, 188
 intrauterine pregnancy confirmation, 182–4
 IUD malposition or displacement on, 186
 molar pregnancy, 185
 ovarian cysts on, 186–7
 ovarian torsion, 187–8
 ovarian tumours on, 186–7
 pelvic anatomy on, 180–2
 PHUS in early pregnancy complications, 203
 PID on, 188–9
 scanning method for, 180–2
 tubo-ovarian abscess on, 188
 uterine fibroids (leiomyomas) on, 185
 obstructive airway disease, 95
 O&G ultrasound. *See* obstetric and gynaecological ultrasound
 ONSD. *See* optic nerve sheath diameter
 optic disc elevation, 169–71
 optic nerve sheath diameter (ONSD) in AMS and HACE, 204–5
 in papilloedema, 168–71
 organ rupture, 110–11
 orientation
 imaging planes, 12
 of probe and display markers, 11–12
 ovarian abscess, 188
 ovarian cysts, 186–7
 ovarian torsion, 187–8
 ovarian tumours, 186–7
 ovary, transabdominal pelvic US of, 180–2
 PA. *See* pulmonary artery
 paediatric multisystem inflammatory syndrome temporarily associated with COVID-19 (PIMS-TS), 229
 palliative and end of life care, 195, 199
 abdominal paracentesis, 195–6
 heart failure management, 196–8
 lymphoedema diagnosis, 196–7
 withdrawal of medical care, 197–8
 pandemic. *See* Coronavirus disease 2019
 papilloedema, 168–71, 173–4
 paracentesis, US guided, 110–11, 195–6
 parapneumonic effusions, 90–3
 parasternal long axis (PLAX) view, 29–30
 of pleural and pericardial fluid, 29–30, 52–3, 78
 of pulmonary embolism, 56–7
 parasternal short axis (PSAX) view, 30–2
 of pericardial effusion, 52–3
 of septal flattening, 57–8
 patella tendinopathy, 161–2
 patient details, 8
 PCA. *See* posterior cerebral artery
 PD. *See* power Doppler
 PE. *See* pulmonary embolism
 pectoralis major tendon, 150–1
 pelvic cavity
 free fluid in, 181–5, 188–9
 masses in, 186–7
 normal anatomy of, 180–2
 pelvic inflammatory disease (PID), 188–9
 pelvic views, FAST, 105–9
 pendulum peristalsis, 121, 195–6
 penetration, 7
 pericardial effusion
 echo of, 50–5, 227
 post COVID-19, 227
 pericardial fluid, 29–30, 52–3, 78
 pericardial tamponade. *See* cardiac tamponade
 period, 4–5
 peripheral nerve blockade, 206
 peripheral venous access, US guided, 136–9
 peroneus longus and brevis tendons, 164–5
 PG. *See* porcelain gallbladder
 phased array probe, 9–11
 echo using, 27
 PHUS. *See* prehospital ultrasound
 physics of ultrasound, 4
 production and characteristics of sound waves, 4–5
 tissue interactions with sound waves, 5–7
 PI. *See* pulsatility index
 PID. *See* pelvic inflammatory disease
 piezoelectric crystals, 4
 PIMS-TS. *See* paediatric multisystem inflammatory syndrome temporarily associated with COVID-19
 plankton sign, 91, 93–4
 plantar fasciopathy, 164–5

