7 EDITION

clinical examination

A systematic guide to physical diagnosis

Nicholas J Talley and
Simon O'Connor

CHURCHILL LIVINGSTONE
ELSEVIER

clinical examination

A systematic guide to physical diagnosis

Seventh edition

Nicholas J Talley

MB BS (Hons), MMedSc (Clin Epi) (Newc), MD (NSW), PhD (Syd), FRACP, FAFPHM, FRCP (Lond), FRCP (Edin), FACP, FACG, AGAF
Pro Vice-Chancellor and Dean (Health and Medicine), and Professor, University of Newcastle, Callaghan, NSW, Australia; Senior Staff Specialist, John Hunter Hospital, Newcastle, NSW, Australia; Adjunct Professor of Medicine, Mayo Clinic, Rochester, MN, United States; Adjunct Professor of Medicine, University of North Carolina, United States; Foreign Guest Professor, Karolinska Institute, Sweden; President-Elect, Royal Australasian College of Physicians

Simon O'Connor

FRACP, DDU, FCSANZ
Cardiologist, The Canberra Hospital; Clinical Senior Lecturer, Australian National University Medical School, Canberra, ACT, Australia

Sydney Edinburgh London New York Philadelphia St Louis Toronto

Churchill Livingstone
is an imprint of Elsevier

Elsevier Australia. ACN 001 002 357
(a division of Reed International Books Australia Pty Ltd)
Tower 1, 475 Victoria Avenue, Chatswood, NSW 2067

ELSEVIER

6th edn 2010; 5th edn 2006; 4th edn 2001; 3rd edn 1996; 2nd edn 1992; 1st edn 1988
eISBN: 9780729581479

National Library of Australia Cataloguing-in-Publication Data

Talley, Nicholas Joseph, author.

Clinical examination: a systematic guide to physical diagnosis/Nicholas J Talley, Simon O'Connor.

7th edition.

9780729541473 (paperback)

Includes index.

Physical diagnosis.

O'Connor, Simon, author.

616.075

Content Strategist: Larissa Norrie
Senior Content Development Specialist: Neli Bryant
Senior Project Manager: Natalie Hamad
Edited by Caroline Hunter, Burrumundi Pty Ltd
Proofread by Tim Learner
Permissions and picture research by Sarah Thomas
Cover and internal design by Darben Design
Index by Robert Swanson
Typeset by Midland Typesetters
Printed by China Translation & Printing Services Ltd

Foreword

The authors deserve warm congratulations and much thanks in preparing this seventh edition of their highly-acclaimed *Clinical examination: a systematic guide to physical diagnosis*. Moving with the times the format and content provide for more flexible use in print and online and confront the educational challenge of tuition and assessment in the development of clinical skills. The central mission of the original edition—to enhance clinical skills—remains soundly intact.

The quality and outcome of an encounter between a sick or injured person and a health professional depends upon the integrity of the exchange of information. That exchange may constitute the entire clinical encounter, as in psychotherapy. The psychotherapist may spend months or years understanding his or her patient and leading them to insights and altered behaviour as a result. Alternatively, the encounter may be fleeting and nonverbal, the prelude to an urgent, extensive technical intervention, as occurs when a trauma surgeon treats a severely injured patient or a physician manages a patient suffering an unheralded life-threatening heart attack. The skills for interviewing and examining a patient physically required of the doctor vary widely among the range of specialities that now offer care. The appropriate mix of information derived from speaking with the patient, examining him or her physically and interpreting test results varies just as widely. This variation is recognised well in this book in that its chapters relate separately to the clinical encounter in fields as diverse as neurology and gastroenterology.

In the haste and pressure characteristic of the practice of medicine and surgery in a large hospital, corners are easily cut, the patient history is stripped to its bare essentials and physical examination can be forgone in favour of scans. On-call medical attendants have been known to resist travelling to review a patient in the emergency department until investigations have been done. These abbreviations to the clinical encounter, while understandable, come at a high cost. Junior doctors in the emergency room adopt the behaviours endorsed by their seniors: stories abound of how patients died while awaiting a CT scan and whose clinical condition would have been detected and emergency treatment instituted if they had been examined properly and their story heard.

All of us engaged in clinical care, whether as front-line clinicians, research workers or managers, should remind ourselves that the most fundamental unit of our concern should be the patient. As such, wherever possible, a human (and humane) relationship with that individual is the platform on which subsequent therapy is then built. The development of those skills is the core business of this book. In its earlier incarnation, it has proved to be immensely popular and the authors have now responded by expanding, clarifying and adding new sections of assessment to the original edition. This book will prove to be valuable and valued by medical students, young doctors and older practitioners in different ways. However used, it can enhance the quality of care we offer our patients—and that is a truly splendid compliment to the authors.

Stephen Leeder, AO MD PhD FRACP

Professor of Public Health and
Community Medicine
Menzies Centre for Health Policy and
School of Public Health
Chair | Western Sydney Local Health District Board
Director | Research Network | Western Sydney
Local Health District
Editor-in-Chief, *Medical Journal of Australia*

Contents

Foreword v
Preface xix
Acknowledgments xx
Clinical methods: an historical perspective xxiii
The Hippocratic oath xxv
Credits: figures, boxes and tables xxvi

SECTION 1
THE GENERAL PRINCIPLES OF HISTORY TAKING AND PHYSICAL EXAMINATION 1

CHAPTER 1
The general principles of history taking 3
T&O'C essentials 3
Bedside manner and establishing rapport 3
Obtaining the history 4
Introductory questions 5
T&O'C essentials 5
Presenting (principal) symptom 6
History of the presenting illness 6
Current symptoms 6
Associated symptoms 7
The effect of the illness 8
Drug and treatment history 8
Past history 9
Menstrual history 10
Social history 10
T&O'C essentials 10
Upbringing and education level 10
Marital status, social support and living conditions 10
Diet and exercise 10
Occupation and hobbies 10
Overseas travel 11
Smoking 11
Alcohol use 11
Analgesics and street drugs 13
Mood 13
Sexual history 13
Family history 13
Systems review 14
Skills in history-taking 16
T&O'C essentials 16
References 16

CHAPTER 2
Advanced history taking 18
Taking a good history 18
The differential diagnosis 18
Fundamental considerations when taking the history 19
Personal history taking 19
Sexual history 20
Cross-cultural history taking 20
The 'uncooperative' or 'difficult' patient 21
Self-harming and Münchhausen's syndrome 22
History taking for the maintenance of good health 22
The elderly patient 23
Activities of daily living 23
Polypharmacy 24
Adherence 24
Mental state 24
Specific problems in the elderly 24
Advanced care planning and living wills (advance health directives) 25
Evidence-based history taking and differential diagnosis 25
The clinical assessment 25
Concluding the consultation 26
T&O'C essentials 26
References 26

CHAPTER 3 28
The general principles of physical examination 28
Clinical examination 29
How to start 29
First impressions 29
Vital signs 29
Facies 30

Jaundice 30
Cyanosis 31
Pallor 32
Hair 33
Weight, body habitus and posture 33
Hydration 34
The hands and nails 35
Temperature 36
Smell 37
Preparing the patient for examination 37
Evidence-based clinical examination 38
Inter-observer agreement (reliability) and the κ-statistic 39
T&O'C essentials 40
Introduction to the OSCE 40
References 42

SECTION 2
THE CARDIOVASCULAR SYSTEM 43

CHAPTER 4
The cardiovascular history 45
Presenting symptoms 45
Chest pain 45
Dyspnoea 48
Ankle swelling 49
Palpitations 49
Syncope, presyncope and dizziness 50
Fatigue 52
Intermittent claudication and peripheral vascular disease 52
Risk factors for coronary artery disease 52
Drug and treatment history 54
Past history 54
Social history 54
Family history 55
T&O'C essentials 55
OSCE revision topics: CVS history 55
OSCE example: CVS history 55
References 55

CHAPTER 5
The cardiac examination 57
Examination anatomy 57
Positioning the patient 60
General appearance 60
Hands 60
Arterial pulse 63
Rate of pulse 64
Rhythm 64
Radiofemoral and radial–radial delay 66
Character and volume 66
Condition of the vessel wall 67
Blood pressure 67
Measuring the blood pressure with the sphygmomanometer 67
Variations in blood pressure 68
High blood pressure 68
Postural blood pressure 69
Face 69
Neck 70
Jugular venous pressure 70
Praecordium 72
Inspection 72
Palpation 73
Percussion 75
Auscultation 75
Abnormalities of the heart sounds 76
Murmurs of the heart 79
Auscultation of the neck 83
The back 84
The abdomen 84
T&O'C essentials 84
OSCE example: CVS examination 84
OSCE revision topics: CVS examination 85
References 85

CHAPTER 6
The lower limb examination and peripheral vascular disease 86
Examination anatomy 86
Arms 86
Legs 86
Lower limbs 86
Peripheral vascular disease 87
Acute arterial occlusion 90
Deep venous thrombosis 91
Varicose veins 91
T&O'C essentials 91
OSCE example: peripheral vascular disease 92
References 92

CHAPTER 7
Correlation of physical signs and cardiovascular disease 93
Cardiac failure 93
Left ventricular failure (LVF) 93
Right ventricular failure (RVF) 94
Chest pain 94
Myocardial infarction 95
Pulmonary embolism 95
Acute aortic dissection 95
Pericardial disease 96
Acute pericarditis 96
Chronic constrictive pericarditis 96
Acute cardiac tamponade 96
Infective endocarditis 96
Systemic hypertension 97

Causes of systemic hypertension 98
Complications of hypertension 98
Malignant (accelerated) hypertension 98
Pulmonary hypertension 98
Causes of pulmonary hypertension 98
Innocent murmurs 99
Valve diseases of the left heart 99
Mitral stenosis 99
Mitral regurgitation (chronic) 101
Acute mitral regurgitation 102
Mitral valve prolapse (systolic-click murmur syndrome) 102
Aortic stenosis 102
Aortic regurgitation 104
Valve diseases of the right heart 105
Tricuspid stenosis 105
Tricuspid regurgitation 106
Pulmonary stenosis (in adults) 108
Pulmonary regurgitation 108
Prosthetic heart valves 108
Cardiomyopathy 109
Hypertrophic cardiomyopathy 109
Dilated cardiomyopathy 110
Restrictive cardiomyopathy 110
Acyanotic congenital heart disease 110
Ventricular septal defect 110
Atrial septal defect 110
Patent ductus arteriosus 110
Coarctation of the aorta 111
Ebstein's anomaly 112
Cyanotic congenital heart disease 112
Eisenmenger's syndrome (pulmonary hypertension and a right-to-left shunt) 112
Tetralogy of Fallot 112
'Grown-up' congenital heart disease 113
Tetralogy of Fallot 113
Transposition of the great arteries 113
T&O'C essentials 113
OSCE example: cardiovascular examination 114
OSCE revision topics: cardiovascular examination 114
References 114

CHAPTER 8
A summary of the cardiovascular examination and extending the cardiovascular examination 115
Extending the cardiovascular physical examination 117
The chest X-ray: a systematic approach 117
The echocardiogram 119
T&O'C essentials 126

SECTION 3
THE RESPIRATORY SYSTEM 127

CHAPTER 9
The respiratory history 129
Presenting symptoms 129
Cough and sputum 129
Haemoptysis 130
Breathlessness (dyspnoea) 131
Wheeze 131
Chest pain 133
Other presenting symptoms 133
Treatment 134
Past history 135
Occupational history 135
Social history 136
Family history 136
T&O'C essentials 136
OSCE revision topics: the respiratory history 136
References 136

CHAPTER 10
The respiratory examination 138
Examination anatomy 138
Positioning the patient 138
General appearance 138
Dyspnoea 138
Characteristic signs of COPD 139
Cyanosis 140
Character of the cough 141
Sputum 141
Stridor 141
Hoarseness 141
Hands 141
Clubbing 141
Staining 141
Wasting and weakness 142
Pulse rate 142
Flapping tremor (asterixis) 142
Face 142
Trachea 142
Chest 143
Inspection 143
Palpation 145
Percussion 147
Auscultation 147
The heart 150
The abdomen 150
Other 150
Pemberton's sign 150
Legs 150
Respiratory rate on exercise 151
Temperature 151
T&O'C essentials 151

OSCE revision topics: the respiratory examination 151
References 151

CHAPTER 11
Correlation of physical signs and respiratory disease 152
Respiratory distress: respiratory failure 152
Consolidation (lobar pneumonia) 152
Symptoms 153
Signs 153
Causes of community-acquired pneumonia 153
Atelectasis (collapse) 153
Signs 153
Causes 154
Pleural effusion 154
Signs 154
Causes 154
Yellow nail syndrome 154
Pneumothorax 155
Signs 155
Causes 155
Tension pneumothorax 155
Signs 155
Causes 155
Bronchiectasis 155
Signs 155
Causes 155
Bronchial asthma 155
Signs 156
Chronic obstructive pulmonary disease 156
Signs 156
Causes of generalised emphysema 157
Chronic bronchitis 157
Signs 157
Causes 157
Interstitial lung disease (ILD) 157
Signs 157
Causes 157
Tuberculosis 158
Primary tuberculosis 158
Post-primary tuberculosis 158
Miliary tuberculosis 158
Mediastinal compression 158
Signs 158
Carcinoma of the lung 158
Respiratory and chest signs 158
Apical (Pancoast's) tumour 159
Distant metastases 159
Non-metastatic extrapulmonary manifestations 159
Sarcoidosis 159
Pulmonary signs 159
Extrapulmonary signs 159
Pulmonary embolism (PE) 159
Signs 159
T&O'C essentials 160
OSCE revision topics: respiratory disease 160
References 160

CHAPTER 12
A summary of the respiratory examination and extending the respiratory examination 161
Extending the respiratory physical examination 163
Bedside assessment of lung function 163
The chest X-ray and CT scan in respiratory medicine 165
Chest X-ray checklist 168
T&O'C essentials 170
OSCE revision topics: respiratory investigations 170
References 170

SECTION 4
THE GASTROINTESTINAL SYSTEM 171

CHAPTER 13
The gastrointestinal history 173
Presenting symptoms 173
Abdominal pain 173
Patterns of pain 173
Appetite and weight change 174
Early satiation and postprandial fullness 174
Nausea and vomiting 174
Heartburn and acid regurgitation 174
Dysphagia 175
Diarrhoea 176
Constipation 177
Mucus 178
Bleeding 178
Jaundice 179
Pruritus 179
Abdominal bloating and swelling 179
Lethargy 180
Treatment 180
Past history 180
Social history 180
Family history 180
T&O'C essentials 180
OSCE revision topics: the gastrointestinal history 181
References 181

CHAPTER 14
The gastrointestinal examination 182
Examination anatomy 182
Positioning the patient 183

General appearance 183
Jaundice 183
Weight and wasting 183
Skin 183
Mental state 187
Hands 187
Nails 187
Palms 187
Hepatic flap (asterixis) 188
Arms 189
Face 190
Eyes 190
Salivary glands 191
Mouth 192
Neck and chest 194
Abdomen 194
Inspection 194
Palpation 197
Percussion 204
Ascites 205
Auscultation 207
Hernias 208
Examination anatomy 208
Hernias in the groin 208
Epigastric hernia 210
Incisional hernias 210
Rectal examination 210
The pelvic floor—special tests for pelvic floor dysfunction 213
Ending the rectal exam 213
Proctosigmoidoscopy 213
Procedure 213
Common abnormalities seen on sigmoidoscopy 214
Testing of the stools for blood 214
Other 214
Examination of the gastrointestinal contents 214
Faeces 214
Vomitus 215
Urinalysis 215
T&O'C essentials 216
OSCE revision topics: the gastrointestinal examination 217
References 217

CHAPTER 15
Correlation of physical signs and gastrointestinal disease 219
Examination of the acute abdomen 219
Acute abdomen after blunt trauma 221
Liver disease 221
Signs 221
Portal hypertension 221
Signs 221
Causes 222
Hepatic encephalopathy 222
Grading 222
Causes 222
Dysphagia 222
Signs 222
Gastrointestinal bleeding 223
Assessing degree of blood loss 223
Determining the possible bleeding site 223
Inflammatory bowel disease 223
Ulcerative colitis 223
Crohn's disease 224
Malabsorption and nutritional status 225
Signs 225
Causes 226
Classification of malabsorption 226
T&O'C essentials 227
References 227

CHAPTER 16
A summary of the gastrointestinal examination and extending the gastrointestinal examination 228
Extending the gastrointestinal examination 230
Endoscopy 230
Biochemistry 230
Imaging the gastrointestinal system 230
Abdominal X-rays 230
Abdominal ultrasound 233
CT of the abdomen 234

SECTION 5
THE GENITOURINARY SYSTEM 237

CHAPTER 17
The genitourinary history 239
Presenting symptoms 239
Change in appearance of the urine 239
Urinary tract infection 241
Urinary obstruction 241
Urinary incontinence 241
Chronic kidney disease 242
Menstrual and sexual history 243
Treatment 244
Past history 244
Social history 244
Family history 245
T&O'C essentials 245
OSCE revision topics: genitourinary history 245
References 245

CHAPTER 18
The genitourinary examination 246
Examination anatomy 246
The examination 246

General appearance 246
Hands 246
Arms 247
Face 248
Neck 248
Chest 249
The abdominal examination 250
Inspection 250
Palpation 250
Ballotting 250
Percussion 250
Auscultation 251
Rectal and pelvic examination 251
The back 251
Legs 251
Blood pressure 252
Fundi 252
Male genitalia 252
Differential diagnosis of a scrotal mass 253
Pelvic examination 254
Taking a cervical (Pap) smear 256
T&O'C essentials 256
OSCE revision topics: genitourinary examination 256
References 256

CHAPTER 19
A summary of the examination of chronic kidney disease and extending the genitourinary examination 257
Extending the genitourinary examination 258
Investigations 258
Imaging the kidneys 262
T&O'C essentials 264
Reference 264

SECTION 6
THE HAEMATOLOGICAL SYSTEM 265

CHAPTER 20
The haematological history 267
Haematological disorders 267
Presenting symptoms 267
Red cell abnormalities 267
Platelets 267
Recurrent infection 267
Treatment history 268
Past history 269
Social history 269
Family history 269
T&O'C essentials 269

CHAPTER 21
The haematological examination 270
Examination anatomy 270
General appearance 270
Hands 270
Forearms 272
Epitrochlear nodes 272
Axillary nodes 273
Face 274
Cervical and supraclavicular nodes 275
Bone tenderness 276
The abdominal examination 276
Inguinal nodes 277
Legs 277
Fundi 278
T&O'C essentials 278
References 278

CHAPTER 22
A summary of the haematological examination and extending the haematological examination 279
Extending the haematological physical examination 280
Haematology tests 280
Examination of the peripheral blood film 280
Anaemia 282
Pancytopenia 283
Acute leukaemia 284
Chronic leukaemia 284
Myeloproliferative disease 284
Lymphoma 286
Multiple myeloma 286
Haematological imaging 287
T&O'C essentials 288
OSCE revision topics: the haematological system 288

SECTION 7
THE RHEUMATOLOGICAL SYSTEM 289

CHAPTER 23
The rheumatological history 291
Presenting symptoms 291
Peripheral joints 291
Back pain 293
Limb pain 293
Raynaud's phenomenon 294
Dry eyes and mouth 294
Red eyes 294
Systemic symptoms 295
Treatment history 295
Past history 295
Social history 295
Family history 295
T&O'C essentials 296
OSCE revision topics: the rheumatological history 296
References 296

CHAPTER 24
The rheumatological examination 297
Examination anatomy 297
General inspection 298
Principles of joint examination 298
Look 299
Feel 299
Move 299
Measure 300
Assessment of individual joints 300
Hands and wrists 300
Elbows 307
Shoulders 308
Temporomandibular joints 312
Neck 312
Thoracolumbar spine and sacroiliac joints 313
Hips 315
Knees 319
T&O'C essentials 326
OSCE revision topics: the rheumatological examination 326
References 326

CHAPTER 25
Correlation of physical signs and rheumatological disease 327
Rheumatoid arthritis 327
General inspection 328
Hands 328
Wrists 328
Elbows 328
Shoulders and axillae 328
Eyes 328
Parotids 328
Mouth 328
Temporomandibular joints 328
Neck 328
Chest 328
Heart 328
Abdomen 329
Lower limbs 329
Ankles and feet 329
Seronegative spondyloarthritides 329
Ankylosing spondylitis 329
Reactive arthritis (Reiter's syndrome) 329
Psoriatic arthritis 330
Enteropathic arthritis 330
Gouty arthritis 330
Calcium pyrophosphate arthritis (pseudogout) 331
Calcium hydroxyapatite arthritis 331
Systemic lupus erythematosus 331
General inspection 331
Hands 331
Forearms 331
Head and neck 332
Chest 333
Abdomen 333
Hips 333
Legs 333
Urine and blood pressure 333
Systemic sclerosis (scleroderma) 333
General inspection 333
Hands 334
Arms 334
Face 335
Chest 336
Legs 336
Urinalysis and blood pressure 336
Rheumatic fever 336
Examining the patient with suspected rheumatic fever 336
The vasculitides 336
Soft-tissue rheumatism 336
Fibromyalgia syndrome 336
Shoulder syndromes 337
Elbow epicondylitis (tennis and golfer's elbow) 339
Tenosynovitis of the wrist 339
Bursitis 340
Nerve entrapment syndromes 340
Carpal tunnel syndrome 340
Meralgia paraesthetica 341
Tarsal tunnel syndrome 341
Morton's 'neuroma' 341
T&O'C essentials 341
OSCE revision topics: rheumatological disease 342
References 342

CHAPTER 26
A summary of the rheumatological examination and extending the rheumatological examination 343
Extending the rheumatological system examination 344
Rheumatology investigations 344
Imaging 344
T&O'C essentials 348
References 348

SECTION 8
THE ENDOCRINE SYSTEM 349

CHAPTER 27
The endocrine history 351
Presenting symptoms 351
Changes in appetite and weight 351
Changes in bowel habit 352

Changes in sweating 352
Changes in hair distribution 352
Lethargy 352
Changes in the skin and nails 352
Changes in pigmentation 352
Changes in stature 352
Erectile dysfunction (impotence) 352
Galactorrhoea 352
Menstruation 352
Polyuria 353
Past history 353
Social history 353
Family history 353
T&O'C essentials 354
OSCE revision topics: the endocrine history 354

CHAPTER 28
The endocrine examination 355
The thyroid 355
The thyroid gland 355
Hyperthyroidism (thyrotoxicosis) 358
Hypothyroidism (myxoedema) 360
The pituitary 362
Panhypopituitarism 362
Acromegaly 364
Other pituitary syndromes 366
The adrenals 366
Cushing's syndrome 366
Addison's disease 368
T&O'C essentials 369
OSCE revision topics: the endocrine examination 370
References 370

CHAPTER 29
Correlation of physical signs and endocrine disease 371
Calcium metabolism 371
Primary hyperparathyroidism 371
The MEN syndromes 371
Hypoparathyroidism 372
Osteoporosis and osteomalacia 373
Syndromes associated with short stature 374
Turner's syndrome (45XO) 375
Down syndrome (Trisomy 21) 375
Achondroplasia (dwarfism) 375
Rickets 375
Hirsutism 375
Gynaecomastia 376
Diabetes mellitus 377
Paget's disease 382
T&O'C essentials 382
OSCE revision topics: endocrine system 383
References 383

CHAPTER 30
A summary of the endocrine examination and extending the endocrine examination 384
The endocrine examination: a suggested method 384
Extending the endocrine physical examination 384
Diagnostic testing 384
T&O'C essentials 389
OSCE revision topics: endocrine system 389

SECTION 9
THE NERVOUS SYSTEM 391

CHAPTER 31
The neurological history 393
Presenting symptoms 393
Headache and facial pain 394
Faints and fits 395
Dizziness 396
Visual disturbances and deafness 396
Disturbances of gait 397
Disturbed sensation or weakness in the limbs 397
Tremor and involuntary movements 397
Speech and mental status 397
Past health 397
Medication history 398
Social history 398
Family history 398
T&O'C essentials 399
OSCE revision topics: the neurological history 399
References 399

CHAPTER 32
The neurological examination: the cranial nerves 400
Examination anatomy 400
General signs 400
Consciousness 400
Neck stiffness 401
Handedness 401
Orientation 401
The cranial nerves 401
Examination anatomy 401
General inspection 401
The first (olfactory) nerve 402
The second (optic) nerve 403
The third (oculomotor), fourth (trochlear) and sixth (abducens) nerves—the ocular nerves 407
The fifth (trigeminal) nerve 414
The seventh (facial) nerve 418