- PLAPS. *See* posterolateral alveolar and/or pleural syndromes
- PLAX view. *See* parasternal long axis view
- pleural effusion
 echo of, 52–3
 haemothorax, 93–4
 hydropneumothorax, 94
 LUS of, 78–9, 83–4, 87–94, 221–2
 parapneumonic effusions, complex effusions and empyema, 90–3
 size of, 88–90
- pleural fluid
 echo of, 29–30, 52–3, 78
 LUS of, 78–9
- pleural line thickening, 79–80, 84–5, 219–20
- pleural sliding. *See* lung sliding
- pneumonia. *See also* parapneumonic effusions
 COVID-19 with, 222–3
 LUS of, 77–8, 85–8
 South Pole diagnosis of, 207–9
- pneumonitis, COVID-19, 229–30
- pneumothorax. *See also*
 hydropneumothorax
 e-FAST of, 201
 LUS of, 75, 80–3, 201–2
 stratosphere sign/bar code sign in, 75
- POCUS. *See* point of care ultrasound
- POD. *See* Pouch of Douglas
- point of care ultrasound (POCUS), 1, 3.
See also specific topics benefits of, 1
 COVID-19 role of, 201, 217, 221–5
 ease of training in, 2
 evidence base for, 1–2
 as mandatory skill for generalists, 2–3
 momentum behind, 2
- polycystic kidney disease, 115–16
- polycystic liver disease, 123–4
- popliteal vein, DVT assessment in, 129–33
- porcelain gallbladder (PG), 118–19
- portable ultrasound machines, 1–2, 11, 200, 203, 213–14
- portal hypertension, 124–5
- portal veins
 abdominal US of, 117–18, 120, 123–6
 echo assessment of, 62–3
 flow within, 124–6
- post disaster medicine. *See*
 humanitarian and disaster relief medicine
- posterior cerebral artery (PCA), 176–7
- posterior interosseous nerve, 154
- posterolateral alveolar and/or pleural syndromes (PLAPS), 72–3
- post-partum DCM, 43–5
- Pouch of Douglas (POD), 108–9, 180–2, 184–5
- power button, US machine, 8
- power Doppler (PD), 15–16, 141–2
- pregnancy
 ectopic, 110, 184–5
 intrauterine, 182–4
 molar, 185
 of unknown location, 184
- prehospital ultrasound (PHUS), 200, 216
- early pregnancy complications, 203
- echocardiography in cardiac arrest, 202
- e-FAST for trauma, 201
- endotracheal intubation
 confirmation using, 202
- LUS, 201–2
- vascular and procedural, 202–3
- presets, selection of, 11
- probe
 abdominal US, 97–8
 all-in-one hand-held, 2, 11, 200
 angle of incidence of, 7
 care for, 24
 curvilinear, 9–10
 echo, 27
 FAST, 105
 governance and quality assurance policy for, 231
 high frequency compared with low frequency, 7
 key elements of, 4–5
 linear, 9–10
 LUS, 68
 movements and manipulation of, 13–14
 phased array, 9–11
 selection of, 9–12
 soft tissue and musculoskeletal US, 140–1
 vascular US, 127
- probe marker, 11–12
- Project Morpho, 213
- propagation velocity, 4–5
- proximal septal hypertrophy, 46–7
- PSAX view. *See* parasternal short axis view
- pseudogestational sac, 182–3
- pulmonary artery (PA), 30–1
- pulmonary embolism (PE)
 COVID-19 and, 227–8
 echo of, 56–9, 205–6
 LUS of, 95
- pulmonary fibrosis, 85
- pulmonary hypertension, high altitude, 204
- pulmonary oedema
 COVID-19 differentiation from, 229–30
 high altitude, 204
 LUS of, 76, 82–5, 204
- pulmonary valve (PV), 30–2
- pulsatility index (PI), 178
- pulse wave (PW) Doppler, 16. *See also*
 transcranial Doppler
 of hepatic vein flow, 124–5
 of portal vein flow, 124–6
- pulsus paradoxus, 51, 54–5
- PV. *See* pulmonary valve
- PW Doppler. *See* pulse wave Doppler
- pyelonephritis, 116
- QA. *See* quality assurance
- quad sign, 78–9
- quadriceps muscles, 159–60
- quadriceps tendon, 160–1
- quality assurance (QA), 231–2, 235
 education, training and continual professional development, 234–5
 image optimisation, 232–3
 in remote, wilderness and austere medicine, 212
 reports, 233–4
- RA. *See* right atrium
- radial vein, 133–5
- rarefaction, sound, 4–5
- record, image, 24, 231–2
- reflection, 7
- refraction artefact, 19–20
- regional wall motion abnormalities (RWMA), 39–42
- remote, wilderness and austere medicine, 200, 203, 216
 equipment maintenance and considerations in, 211–12
 foreign body removal in, 206, 209–11
 hip fracture diagnosis and management at South Pole, 208–10
 LUS use in, 203–4
 musculoskeletal injury and peripheral nerve blockade in, 206
 neurology US use in, 204–5
 pneumonia differential diagnosis at South Pole, 207–9
 research conducted in, 212
 teleultrasound in, 212
 training and quality assurance in, 212
 tropical diseases in, 206–7
 vascular US use in, 205–6