The eighth (acoustic) nerve 421
The ninth (glossopharyngeal) and tenth (vagus) nerves 422
The eleventh (accessory) nerve 424
The twelfth (hypoglossal) nerve 425
Multiple cranial nerve lesions 426
Head and neck 427
Carotid bruits 427
T&O'C essentials 428
References 428
OSCE example: introduction (stem) 429

CHAPTER 33
The neurological examination: speech and higher centres 430
Examination of speech 430
Dysphasia 430
Dysarthria 431
Dysphonia 432
The cerebral hemispheres 432
Parietal lobe function 432
Temporal lobe function 434
Frontal lobe function 434
T&O'C essentials 435
OSCE revision topics: speech and higher centres 435
References 435

CHAPTER 34
The neurological examination: the peripheral nervous system 436
Limbs and trunk 436
History 436
Examination anatomy 436
General examination approach 436
General inspection 437
Upper limbs 437
Lower limbs 448
Gait 458
T&O'C essentials 461
OSCE revision topics: the peripheral nervous system 461
References 461

CHAPTER 35
Correlation of physical signs and neurological syndromes and disease 462
Upper motor neurone lesions 462
Causes of hemiplegia (upper motor neurone lesion) 462
Lower motor neurone lesions 464
Motor neurone disease 464
Peripheral neuropathy 464
Guillain-Barré syndrome (acute inflammatory polyradiculoneuropathy) 465
Multiple sclerosis 465
Thickened peripheral nerves 466
Spinal cord compression 466
Important spinal cord syndromes 466
Brown-Séquard syndrome 466
Subacute combined degeneration of the cord (vitamin B_{12} deficiency) 469
Dissociated sensory loss 469
Syringomyelia (a central cavity in the spinal cord) 470
An extensor plantar response plus absent knee and ankle jerks 470
Myopathy 470
Dystrophia myotonica 470
Myasthenia gravis 471
The cerebellum 473
Parkinson's disease 475
Inspection 476
Gait and movements 476
Tremor 476
Tone 476
Face 477
Writing 477
Causes of Parkinson's syndrome 478
Other extrapyramidal movement disorders (dyskinesia) 478
Chorea 478
Dystonia 478
The unconscious patient 478
General inspection 479
Level of consciousness 479
Neck 479
Head and face 479
Upper and lower limbs 481
Body 481
Urine 481
Blood glucose 481
Temperature 481
Coma scale 481
T&O'C essentials 481
OSCE revision topics: neurological syndromes and disorders 481
References 481

CHAPTER 36
A summary of the neurological examination and extending the neurological examination 483
Handedness, orientation and speech 484
Neck stiffness and Kernig's sign 484
Cranial nerves 484
Upper limbs 485
Lower limbs 486
Diagnostic testing 486
Lumbar puncture 486
Neurological imaging 487
T&O'C essentials 490

OSCE revision topics: higher centres and cranial nerves 490

CHAPTER 37
The psychiatric history and mental health examination 491
Obtaining the history 491
Introductory questions 492
History of the presenting illness 492
Past history and treatment history 496
Family history 497
Social and personal history 498
The mental state examination 499
The diagnosis 499
T&O'C essentials 504
OSCE revision topics: the psychiatric history and the mental state examination 504
References 504

SECTION 10
SPECIALTY EXAMINATIONS 505

CHAPTER 38
The eyes, ears, nose and throat 507
Eyes 507
Examination anatomy 507
History 508
Examination method 509
Diplopia 513
Horner's syndrome 514
Iritis 515
Glaucoma 515
Shingles 515
Eyelid 515
Ears 516
Examination anatomy 516
History 517
Examination method 518
Nose and sinuses 520
Examination anatomy 520
History 521
Examination method 521
Sinusitis 522
Mouth and throat 522
Examination anatomy 522
History 523
Examination method 524
Pharyngitis 525
Supraglottitis (epiglottitis) 526
Common investigations 526
T&O'C essentials 527
OSCE examples 527
OSCE revision topics: eyes, ears, nose and throat 528
References 528

CHAPTER 39
The breasts 529
Examination anatomy 529
History 529
Examination 530
Inspection 530
Palpation 530
Evaluation of a breast lump 531
T&O'C essentials 532
OSCE revision topics: the breasts 532
References 532

CHAPTER 40
The skin, nails and lumps 533
Examination anatomy 533
Dermatological history 533
General principles of physical examination of the skin 535
How to approach the clinical diagnosis of a lump 536
Correlation of physical signs and skin disease 537
Pruritus 539
Erythrosquamous eruptions 539
Blistering eruptions 540
Erythroderma 540
Pustular and crusted lesions 543
Dermal plaques 544
Erythema nodosum 544
Erythema multiforme 545
Cellulitis and erysipelas 545
Folliculitis, furuncles and carbuncles 545
Other infections 546
Hyperpigmentation 547
Flushing and sweating 547
Skin tumours 548
The nails 550
T&O'C essentials 552
OSCE example: skin 552
References 553

CHAPTER 41
A system for the infectious diseases examination 554
Pyrexia of unknown origin 554
History 554
Examination 555
HIV infection and AIDS 556
History 556
Examination 556
T&O'C essentials 559
OSCE revision topics: infectious diseases 559
References 559

CHAPTER 42
Assessment of the geriatric patient 560
History taking in geriatric patients: special considerations 560
Physical examination in geriatric patients: special considerations 562
OSCE revision topics: assessment of the geriatric patient 564
References 564

CHAPTER 43
Assessment of the acutely ill patient 565
Initial assessment 565
Level of consciousness 567
Further examination 567
OSCE example: emergency care 568
References 568

CHAPTER 44
Assessment of death 569
Assessment 569
Do-not-resuscitate (DNR) orders 569
Do not misdiagnose death 569
Examining a suspected death 569
Informing relatives 570
Completing the death certificate 570
Postmortem 570
Organ donation 570

APPENDIX I
Writing and presenting the history and physical examination 571
History 571
Physical examination (PE) 571
Provisional diagnosis 571
Problem list and plans 572
Continuation notes 572
Presentation 572
Suggested reading 573

APPENDIX II
A suggested method for a rapid screening physical examination 574
Hands and arms 575
Face 575
Front of the neck 575
Chest 575
Back of the chest and neck 575
Abdomen 575
Legs 575
Neurological examination 575
Completing the examination 575

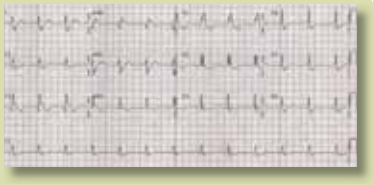
APPENDIX III
The pre-anaesthetic medical evaluation (PAME) 576
The history 576
Cardiovascular history 576
The respiratory history 577
Other 577
The examination 577

Index 578

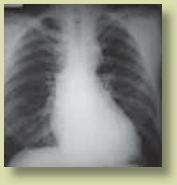
eResources available for this edition

This print edition also includes supplementary material via Student CONSULT

- 8 OSCE-based scenario videos to assist with examination preparation



- 47 ECG case studies



- more than 80 images in the imaging library (X-rays, MRIs and CT scans).

Please note that access to Student Consult is available *only with purchase of this print copy.*

To enrich your learning experience you may also be interested in purchasing:

- **An interactive enhanced eBook** containing all the content from this edition plus four additional chapters covering the history and examination of gynaecology, obstetrics, neonatology and paediatrics, OSCE videos, ECG case studies, an imaging library and MCQs. Search for *Clinical examination* on elsevierhealth.com.au to find out more.
- **A standard eBook** containing content from the print edition plus four additional chapters covering the history and examination of gynaecology, obstetrics, neonatology and paediatrics. Please note that access to Student Consult is not available with purchase of the eBook.

Also available in the Talley & O'Connor suite:

- **Pocket clinical examination:** featuring comprehensive tips on history taking and examination, this invaluable revision tool is available as an app, a printed book or eBook for medical students performing examinations in a clinical setting.
- **Examination medicine 7th edition:** this guide to physician training is widely used by medical students as well as candidates for other specialty examinations involving medical clinical exams. Also available as a standard eBook and an interactive enhanced eBook.

Preface

The four points of a medical student's compass are: Inspection, Palpation, Percussion, and Auscultation.

Sir William Osler

It is now more than 25 years since we set out to write the first edition of *Clinical examination* in our spare time as registrars at the Royal North Shore Hospital, Sydney. Much has changed since then with regard to both the management of patients and medical education. At the time we began the first edition we were both strongly influenced by our recent experiences as basic physician trainees. The Royal Australasian College of Physicians training scheme had and still has a major emphasis on excellence in history taking and physical examination as the basis of management. We both feel strongly that a thorough grounding in these skills and arts is essential for everyone beginning a career in medicine.

A diagnosis is the foundation of all medical practice, and history taking and physical examination are key in the diagnostic process despite the ever-increasing sophistication of diagnostic testing. Tests ordered indiscriminately or inappropriately can seriously mislead and be dangerous: test ordering must be based on the findings of a proper clinical assessment of the patient. Making the wrong diagnosis can cause harm and distress that lasts a lifetime. It is distressingly common for tests to be ordered and referrals made without an adequate history or even a cursory examination of the patient.

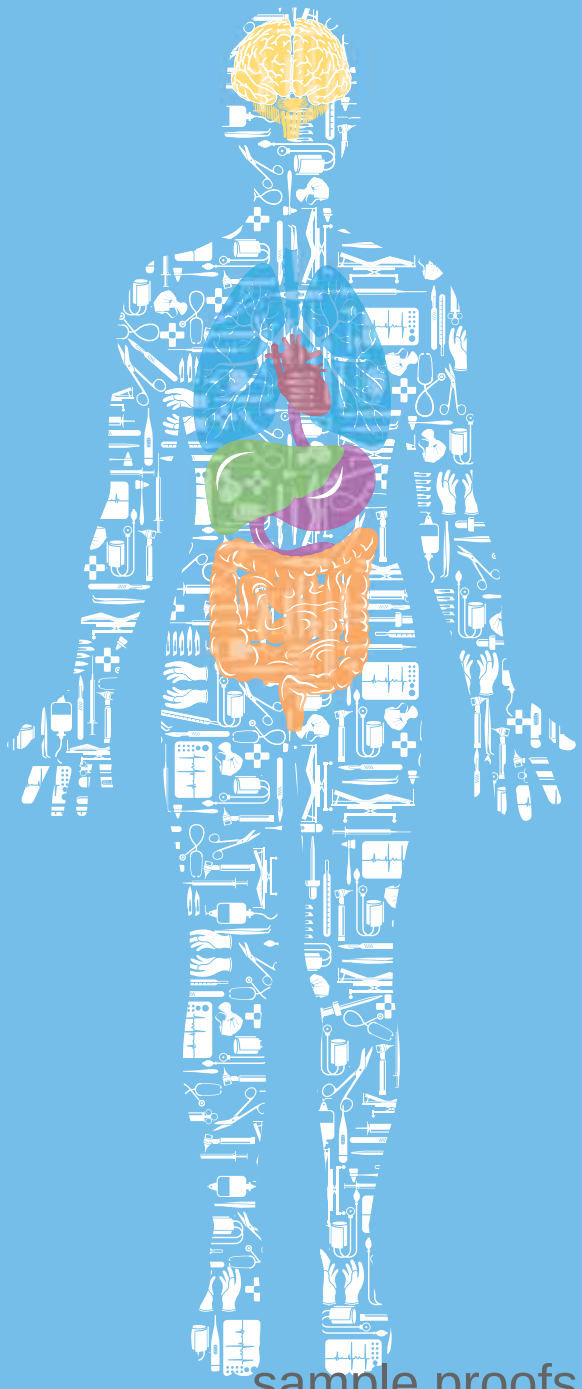
In this new edition of *Clinical examination* we cover the core clinical skills from the basics to an advanced level. We have taken an approach that is patient-centric and evidence-based; the patient must always come first. This edition has been brought right up to date with the latest clinical data, including new research specially commissioned for this edition. Learning should also be fun and the book is deliberately laced with humour and historical anecdotes that generations of students have told us enhance the learning experience.

Not only have there been changes to medical practice over the last 25 years but the format of teaching and use of books has changed irrevocably. The flexibility now offered by computer and tablet versions of books has altered the way students study and perhaps think. This edition offers the book in three formats: a paper book, an eBook and an enhanced eBook. Each version offers new features to help students to study.

Again we are grateful to all those who have helped us with the increasingly complicated job of producing a book like this: our publishers, the colleagues who have contributed pictures and advice, and the many students who have written to us to correct errors (real or perceived).

Nicholas Talley & Simon O'Connor
Newcastle and Canberra, August 2013

SECTION 3



The respiratory system

Chapter 9 The respiratory history

Chapter 10 The respiratory examination

Chapter 11 Correlation of physical signs and respiratory disease

Chapter 12 A summary of the respiratory examination and extending the respiratory examination

CHAPTER 9

The respiratory history

A medical chest specialist is long winded about the short winded.

Kenneth T Bird (b.1917)

Presenting symptoms
(see List 9.1)

LIST 9.1 Presenting symptoms

Major symptoms
Cough
Sputum
Haemoptysis
Dyspnoea (acute, progressive or paroxysmal)
Wheeze
Chest pain
Fever
Hoarseness
Night sweats

COUGH AND SPUTUM

Cough is a common presenting respiratory symptom. It occurs when deep inspiration is followed by explosive expiration. Flow rates of air in the trachea approach the speed of sound during a forceful cough. Coughing enables the airways to be cleared of secretions and foreign bodies.

The duration of a cough is important (see Questions box 9.1). Find out when the cough first became a problem. A cough of recent origin, particularly if associated with fever and other symptoms of respiratory tract infection, may be due to acute bronchitis or pneumonia. A chronic cough (of more than 8 weeks duration) associated with wheezing may be due to asthma; sometimes asthma can present with just cough alone. A change in the character of a chronic cough may indicate the development of a new and serious underlying problem (e.g. infection or lung cancer).

Questions box 9.1

Questions to ask the patient with a cough
! denotes symptoms for the possible diagnosis of an urgent or dangerous problem.

1. How long have you had the cough?
2. Do you cough up anything? What? How much?
3. Have you had sinus problems?
! 4. Is the sputum clear or discoloured? Is there any blood in the sputum?
5. Have you had high temperatures?
6. Does coughing occur particularly at night (acid reflux)?
7. Have you become short of breath?
8. Have you had lung problems in the past?
9. Have you been a smoker? Do you still smoke?
10. Have you noticed wheezing? (Asthma, chronic obstructive pulmonary disease [COPD])?
11. Do you take any tablets? (e.g. ACE inhibitors)

A differential diagnosis of cough based on its character is shown in Table 9.1 and on its duration is shown in List 9.2.

A cough associated with a postnasal drip or sinus congestion or headaches may be due to the upper airway cough syndrome, which is the single most common cause of chronic cough. Although patients with this problem often complain of a cough, when asked to demonstrate their cough they do not cough but clear the throat. This annoys chest doctors (who feel their time is valuable) intensely.

An irritating, chronic dry cough can result from oesophageal reflux and acid irritation of the lungs. There is some controversy about these as causes of true cough. A similar dry cough may be a feature of late interstitial lung disease or associated with the use of the angiotensin-converting enzyme (ACE) inhibitors—drugs used in the treatment of hypertension and cardiac failure. Cough that wakes a patient from sleep may be a symptom of cardiac failure or of the reflux of acid from the oesophagus into the lungs that can occur when a person lies down.

TABLE 9.1 Differential diagnosis of cough based on its character

Origin	Character	Causes
Nasopharynx/larynx	Throat clearing, chronic	Postnasal drip, acid reflux
Larynx	Barking, painful, acute or persistent	Laryngitis, pertussis (whooping cough), croup
Trachea	Acute, painful	Tracheitis
Bronchi	Intermittent, sometimes productive, worse at night	Asthma
	Worse in morning	Chronic obstructive pulmonary disease (COPD)
	With blood	Bronchial malignancy
Lung parenchyma	Dry then productive	Pneumonia
	Chronic, very productive	Bronchiectasis
	Productive, with blood	Tuberculosis
	Irritating and dry, persistent	Interstitial lung disease
	Worse on lying down, sometimes with frothy sputum	Pulmonary oedema
ACE inhibitors	Dry, scratchy, persistent	Medication-induced

LIST 9.2 Differential diagnosis of cough based on its duration

Acute cough (<3 weeks duration): differential diagnosis

Upper respiratory tract infection
- Common cold, sinusitis

Lower respiratory tract infection
- Pneumonia, bronchitis, exacerbation of COPD
- Irritation—inhalation of bronchial irritant (e.g. smoke or fumes)

Chronic cough: differential diagnosis and clues

COPD—smoking history
Asthma—wheeze, relief with bronchodilators
Gastro-oesophageal reflux—occurs when lying down, burning central chest pain
Upper airway cough syndrome—history of rhinitis, postnasal drip, sinus headache and congestion
Bronchiectasis—chronic, very productive
ACE inhibitor medication—drug history
Carcinoma of the lung—smoking, haemoptysis
Cardiac failure—dyspnoea, PND
Psychogenic—variable, prolonged symptoms, usually mild

ACE = angiotensin-converting enzyme; COPD = chronic obstructive pulmonary disease; PND = paroxysmal nocturnal dyspnoea.

A chronic cough that is productive of large volumes of purulent sputum may be due to bronchiectasis.

Some patients feel the need to cough after an ectopic heartbeat. There may be an associated sensation of a missed heartbeat.

Patients' descriptions of their cough may be helpful. In children, a cough associated with inflammation of the epiglottis may have a muffled quality and cough related to viral croup is often described as 'barking'. Cough caused by tracheal compression by a tumour may be loud and brassy. Cough associated with recurrent laryngeal nerve palsy has a hollow sound because the vocal cords are unable to close completely; this has been described as a bovine cough. A cough that is worse at night is suggestive of asthma or heart failure, while coughing that comes on immediately after eating or drinking may be due to incoordinate swallowing or oesophageal reflux or, rarely, a tracheo-oesophageal fistula.

It is an important (though perhaps a somewhat unpleasant task) to enquire about the type of sputum produced and then to look at it, if it is available. Be warned that some patients have more interest in their sputum than others and may go into more detail than you really want. A large volume of purulent (yellow or green) sputum suggests the diagnosis of bronchiectasis or lobar pneumonia. Foul-smelling dark-coloured sputum may indicate the presence of a lung abscess with anaerobic organisms. Pink frothy secretions from the trachea, which occur in pulmonary oedema, should not be confused with sputum. It is best to rely on the patient's assessment of the taste of the sputum, which, not unexpectedly, is foul in conditions like bronchiectasis or lung abscess.

HAEMOPTYSIS

Haemoptysis (coughing up of blood) can be a sinister sign of lung disease (see Table 9.2) and must always be investigated. It must be distinguished

TABLE 9.2 Causes (differential diagnosis) of haemoptysis and typical histories

Respiratory	
Bronchitis	Small amounts of blood with sputum
Bronchial carcinoma	Frank blood, history of smoking, hoarseness
Bronchiectasis	Large amounts of sputum with blood
Pneumonia	Fever, recent onset of symptoms, dyspnoea
(The above four account for about 80% of cases)	
Pulmonary infarction	Pleuritic chest pain, dyspnoea
Cystic fibrosis	Recurrent infections
Lung abscess	Fever, purulent sputum
Tuberculosis (TB)	Previous TB, contact with TB, HIV-positive status
Foreign body	History of inhalation, cough, stridor
Goodpasture's* syndrome	Pulmonary haemorrhage, glomerulonephritis, antibody to basement membrane antigens
Wegener's granulomatosis	History of sinusitis, saddle-nose deformity
Systemic lupus erythematosus	Pulmonary haemorrhage, multisystem involvement
Rupture of a mucosal blood vessel after vigorous coughing	History of severe cough preceding haemoptysis
Cardiovascular	
Mitral stenosis (severe)	
Acute left ventricular failure	
Bleeding diatheses	

Note: Exclude spurious causes, such as nasal bleeding or haematemesis.
*Ernest W Goodpasture (1886–1960), pathologist at Johns Hopkins, Baltimore. He described this syndrome in 1919.

from haematemesis (vomiting of blood) and from nasopharyngeal bleeding (see Table 9.3).

Ask how much blood has been produced. Mild haemoptysis usually means less than 20 mL in 24 hours. It appears as streaks of blood discolouring sputum. Massive haemoptysis is more than 250 mL of blood in 24 hours and represents a medical emergency. Its most common causes are carcinoma, cystic fibrosis, bronchiectasis and tuberculosis.

BREATHLESSNESS (DYSPNOEA)

The awareness that an abnormal amount of effort is required for breathing is called dyspnoea. It can

TABLE 9.3 Features distinguishing haemoptysis from haematemesis and nasopharyngeal bleeding

Favours haemoptysis	Favours haematemesis	Favours nasopharyngeal bleeding
Mixed with sputum	Follows nausea	Blood appears in mouth
Occurs immediately after coughing	Mixed with vomitus; follows dry retching	

be due to respiratory or cardiac disease, or lack of physical fitness or sometimes to anxiety (see List 9.3). Careful questioning about the timing of onset, severity and pattern of dyspnoea is helpful in making the diagnosis (see Questions box 9.2 and List 9.4).[1] The patient may be aware of this only on heavy exertion or have much more limited exercise tolerance. Dyspnoea can be graded from I to IV based on the New York Heart Association classification:

Class I Disease present but no dyspnoea or dyspnoea only on heavy exertion.
Class II Dyspnoea on moderate exertion.
Class III Dyspnoea on minimal exertion.
Class IV Dyspnoea at rest.

It is more useful, however, to determine the amount of exertion that actually causes dyspnoea—that is, the distance walked or the number of steps climbed.

The association of dyspnoea with wheeze suggests *airways disease*, which may be due to asthma or chronic obstructive pulmonary disease (COPD; see List 9.5). The duration and variability of the dyspnoea are important. Dyspnoea that worsens progressively over a period of weeks, months or years may be due to *interstitial lung disease* (ILD). Dyspnoea of more rapid onset may be due to an *acute respiratory infection* (including bronchopneumonia or lobar pneumonia) or to *pneumonitis* (which may be infective or secondary to a hypersensitivity reaction). Dyspnoea that varies from day to day or even from hour to hour suggests a diagnosis of *asthma*. Dyspnoea of very rapid onset associated with sharp chest pain suggests a *pneumothorax* (see List 9.6). Dyspnoea that is described by the patient as inability to take a breath big enough to fill the lungs and associated with sighing suggests *anxiety*. Dyspnoea that occurs on moderate exertion may be due to the combination of *obesity* and a *lack of physical fitness* ('deconditioning'; a not uncommon occurrence).

WHEEZE

A number of conditions can cause a continuous whistling noise that comes from the chest (rather

LIST 9.3 Causes of dyspnoea

Respiratory
1. Airways disease
Chronic bronchitis and emphysema (chronic obstructive pulmonary disease [COPD])
Asthma
Bronchiectasis
Cystic fibrosis
Laryngeal or pharyngeal tumour
Bilateral cord palsy
Tracheal obstruction or stenosis
Tracheomalacia
Cricoarytenoid rheumatoid arthritis
2. Parenchymal disease
Interstitial lung diseases (diffuse parenchymal lung diseases, e.g. idiopathic pulmonary fibrosis, sarcoidosis, connective tissue disease, inorganic or organic dusts)
Diffuse infections
Acute respiratory distress syndrome (ARDS)
Infiltrative and metastatic tumour
Pneumothorax
Pneumoconiosis
3. Pulmonary circulation
Pulmonary embolism
Chronic thromboembolic pulmonary hypertension
Pulmonary arteriovenous malformation
Pulmonary arteritis
4. Chest wall and pleura
Effusion or massive ascites
Pleural tumour
Fractured ribs
Ankylosing spondylitis
Kyphoscoliosis
Neuromuscular diseases
Bilateral diaphragmatic paralysis

Cardiac
Left ventricular failure
Mitral valve disease
Cardiomyopathy
Pericardial effusion or constrictive pericarditis
Intra-cardiac shunt

Anaemia

Non-cardiorespiratory
Psychogenic
Acidosis (compensatory respiratory alkalosis)
Hypothalamic lesions

Questions box 9.2

Questions to ask the breathless patient
! denotes symptoms for the possible diagnosis of an urgent or dangerous problem.