Index

- renal tract
 abdominal US of, 112–17
 anatomy of, 112–13
 bladder residual volume, 116, 190–2
 calculi in, 114–15
 cancer of, 116
 CKD of, 116
 cysts of, 115–16
 Hospital at Home care for, 190, 191, 191, 192
 hydronephrosis of, 112–15
 pyelonephritis of, 116
 scanning methods for, 113
 reports, 233–4
 resolution, 5, 7
 respiratory failure, BLUE Protocol for, 1–2, 69, 71–3
 respiratory phasicity, 131, 133
 return of spontaneous circulation (ROSC), 37–8
 reverberation artefact, 18, 74–5, 86
 rheumatic heart disease (RHD), 214–15
 rib shadows, 72–3
 right atrial pressure
 echo assessment of, 35–6, 62
 IVC collapsibility as marker of, 104–5
 right atrium (RA)
 A4C view, 33
 diastolic collapse of, 52–4
 PSAX view, 30–2
 RV inflow view of, 30–1
 right upper quadrant (RUQ), 105–7, 182–3
 right ventricle (RV)
 A4C view, 33
 diastolic collapse of, 52–4
 dilatation of, 56–7, 59
 echo assessment of function of, 55–6
 hypertrophy of, 57–8
 inflow and outflow view of, 30–1
 McConnell's sign in, 57
 PLAX view of, 29
 pressure and volume overload of, 57–8
 SC view, 34–5
 ring down artefact, 18–19
 ring of fire sign, 184
 rocking, probe, 14
 ROSC. *See* return of spontaneous circulation
 rotation, probe, 14
 rotator cuff interval, 150, 152
 ruptured ovarian cysts, 187
 RUQ. *See* right upper quadrant
 RV. *See* right ventricle
 RWMA. *See* regional wall motion abnormalities
 SAM. *See* systolic anterior motion
 saphenofemoral junction (SFJ), 129–30
 SARS-CoV-2. *See* Severe Acute Respiratory Syndrome Coronavirus
 SBO. *See* small bowel obstruction
 SC view. *See* subcostal view
 scanning method, 36.120. *See also specific US techniques*
 image acquisition, 12–21
 image optimisation, 21–4, 232–3
 image saving, 24, 231–2
 machine knobology, 8–9
 orientation and imaging planes, 12
 probe and preset selection, 9–12
 scapholunate ligament, 157–8
 SCUF. *See* Society of Clinical Ultrasound Fellowships
 sea-shore sign, 74
 sebaceous cysts, 146
 sector width, 21–2
 septal bulge, 46–7
 septal flattening, 57–8
 septic shock, 197–8
 Severe Acute Respiratory Syndrome Coronavirus 2 (SARS-CoV-2), 217. *See also* Coronavirus disease 2019
 SFJ. *See* saphenofemoral junction
 SFV. *See* superficial femoral vein
 shock
 echo assessment of, 59–63
 septic, 197–8
 short axis, 12
 shortness of breath. *See* dyspnoea
 shoulder, MSKUS of, 150–4
 shred sign, 76–8, 86
 side lobe artefact, 20–1
 silent hypoxia, 223–4
 simple ovarian cysts, 186
 Singapore, training and accreditation pathways in, 237–44
 sinusoid sign, 78–9
 60–60 sign, 57–8
 sliding, probe, 13
 sliding sign, 73–4, 219–20
 endotracheal intubation confirmation using, 202
 pneumothorax absence of, 75, 80–3, 201–2
 small bowel, 121
 small bowel obstruction (SBO), 121, 195–6
 snow storm appearance, molar pregnancy, 185
 Society of Clinical Ultrasound Fellowships (SCUF), 236
 soft tissue ultrasound, 140, 143, 167.
See also musculoskeletal ultrasound
 abscess on, 143–5
 Baker's cyst on, 148–9, 162
 cellulitis on, 143–4
 foreign bodies on, 148–9
 fractures on, 147
 ganglion cysts on, 146
 haematoma on, 147–8
 lipoma on, 146
 lymph nodes on, 145–6
 necrotising fasciitis on, 145
 normal anatomical structures on, 141–3
 probe selection for, 140–1
 scanning methods for, 140–2
 sebaceous cysts on, 146
 tendonitis and tenosynovitis on, 148
 sonographic Murphy's sign, 118–19
 sound waves
 production and characteristics of, 4–5
 tissue interactions with, 5–7
 South Africa, training and accreditation pathways in, 237–44
 South Pole
 equipment maintenance and considerations in, 211
 hip fracture diagnosis and management at, 208–10
 pneumonia differential diagnosis at, 207–9
 spectral Doppler, 16
 specular reflection, 7
 spine sign, 78–9
 spleen
 acoustic impedance of, 7
 FAST of, 106–7
 propagation velocity through, 4–5
 splenic rupture, 111
 splenomegaly, 124–5
 spongy myocardium. *See* left ventricular non-compaction cardiomyopathy
 SSN view. *See* suprasternal view
 sternal fracture, 147
 sternoclavicular joint, 153–4
 stratosphere sign, 75
 string of pearls sign, 187–8
 stroke, ischaemic, 177, 205
 stroke volume (SV), 33–4, 60–1
 subacromial bursa, 152
 subclavian vein, 133–5
 subcostal (SC) view, 34–5, 52, 54
 subpleural consolidation, 76–7, 84–6, 220–1
 subscapularis, 150, 152