1. How long have you been short of breath? Has it come on quickly?
2. How much exercise can you do before your shortness of breath stops you or slows you down? Can you walk up a flight of stairs?
3. ! Have you been woken at night by breathlessness or had to sleep sitting up? (Paroxysmal nocturnal dyspnoea [PND], orthopnoea)
4. Have you had heart or lung problems in the past?
5. ! Have you had a temperature?
6. Do you smoke?
7. ! Is there a feeling of tightness in the chest when you feel breathless? (Angina)
8. Do you get wheezy in the chest? Cough?
9. Is the feeling really one of difficulty getting a satisfying breath? (Anxiety)
10. Is it painful to take a big breath? (Pleurisy or pericarditis)
11. ! Did the shortness of breath come on very quickly or instantaneously? (Pulmonary embolus [very quick onset] or pneumothorax [instantaneous onset])
12. Are you often short of breath when you are anxious? Do you feel numbness and tingling around your lips when you are breathless? (Hyperventilation associated with anxiety)

LIST 9.4 Differential diagnosis of dyspnoea based on time course of onset

Seconds to minutes—favours:
Asthma
Pulmonary embolism
Pneumothorax
Pulmonary oedema
Anaphylaxis
Foreign body causing airway obstruction

Hours or days—favours:
Exacerbation of chronic obstructive pulmonary disease (COPD)
Cardiac failure
Asthma
Respiratory infection
Pleural effusion
Metabolic acidosis

Weeks or longer—favours:
Pulmonary fibrosis
COPD
Interstitial lung disease
Pleural effusion
Anaemia

than the throat) during breathing. These include asthma or COPD, infections such as bronchiolitis and airways obstruction by a foreign body or tumour. Wheeze is usually maximal during expiration and is accompanied by prolonged expiration. This must be differentiated from *stridor* (see below), which can have a similar sound, but is loudest over the trachea and occurs during inspiration.

CHAPTER 10

The respiratory examination

More would I, but my lungs are wasted so,
That strength of speech is utterly denied me.

William Shakespeare, *Henry IV, Part 2*

Examination anatomy

The **lungs** are paired asymmetrical organs protected by the cylinder composed of the ribs, vertebrae and diaphragm. The surface of the lungs is covered by the visceral **pleura**, a thin membrane, and a similar outer layer (the parietal pleura) lines the rib cage. These membranes are separated by a thin layer of fluid and enable the lungs to move freely during breathing. Various diseases of the lungs and of the pleura themselves, including infection and malignancy, can cause accumulation of fluid within the pleural cavity (a pleural effusion).

The heart, trachea, oesophagus and the great blood vessels and nerves sit between the lungs and make up the structure called the **mediastinum**. The left and right pulmonary arteries supply their respective lung. Gas exchange occurs in the pulmonary capillaries that surround the alveoli, the tiny air sacs which lie beyond the terminal bronchioles. Oxygenated blood is returned via the pulmonary veins to the left atrium. Abnormalities of the pulmonary circulation such as raised pulmonary venous pressure resulting from heart failure or pulmonary hypertension can interfere with gas exchange.

The position of the heart, whose apex points to the left, means that the **left lung** is smaller than the right and has only two lobes, which are separated by the oblique fissure. The **right lung** has both horizontal (upper) and oblique (lower) fissures dividing it into three lobes (see Figure 10.1).

The muscles of respiration are the **diaphragm** upon which the bases of the lungs rest and the **intercostal muscles**. During inspiration, the diaphragm flattens and the intercostal muscles contract to elevate the ribs. Intrathoracic pressure falls as air is forced under atmospheric pressure into the lungs. Expiration is a passive process resulting from elastic recoil of the muscles. Abnormalities of lung function or structure may change the normal anatomy and physiology of respiration, for example as a result of over-inflation of the lungs (chronic obstructive pulmonary disease [COPD]. Muscle and neurological diseases can also affect muscle function adversely, and abnormalities of the control of breathing in the respiratory centres of the brain in the pons and medulla can interfere with normal breathing patterns.

During the respiratory examination, keep in mind the **surface anatomy** (see Figure 10.2) of the lungs and try to decide which lobes are affected.

Positioning the patient

The patient should be undressed to the waist.[1] Women should wear a gown or have a towel or some clothing to cover their breasts when the front of the chest is not being examined. If the patient is not acutely ill, the examination is easiest to perform with him or her sitting over the edge of the bed or on a chair.

General appearance

If the patient is an inpatient in hospital, look around the bed for oxygen masks, metered dose inhalers (puffers) and other medications, and the presence of a sputum mug. Then make a deliberate point of looking for the following signs before beginning the detailed examination.

DYSPNOEA

Watch the patient for signs of dyspnoea at rest. Count the respiratory rate; the normal rate at rest should not exceed 25 breaths per minute (range 16–25). The frequently quoted normal value of 14 breaths per minute is probably too low; normal people can

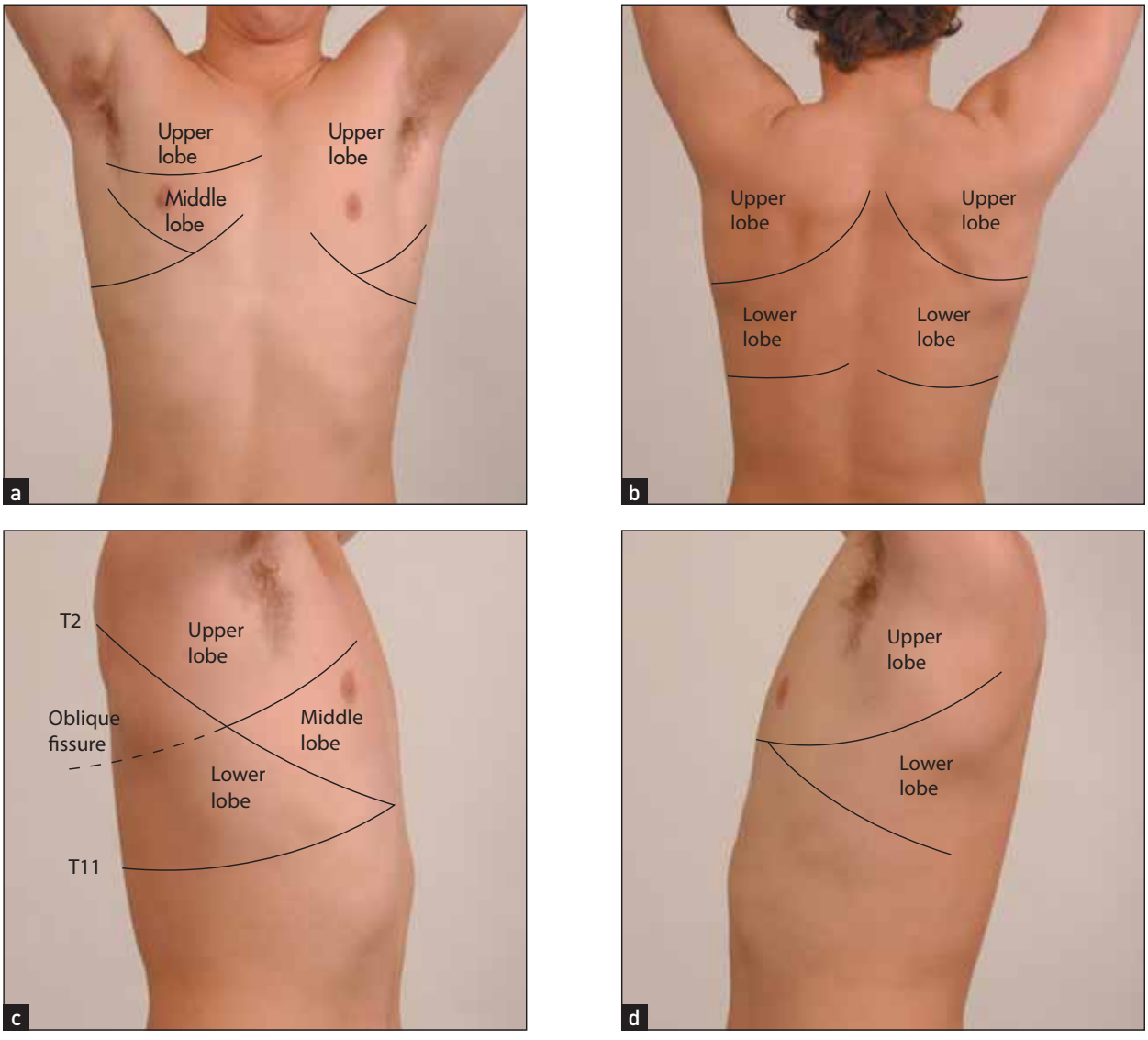


Figure 10.1 Lobes of the lung
(a) Anterior; (b) posterior; (c) lobes of the right lung; (d) lobes of the left lung. Refer to Figure 12.4, page 165, for a list of the segments in each lobe.
(Courtesy of Glenn McCulloch)

have a respiratory rate of up to 25, and the average is 20 breaths per minute. It is traditional to count the respiratory rate surreptitiously while affecting to count the pulse. The respiratory rate is the only vital sign that is under direct voluntary control. *Tachypnoea* refers to a rapid respiratory rate of greater than 25. *Bradypnoea* is defined as a rate below 8, a level associated with sedation and adverse prognosis. In normal relaxed breathing, the diaphragm is the only active muscle and is active only in inspiration; expiration is a passive process.

CHARACTERISTIC SIGNS OF COPD

Look to see whether the accessory muscles of respiration are being used. This is a sign of an increase in the work of breathing, and COPD[a] is an important cause. These muscles include the sternocleidomastoids, the platysma and the strap muscles of the neck. Characteristically, the accessory muscles cause elevation of the shoulders with inspiration, and aid respiration by increasing chest expansion. Contraction of the abdominal muscles

[a] This condition has undergone many changes in nomenclature, and it is pleasing to think that chest doctors have something to keep them occupied. The term COPD encompasses emphysema, chronic bronchitis, chronic obstructive lung disease (COLD) and chronic airflow limitation (CAL). This term seems quite firmly established (at least for now). The diagnosis of COPD depends on clinical, radiographic and lung function assessment. There may be components of what used to be called chronic bronchitis and emphysema.

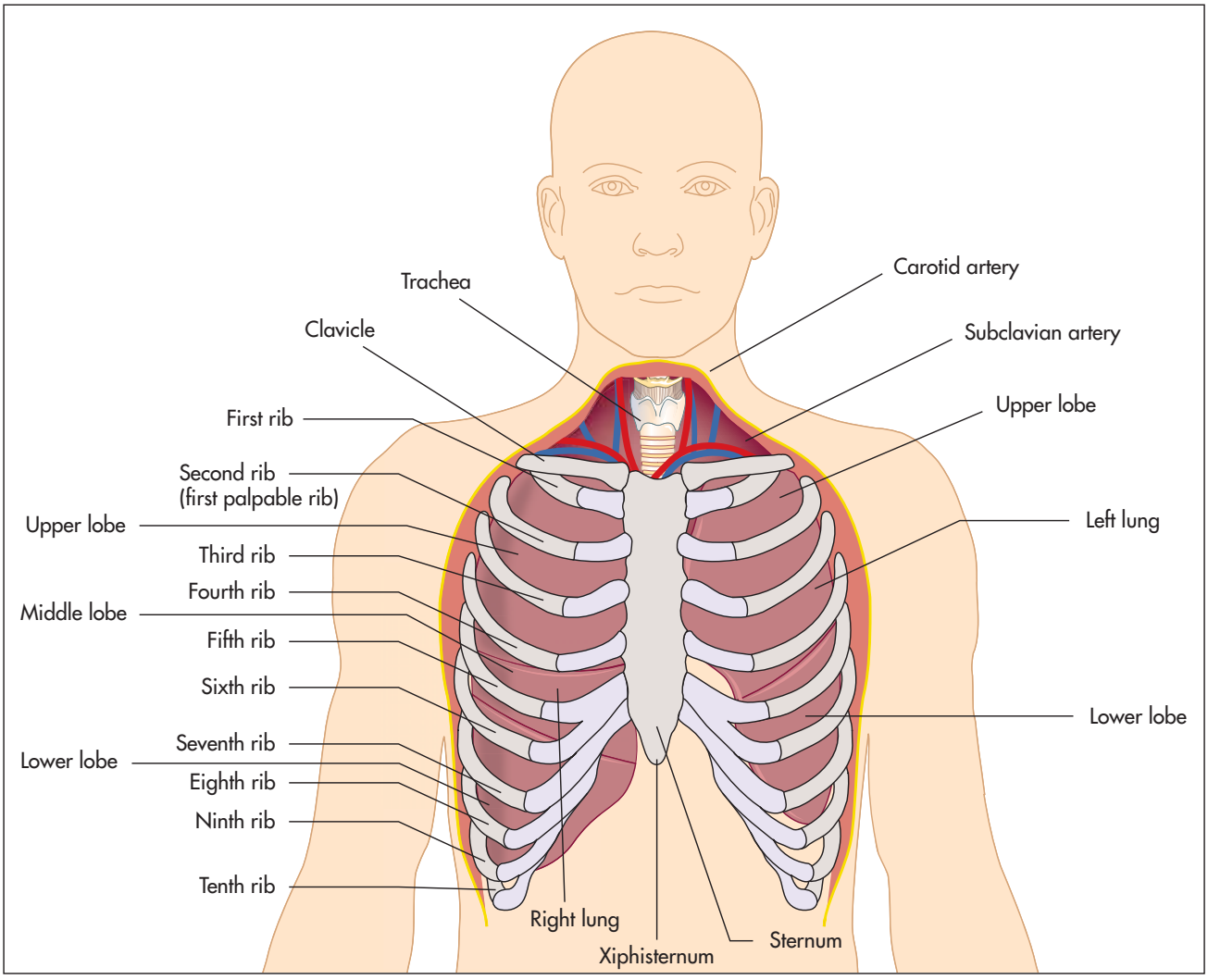


Figure 10.2 Basic anatomy of the lungs

may occur in expiration in patients with obstructed airways. Patients with severe COPD often have in-drawing of the intercostal and supraclavicular spaces during inspiration. This is due to a delayed increase in lung volume despite the generation of large negative pleural pressures.

In some cases, the pattern of breathing is diagnostically helpful (see Table 9.4, page 134). Look for pursed-lips breathing, which is characteristic of patients with severe COPD. This manoeuvre reduces the patient's breathlessness, possibly by providing continuous positive airways pressure and helping to prevent airways collapse during expiration. Patients with severe COPD may feel more comfortable leaning forwards with their arms on their knees. This position compresses the abdomen and pushes the diaphragm upwards. This partly restores its normal domed shape and improves its effectiveness during inspiration. Increased diaphragmatic movements may cause downward displacement of the trachea during inspiration—tracheal tug (this is also a sign of severe asthma, especially in children).[b]

CYANOSIS

Central cyanosis is best detected by inspecting the tongue. Examination of the tongue differentiates central from peripheral cyanosis. Lung disease severe enough to result in significant ventilation–perfusion imbalance (such as pneumonia, COPD and pulmonary embolism), may cause reduced arterial oxygen saturation and central cyanosis. Cyanosis becomes evident when the absolute concentration of deoxygenated haemoglobin is

[b] When the trachea moves in time with the pulse, the sign suggests an aneurysm of the thoracic aorta—this is the original meaning of *tracheal tug*. Its appropriation by the chest doctors annoys those aware of its original meaning.

50 g/L of capillary blood. Cyanosis is usually obvious when the arterial oxygen saturation falls below 90% in a person with a normal haemoglobin level. Central cyanosis is therefore a sign of severe hypoxaemia. In patients with anaemia, cyanosis does not occur until even greater levels of arterial desaturation are reached. The absence of obvious cyanosis does not exclude hypoxia. The detection of cyanosis is much easier in good (especially fluorescent) lighting conditions and is said to be more difficult if the patient's bed is surrounded by cheerful pink curtains.

CHARACTER OF THE COUGH

Coughing is a protective response to irritation of sensory receptors in the submucosa of the upper airways or bronchi. Ask the patient to cough several times. *Lack of the usual explosive beginning* may indicate vocal cord paralysis (the 'bovine' cough). A *muffled, wheezy, ineffective cough* suggests obstructive pulmonary disease. A *very loose productive cough* suggests excessive bronchial secretions due to chronic bronchitis, pneumonia or bronchiectasis. A *dry, irritating cough* may occur with chest infection, asthma or carcinoma of the bronchus and sometimes with left ventricular failure or interstitial lung disease (ILD). It is also typical of the cough produced by ACE inhibitor drugs. A *barking* or *croupy cough* may suggest a problem with the upper airway—the pharynx and larynx, or pertussis infection.

SPUTUM

Sputum should be inspected. Careful study of the sputum is an essential part of the physical examination. The colour, volume and type (purulent, mucoid or mucopurulent), and the presence or absence of blood, should be recorded.

STRIDOR

Obstruction of the larynx or trachea (the extra-thoracic airways) may cause stridor, a rasping or croaking noise loudest on inspiration. This can be due to a foreign body, a tumour, infection (e.g. epiglottitis) or inflammation (see List 10.1). It is a sign that requires urgent attention.

HOARSENESS

Listen to the patient's voice for hoarseness (dysphonia), as this may indicate recurrent laryngeal nerve palsy associated with carcinoma of the lung (usually left-sided), or laryngeal carcinoma. However, the most common cause is laryngitis and the use of inhaled corticosteroids for asthma. Non-respiratory causes include hypothyroidism.

LIST 10.1 Important causes of stridor in adults

Sudden onset (minutes)
Anaphylaxis
Toxic gas inhalation
Acute epiglottitis
Inhaled foreign body

Gradual onset (days, weeks)
Laryngeal or pharyngeal tumours
Cricoarytenoid rheumatoid arthritis
Bilateral vocal cord palsy
Tracheal carcinoma
Paratracheal compression by lymph nodes
Post-tracheostomy or intubation granulomata

Hands

As usual, examination in detail begins with the hands.

CLUBBING

Look for clubbing, which is due to respiratory disease in up to 80% of cases (see Figure 10.3 and List 5.1 on page 62). An uncommon but important association with clubbing is *hypertrophic pulmonary osteoarthropathy* (HPO). HPO is characterised by the presence of periosteal inflammation at the distal ends of long bones, the wrists, the ankles and the metacarpal and the metatarsal bones. There is swelling and tenderness over the wrists and other involved areas. Rarely HPO may occur without clubbing. The causes of HPO include primary lung carcinoma and pleural fibromas. It is important to note that clubbing does not occur as a result of COPD.

STAINING

Look for staining of the fingers (actually caused by tar, as nicotine is colourless); a sign of cigarette smoking (see Figure 3.12 on page 36). The density of staining does not indicate the number of cigarettes

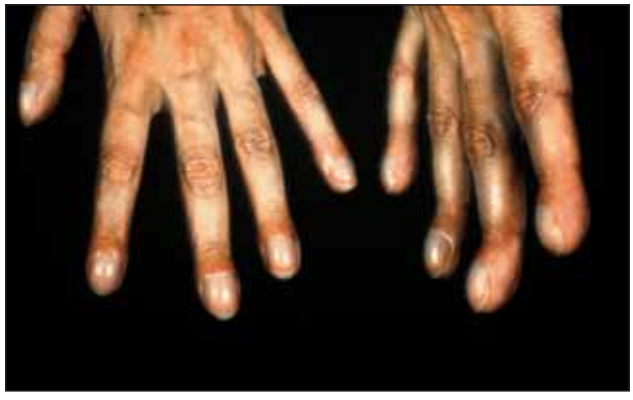


Figure 10.3 Finger clubbing

CHAPTER 11

Correlation of physical signs and respiratory disease

Life cannot bee maintained without respiration, neither can respiration bee performed without motion.

Crooke, *Body of Man* (1615)

Respiratory distress: respiratory failure

A severe respiratory illness may be a medical emergency. Many of the respiratory illnesses discussed below and some non-respiratory illnesses (see List 11.1) can result in acute respiratory problems and it is important to recognise signs that suggest there is an urgent problem. These signs include:

- cyanosis or low SpO_2 on oximetry
- use of accessory muscles of respiration
- inability to speak
- greatly increased or reduced respiratory rate
- signs of exhaustion
- silent lung fields
- stridor (airway obstruction)
- drowsiness
- chest injury
- tachycardia
- pulsus paradoxus.

There may be signs of an underlying respiratory illness (see Table 11.1).

LIST 11.1 Causes of acute respiratory distress or failure

Lung disease
COPD or asthma
Very large pleural effusion
Pneumonia
Non-cardiogenic pulmonary oedema (e.g. from toxic gas inhalation)
Pulmonary embolism
Chest injury or pneumothorax

Airways obstruction
Inhaled foreign body
Facial or neck injury
Angio-oedema
Epiglottis or quinsy
Unconsciousness and aspiration—loss of airway protecting reflexes

Non-respiratory causes
Anaemia
Diabetic ketoacidosis
Anxiety and hyperventilation

Consolidation (lobar pneumonia)

Pneumonia is defined as inflammation of the lung that is characterised by exudation into the alveoli (see Good signs guide 11.1). X-ray changes of new shadowing in one or more lung segments (lobes) are present. Pneumonia is now classified as:

1. community-acquired (CAP)
2. hospital-acquired
3. occurring in a damaged lung (e.g. as a result of aspiration)
4. occurring in an immunocompromised host.

This classification allows prediction of the likely pathogens and assists in the choice of antibiotics for treatment. The signs of lobar pneumonia are characteristic and are referred to clinically as *consolidation*.[1]

There may be a history of the sudden onset of malaise, chest pain, dyspnoea and fever. Patients may appear very ill and the vital signs—including the temperature, respiratory rate and blood pressure—must be recorded. There may be signs of cyanosis and exhaustion in sick patients. The term *bronchopneumonia* refers to lung infection characterised by more patchy X-ray changes that often affect both lower lobes. The clinical signs of consolidation may be absent.

TABLE 11.1 Comparison of the chest signs in common respiratory disorders

Disorder	Mediastinal displacement	Chest wall movement	Percussion note	Breath sounds	Added sounds
Consolidation	None	Reduced over affected area	Dull	Bronchial	Crackles
Collapse	Ipsilateral shift	Decreased over affected area	Dull	Absent or reduced	Absent
Pleural effusion	Heart displaced to opposite side (trachea displaced only if massive)	Reduced over affected area	Stony dull	Absent over fluid; may be bronchial at upper border	Absent; pleural rub may be found above effusion
Pneumothorax	Tracheal deviation to opposite side if under tension	Decreased over affected area	Resonant	Absent or greatly reduced	Absent
Bronchial asthma	None	Decreased symmetrically	Normal or decreased	Normal or reduced	Wheeze
Interstitial pulmonary fibrosis	None	Decreased symmetrically (minimal)	Normal unaffected by cough or posture	Normal	Fine, late or pan-inspiratory crackles over affected lobes

SYMPTOMS

- Cough (painful and dry at first).
- Fever and rigors (shivers).
- Pleuritic chest pain.
- Dyspnoea.
- Tachycardia.
- Confusion.

GOOD SIGNS GUIDE 11.1
Pneumonia

Sign	LR+	LR–
General appearance		
Dementia	4.0	NS
Vital signs	3.4	0.94
Temperature >37.8°C	2.4	0.58
Respiratory rate >25/minute	1.5	0.8
Heart rate		
>100 beats/minute	2.3	0.49
Lung findings		
Percussion dullness	4.3	0.79
Reduced breath sounds	2.5	0.6
Bronchial breath sounds	3.5	0.9
Aegophony	5.3	0.76
Crackles	3.5	0.62
Wheezes	1.4	0.76

NS = not significant.
(Heckerling PS, Tape TG et al. Clinical prediction rule for pulmonary infiltrates. *Ann Intern Med* 1990; 113(9):664–670.)

SIGNS

- **Expansion:** reduced on the affected side.
- **Vocal fremitus:** increased on the affected side (in other chest disease this sign is of very little use!).
- **Percussion:** dull, but not stony dull.
- **Breath sounds:** bronchial.
- **Additional sounds:** medium, late or pan-inspiratory crackles as the pneumonia resolves.
- **Vocal resonance:** increased.
- **Pleural rub:** may be present.

CAUSES OF COMMUNITY-ACQUIRED PNEUMONIA

- *Streptococcus pneumoniae* (>30%).
- *Chlamydia pneumoniae* (10%).
- *Mycoplasma pneumoniae* (10%).
- *Legionella pneumoniae* (5%).

Atelectasis (collapse)

If a bronchus is obstructed by a tumour mass, retained secretions or a prolonged presence of a foreign body, the air in the part of the lung supplied by the bronchus is absorbed and the affected part of the lung collapses.

SIGNS

- **Trachea:** displaced towards the collapsed side.
- **Expansion:** reduced on the affected side with flattening of the chest wall on the same side.
- **Percussion:** dull over the collapsed area.

- **Breath sounds:** reduced, often without bronchial breathing above the area of atelectasis when a tumour is the cause, because the airways are not patent.