- superficial femoral vein (SFV), 129–30, 132–3
 supraspinatus, 150, 152–3
 suprasternal (SSN) view, 35–6
 SV. *See* stroke volume
 swirl sign, 143–4
 systolic anterior motion (SAM), 47–8
- Tanga sign, 121
 TAPSE. *See* tricuspid annular plane of systole excursion
 target sign, 122
 TAUS. *See* temporal artery ultrasound
 TB. *See* tuberculosis
 TCD. *See* transcranial Doppler
 TDI. *See* tissue Doppler imaging
 teleultrasound, 212
 temporal artery ultrasound (TAUS), 174–6
 tendinopathy, 141–2, 148
 tendon, US characteristics of, 141–3
 tendonitis, 148
 tenosynovitis, 148
 TGC. *See* time gain compensation
 THI. *See* tissue harmonic imaging
 thoracic ultrasound. *See* lung ultrasound
 thoracocentesis, LUS guided, 95
 thrombus. *See also* deep vein thrombosis; venous thromboembolism
 in acute pulmonary embolism, 59
 echo of, 63–4
 post-MI LV, 42–3
 tilting, probe, 14
 time gain compensation (TGC), 22–3
 tissue Doppler imaging (TDI), 17
 tissue harmonic imaging (THI), 23–4, 140–1
 tissue sign, 76–8, 87
 tissues. *See also specific tissues*
 propagation velocity through, 4–5
 sound wave interactions with, 5–7
 TR. *See* tricuspid regurgitation
 training and accreditation
 ease of, 2
 governance and quality assurance, 234–5
 pathways, 236–44
 in remote, wilderness and austere medicine, 212
 transabdominal pelvic ultrasound
 confirmation of intrauterine pregnancy using, 182–4
 free fluid on, 181–5, 188–9
 scanning method for, 180–2
 transcranial Doppler (TCD), 176
 intracranial vasospasm on, 177–8
 ischaemic stroke on, 177, 205
 pulsatility index and ICP estimation, 178
 remote, wilderness and austere medicine use of, 205
 scanning method for, 176–7
 transducer. *See* probe
 transfer medicine. *See* prehospital ultrasound
 transthoracic echocardiography (TTE), 213
 trauma. *See* focused assessment with sonography in trauma
 triceps tendon, 156
 tricuspid annular plane of systole excursion (TAPSE), 55–6
 tricuspid regurgitation (TR), 57–8
 tricuspid valve (TV)
 A4C view, 33
 exaggerated inflow variability of, 54–5
 PSAX view, 30–2
 RV inflow view of, 30–1
 SC view, 34–5
 trochanteric bursitis, 159–60
 tropical disease, 206–7
 TTE. *See* transthoracic echocardiography
 tubal ring sign, 184
 tuberculosis (TB), 92–3, 207
 tubo-ovarian abscess, 188
 tumours. *See also specific cancers*
 cardiac, 64
 ovarian, 186–7
 TV. *See* tricuspid valve
 twinkle artefact, 114
 2D mode, 13
- UGRA. *See* ultrasound guided regional anaesthesia
 ulnar collateral ligament, 156–8