Note: (1) There may be no signs with complete lobar collapse. (2) The early changes after the inhalation of a foreign body may be over-inflation of the affected side.

CAUSES

- **Intraluminal:** mucus (e.g. postoperative, asthma, cystic fibrosis), foreign body, aspiration.
- **Mural:** bronchial carcinoma.
- **Extramural:** peribronchial lymphadenopathy, aortic aneurysm.

Pleural effusion

This is a collection of fluid in the pleural space. Note that pleural collections consisting of blood (haemothorax), chyle (chylothorax) or pus (empyema) have specific names and are not called pleural effusions, although the physical signs are similar.

SIGNS

- **Trachea and apex beat:** displaced away from a massive effusion.
- **Expansion:** reduced on the affected side.
- **Percussion:** stony dullness over the fluid.
- **Breath sounds:** reduced or absent. There may be an area of bronchial breathing audible above the effusion due to compression of overlying lung.
- **Vocal resonance:** reduced.

CAUSES

- **Transudate** (Light's criteria): (1) cardiac failure; (2) hypoalbuminaemia from the nephrotic syndrome or chronic liver disease; (3) hypothyroidism.
- **Exudate** (Light's criteria[a]): (1) pneumonia; (2) neoplasm—bronchial carcinoma, metastatic carcinoma, mesothelioma; (3) tuberculosis; (4) pulmonary infarction; (5) subphrenic abscess; (6) acute pancreatitis; (7) connective tissue disease such as rheumatoid arthritis, systemic lupus erythematosus; (8) drugs such as methysergide, cytotoxics; (9) irradiation; (10) trauma; (11) Meigs' syndrome[b] (ovarian fibroma causing pleural effusion and ascites).
- **Haemothorax** (blood in the pleural space): (1) severe trauma to the chest; (2) rupture of a pleural adhesion containing a blood vessel.
- **Chylothorax** (milky-appearing pleural fluid due to leakage of lymph): (1) trauma or surgery to the thoracic duct; (2) carcinoma or lymphoma involving the thoracic duct.
- **Empyema** (pus in the pleural space): (1) pneumonia; (2) lung abscess; (3) bronchiectasis; (4) tuberculosis; (5) penetrating chest wound.

YELLOW NAIL SYNDROME

This is a rare condition that is caused by hypoplasia of the lymphatic system. The nails are thickened and yellow (see Figure 11.1) and there is separation of the distal nail plate from the nail bed (onycholysis). It may be associated with a pleural effusion and bronchiectasis, and usually with lymphoedema of the legs.

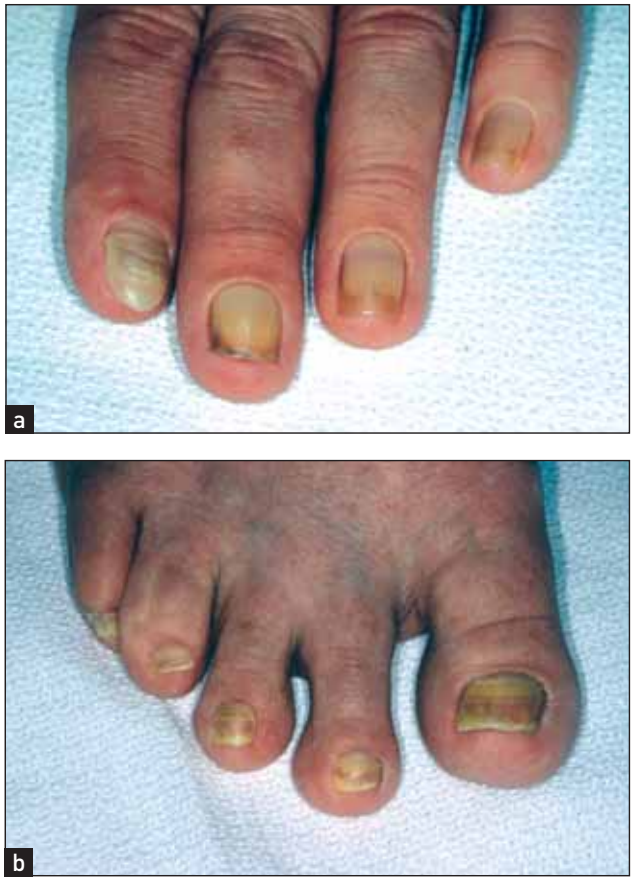


Figure 11.1 Yellow nail syndrome: (a) hands; (b) feet (From McDonald FS, ed. *Mayo Clinic images in internal medicine*, with permission. © Mayo Clinic Scientific Press and CRC Press.)

[a] The formal definition of an exudate is that the fluid has at least one of the following (Light's) criteria; (1) fluid protein/serum protein >0.5; (2) pleural fluid LDH/serum LDH >0.6; (3) pleural fluid LDH >2/3 normal upper limit of LDH in serum. The fluid is otherwise a transudate.

[b] Joe Vincent Meigs (1892–1963), Professor of Gynaecology at Harvard, described this in 1937.

Pneumothorax

Leakage of air from the lung or a chest wall puncture into the pleural space causes a pneumothorax.

SIGNS

- **Expansion:** reduced on the affected side.
- **Percussion:** hyperresonance if the pneumothorax is large.
- **Breath sounds:** greatly reduced or absent.
- There may be subcutaneous emphysema.
- There may be no signs if the pneumothorax is small (less than 30%).

CAUSES

Primary

- **'Spontaneous':** subpleural bullae rupture, usually in tall, healthy young males.

Secondary

- **Traumatic:** rib fracture, penetrating chest wall injury, or during pleural or pericardial aspiration.
- **Iatrogenic**[c] (caused by medical intervention): following the insertion of a central venous catheter.
- Emphysema with rupture of bullae, usually in middle-aged or elderly patients with generalised emphysema.
- Rarer causes include asthma, lung abscess, bronchial carcinoma, eosinophilic granuloma, lymphangioleiomyomatosis (LAM—pre-menopausal women), end-stage fibrosis or Marfan's syndrome.

Tension pneumothorax

This occurs when there is a communication between the lung and the pleural space, with a flap of tissue acting as a valve, allowing air to enter the pleural space during inspiration and preventing it from leaving during expiration. A tension pneumothorax results from air accumulating under increasing pressure in the pleural space; it causes considerable displacement of the mediastinum with obstruction and kinking of the great vessels, and represents a medical emergency.

SIGNS

- The patient is often tachypnoeic and cyanosed, and may be hypotensive.
- **Trachea and apex beat:** displaced away from the affected side.
- **Expansion:** reduced or absent on affected side.
- **Percussion:** hyperresonant over the affected side.
- **Breath sounds:** absent.
- **Vocal resonance:** absent.

CAUSES

- Trauma.
- Mechanical ventilation at high pressure.
- Spontaneous (rare cause of tension pneumothorax).

Bronchiectasis

This is a pathological dilation of the bronchi, resulting in impaired clearance of mucus and chronic infection. A history of chronic cough and purulent sputum since childhood is virtually diagnostic.

SIGNS

Most likely during an exacerbation of the condition.

- **Systemic signs:** fever, cachexia; sinusitis (70%).
- **Sputum:** voluminous, purulent, foul-smelling, sometimes bloodstained.
- **Breath sounds:** Coarse pan-inspiratory or late inspiratory crackles over the affected lobe.
- **Signs of severe bronchiectasis:** very copious amounts of sputum and haemoptysis, clubbing, cyanosis, widespread crackles, signs of airways obstruction, signs of respiratory failure and cor pulmonale, signs of secondary amyloidosis (e.g. oedema from proteinuria, cardiac failure, enlarged liver and spleen, carpal tunnel syndrome).

CAUSES

- **Congenital:** (1) primary ciliary dyskinesia (including the immotile cilia syndrome); (2) cystic fibrosis; (3) congenital hypogammaglobulinaemia.
- **Acquired:** (1) infections in childhood, such as whooping cough, pneumonia or measles; (2) localised disease such as a foreign body, a bronchial adenoma or tuberculosis; (3) allergic bronchopulmonary aspergillosis—this causes proximal bronchiectasis.

Bronchial asthma

This may be defined as paroxysmal recurrent attacks of wheezing (or in childhood of cough) due to airways narrowing, which changes in severity over short periods of time.

[c] *Iatros* means physician in Greek.

CHAPTER 12

A summary of the respiratory examination and extending the respiratory examination

Investigation; the act of the mind by which unknown truths are discovered.
Samuel Johnson, *A Dictionary of the English Language* (1775)

TEXT BOX 12.1 The respiratory examination: a suggested method

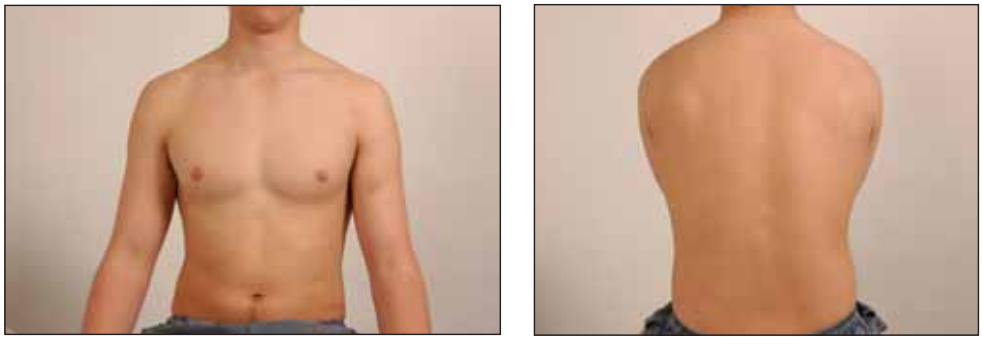


Figure 12.1 Respiratory system
(Courtesy of Glenn McCulloch)

Sitting up (if not acutely ill)

1. **General inspection**
   - Sputum mug contents (blood, pus etc)
   - Type of cough
   - Rate and depth of respiration, and breathing pattern at rest
   - Accessory muscles of respiration
2. **Hands**
   - Clubbing
   - Cyanosis (peripheral)
   - Nicotine staining
   - Wasting, weakness—finger abduction and adduction (lung cancer involving the brachial plexus)
   - Wrist tenderness (hypertrophic pulmonary osteoarthropathy)
   - Pulse (tachycardia, pulsus paradoxus)
   - Flapping tremor (CO_2 narcosis)
3. **Face**
   - Eyes—Horner's syndrome (apical lung cancer), anaemia
   - Mouth—central cyanosis
   - Voice—hoarseness (recurrent laryngeal nerve palsy)
   - Facial plethora—smoker, SVC obstruction
4. **Trachea**
5. **Chest posteriorly**
   - *Inspect*
   - Shape of chest and spine
   - Scars
   - Prominent veins (determine direction of flow)
   - *Palpate*
   - Cervical lymph nodes
   - Expansion
   - Vocal fremitus
   - *Percuss*
   - Supraclavicular region
   - Back
   - Axillae
   - Tidal percussion (diaphragm paralysis)
   - *Auscultate*
   - Breath sounds
   - Adventitious sounds
   - Vocal resonance

continues

TEXT BOX 12.1 The respiratory examination: a suggested method *continued*

6. Chest anteriorly
Inspect
Radiotherapy marks, other signs as noted above
Palpate
Supraclavicular nodes
Expansion
Vocal fremitus
Apex beat
Percuss
Auscultate
Pemberton's sign (SVC obstruction)

7. Cardiovascular system (lying at 45°)
Jugular venous pressure (SVC obstruction etc)
Cor pulmonale
8. Forced expiratory time
9. Other
Lower limbs—oedema, cyanosis
Breasts
Temperature chart (infection)
Evidence of malignancy or pleural effusion: examine the breasts, abdomen, rectum, lymph nodes etc
Respiratory rate after exercise

Ask the patient to undress to the waist (provide women with a gown) and to sit over the side of the bed. In the clinic or surgery the examination can often be performed with the patient sitting on a chair. While standing back to make your usual **inspection** (does the patient appear breathless while walking into the room or undressing?), ask if sputum is available for inspection. Purulent sputum always indicates respiratory infection, and a large volume of purulent sputum is an important clue to bronchiectasis. Haemoptysis is also an important sign. Look for dyspnoea at rest and count the respiratory rate. Note any paradoxical inward motion of the abdomen during inspiration (diaphragmatic paralysis). Look for use of the accessory muscles of respiration, and any intercostal in-drawing of the lower ribs anteriorly (a sign of emphysema). General cachexia should also be noted.