 ulnar nerve, 156–7
 ulnar vein, 133–5
 ultrasound (US), 24.30. *See also specific topics*
 physics of, 4–7
 ultrasound guided regional anaesthesia (UGRA), 206
 ultrasound (US) machine. *See also* probe
 care for, 24
 governance and quality assurance policy for, 231
 imaging modes, 12–17
 knowledge and understanding of, 8–9
 portable, 1–2, 11, 200, 203, 213–14
 presets of, 11
 United Kingdom, training and accreditation pathways in, 237–44
 United States of America, training and accreditation pathways in, 237–44
 UPJ. *See* ureteropelvic junction
 upper limb
 DVT assessment in, 133–6
 MSKUS of, 150–8
 vascular anatomy of, 133–4
 ureter, 113–14
 ureteropelvic junction (UPJ), 113–14
 urinary retention, 116, 190–2
 US. *See* ultrasound
 uterus
 fibroids (leiomyomas) of, 185
 transabdominal pelvic US of, 180–1
- vaginal stripe, 180–1
 valvular heart disease
 A4C view, 33
 echo assessment of, 49–51
 infective endocarditis, 64–5
 PLAX view of, 29–30
 rheumatic, 215
 vascular ultrasound, 127, 139
 in COVID-19, 227–8
 general principles and scanning methods for, 127–8
 lower limb DVT assessment using, 128–33
 prehospital, 202–3
 probe selection for, 127
 remote, wilderness and austere medicine use of, 205–6
 upper limb DVT assessment using, 133–6
 venous and arterial vascular access guidance by, 136–9, 225
 vasospasm, TCD of, 177–8
 veins, 127–8. *See also* vascular ultrasound
 velocity. *See* propagation velocity
 venous access, US guided, 136–9, 225
 venous excess ultrasound (VEXUS), 62–3
 venous gas emboli (VGE), 206
 venous thromboembolism (VTE), 227–8. *See also* deep vein thrombosis
 ventilation, for COVID-19, 224–5
 ventricular septal defect (VSD), 41–3
 vesicoureteric junctions (VUJ), 113–14
 VEXUS. *See* venous excess ultrasound
 VGE. *See* venous gas emboli
 viruses. *See also* Coronavirus disease 2019

Index

- viruses. (cont.)
 LUS changes caused by, 226
volume assessment. *See*
 haemodynamics
VSD. *See* ventricular septal defect
VTE. *See* venous thromboembolism
VUJ. *See* vesicoureteric junctions

wall echo shadow (WES), 118–19
- water
 acoustic impedance of, 5–7
 propagation velocity through, 4–5
water bath, soft tissue and
 musculoskeletal US using, 141–2
waterfall sign, 76, 220–1
wavelength, 4–5
WES. *See* wall echo shadow
whirlpool sign, 187
- wilderness medicine. *See* remote,
 wilderness and austere
 medicine
withdrawal of medical care, 197–8
wrist, MSKUS of, 156–8

yolk sac, 183

zoom, image optimisation with, 21–2