Pick up the patient's **hands**. Look for clubbing, peripheral cyanosis, tar staining and anaemia. Note any wasting of the small muscles of the hands and weakness of finger abduction (lung cancer involving the brachial plexus). Palpate the wrists for tenderness (hypertrophic pulmonary osteoarthropathy). While holding the patient's hand, palpate the radial pulse for obvious pulsus paradoxus. Take the blood pressure if indicated.

Go on to the **face**. Look closely at the eyes for constriction of one of the pupils and for ptosis (Horner's syndrome from an apical lung cancer). Inspect the tongue for central cyanosis.

Palpate the position of the **trachea**. This is an important sign, so spend time on it. If the trachea is displaced, you must concentrate on the upper lobes for physical signs. Also look and feel for a tracheal tug, which indicates severe airflow obstruction, and feel for the use of the accessory muscles. Now ask the patient to speak (hoarseness) and then cough, and note whether this is a loose cough, a dry cough or a bovine cough. Next measure the forced expiratory time (FET).[a] Tell the patient to take a maximal inspiration and blow out as rapidly and forcefully as possible while you listen. Note audible wheeze and prolongation of the time beyond 3 seconds as evidence of chronic obstructive pulmonary disease.[1]

The next step is to examine the **chest**. You may wish to examine the front first, or go to the back to start. The advantage of the latter is that there are often more signs there, unless the trachea is obviously displaced.

Inspect the **back**. Look for kyphoscoliosis. Do not miss ankylosing spondylitis, which causes decreased chest expansion and upper lobe fibrosis. Look for thoracotomy scars and prominent veins. Also note any skin changes from radiotherapy.

Palpate first from behind for the cervical nodes. Then examine for expansion—first upper lobe expansion, which is best seen by looking over the patient's shoulders at clavicular movement during moderate respiration. The affected side will show a delay or decreased movement. Then examine lower lobe expansion by palpation. Note asymmetry and reduction of movement.

Now ask the patient to bring his or her elbows together in the front to move the scapulae out of the way. Examine for vocal fremitus and then **percuss** the back of the chest.

Auscultate the chest. Note breath sounds (whether normal or bronchial) and their intensity (normal or reduced). Listen for adventitious sounds (crackles and wheezes). Finally examine for vocal resonance. If a localised abnormality is found, try to determine the abnormal lobe and segment.

Return to the **front of the chest**. Inspect again for chest deformity, distended veins, radiotherapy changes and scars. Palpate the supraclavicular nodes carefully. Then proceed with percussion and auscultation as before. Listen high up in the axillae too. Before leaving the chest feel the axillary nodes and examine the breasts (see Chapter 36).

Lay the patient down at 45° and measure the jugular venous pressure. Then examine the praecordium and lower limbs for signs of cor pulmonale. Finally examine the **liver** and take the **temperature**.

Remember that most respiratory examinations are 'targeted'. Not every part of the examination is necessary for every patient.

[a] There is good correlation between clinicians for the results of this test: κ value 0.7. It is most accurate if performed with a stopwatch.

Extending the respiratory physical examination

BEDSIDE ASSESSMENT OF LUNG FUNCTION

Forced expiratory time

Physical examination can be complemented with an estimate of the forced expiratory time (FET).[1] Measure the time taken by the patient to exhale forcefully and completely through the open mouth after taking a maximum inspiration. It may be necessary to demonstrate this to the patient. The normal forced expiratory time is 3 seconds or less. Note any audible wheeze or cough. An increased FET indicates airways obstruction. The combination of a significant smoking history and an FET of 9 seconds or more is predictive of COPD (positive LR 9.6).[2] A peak flow meter or spirometer, however, will provide a more accurate measurement of lung function.

Peak flow meter

A peak flow meter is a simple gauge that is used to measure the maximum flow rate of expired air. Again the patient is asked to take a full breath in, but rather than a prolonged expiration, a rapid forced maximal expiratory puff is made through the mouth.[b] The value obtained (the peak expiratory flow [PEF]) depends largely on airways diameter. Normal values are approximately 600 litres per minute for young men and 400 litres per minute for young women. The value depends on age, sex and height, so tables of normal values should be consulted. Airways obstruction, such as that caused by asthma or COPD, results in a reduced and variable PEF. It is a simple way of assessing and following patients with airways obstruction, but is rather effort-dependent. The PEF is most useful when used for serial estimates of lung function.

Spirometry

The spirometer records graphically or numerically the forced expiratory volume and the forced vital capacity (see Figure 12.2). The *forced expiratory volume* (FEV) is the volume of air expelled from the lungs after maximum inspiration using maximum forced effort, and is measured in a given time.[c] Usually this is 1 second (FEV_1). The *forced vital capacity* (FVC) is the total volume of air expelled from the lungs after maximum inspiratory effort followed by maximum forced expiration. The FVC is often nearly the same as the vital capacity, but in airways obstruction it may be less because of premature airways closure. It is usual to record the best of three attempts and to calculate the FEV_1/FVC ratio as a percentage. In healthy youth, the normal value is 80%, but this may decline to as little as 60% in old age. Normal values also vary with sex, age, height and race.

Reversibility of a reduced FEV_1/FVC after the use of bronchodilators is an important test for distinguishing asthma from COPD.

Obstructive ventilatory defect

When the FEV_1/FVC ratio is reduced (<0.7) this is referred to as an obstructive defect. Both values tend to be reduced, but the FEV_1 is disproportionately low. The causes are loss of elastic recoil or airways narrowing, as in asthma or COPD.

Restrictive ventilatory defect

When the FEV_1/FVC ratio is normal or higher than normal, but both values are reduced, the pattern is described as a restrictive defect. This occurs in parenchymal lung disease, such as ILD, sarcoidosis or when lung expansion is reduced by pneumonia o chest wall abnormalities.

[b] Students are advised to practise this so as to be able to demonstrate it without embarrassment.

[c] Ask the patient to breathe in as far as possible and then to breathe out as hard and fast as possible until the lungs are apparently empty.

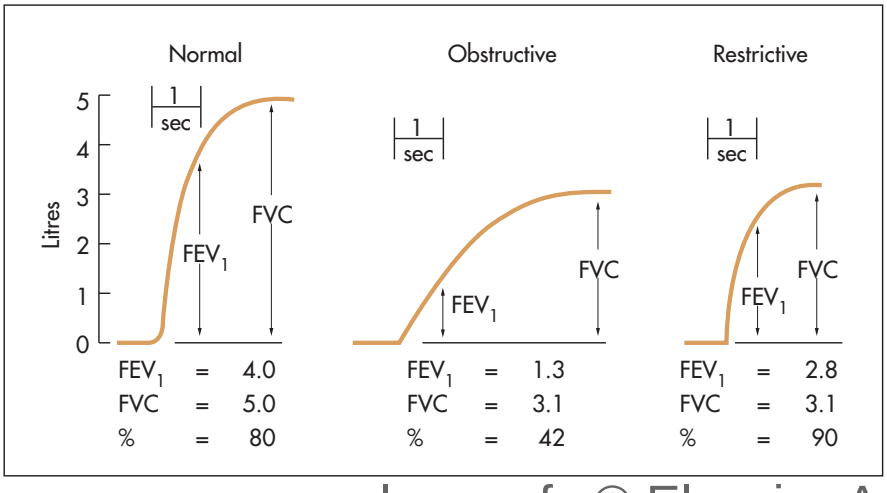


Figure 12.2 Spirometry tracings

Flow volume curve

As a part of spirometric assessment, the flow volume curve may be measured using a portable electronic device. This measures expiratory and inspiratory flow as a function of exhaled volume rather than against time. It is a simple and reproducible test easily performed in the respiratory laboratory or at the bedside. The FVC, FEV_1 and various flow measurements (e.g. peak flow) can be calculated from the curve (see Figure 12.3).

Pulse oximetry

Continuous measurement of a patient's arterial blood oxygen saturation (SpO_2) is now possible with readily available oximetry devices. These simple devices can be used as an extension of the physical examination,

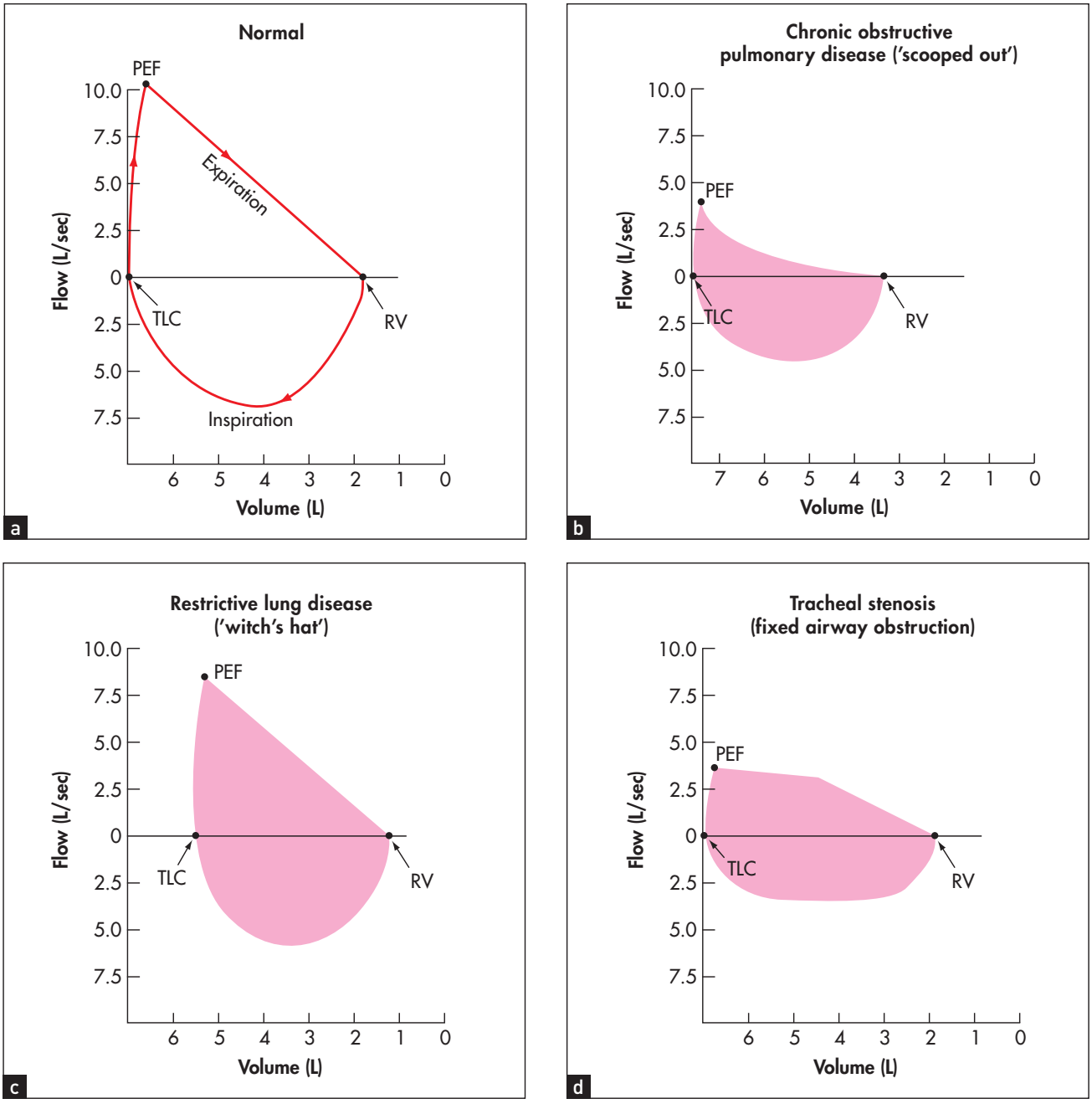


Figure 12.3 Flow volume curves

Look at the shape of the loop in each case ((a) to (d)). A normal flow volume curve is convex and symmetrical. In chronic obstructive lung disease (COPD), all flow routes are reduced and there is prolonged expiration (creating a 'scooped out' shape). In restrictive lung disease (e.g. pulmonary fibrosis), the loop is narrow but the shape normal (like a witch's hat). In fixed airway obstruction (e.g. tracheal stenosis), the loops look flattened as both expiration and inspiration are limited.

PEF = peak expiratory flow; TLC = total lung capacity; RV = residual volume.