30.1 Acute medical presentations 6591 Sian Coggle,

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ESSENTIALS This chapter provides concise details of the clinical features, immediate management, key investigations, and further man- agement of all of the common acute medical presentations. Other scales, charts, and reference tables are also provided
where relevant. These emergency presentations are clearly organ- ized in the following sections: cardiac, respiratory, gastrointes- tinal, renal, metabolic and endocrine, neurological, infectious diseases, psychiatric, and 'other' (disseminated intravascular co- agulation, extremes of temperature, and sickle cell crises). Links throughout the chapter also point back into the detailed discus- sion of each relevant presentation that the Oxford Textbook of Medicine provides. Heart and circulation Cardiac arrest See Chapter 17.2. Clinical features History (1) Sudden collapse Examination (1) Patient unresponsive (2) Airway, breathing—no respiration or agonal breathing (3) Circulation—pulse not palpable Immediate management See Figs. 30.1.1 and 30.1.2 30.1 Acute medical presentations Sian Coggle, Elaine Jolly, and John D. Firth Unresponsive and not breathing normally 30 Chest compressions Call 999 and ask for an ambulance 2 Rescue breaths As soon as AED arrives switch it on and follow instructions Continue CPR 30:2 Fig. 30.1.1 The adult basic life support algorithm for use of a single rescuer out of hospital. (Note—'999' is the telephone number for emergency services in the United Kingdom.) AED, automated external defibrillator; CPR, cardiopulmonary resuscitation. Reproduced with permission from the Resuscitation Council UK.

Section 30 Acute medicine 6592 Unresponsive and not breathing normally Call resuscitation team CPR 30:2 Attach defibrillator/monitor Minimise interruptions Shockable (VF/Pulseless VT) 1 Shock Minimise interruptions Immediately resume CPR for 2 min Minimise interruptions Return of spontaneous circulation Immediate post cardiac arrest treatment • Use ABCDE approach • Aim for SpO2 of 94–98% • Aim for normal PaCO2 • 12-lead ECG • Treat precipitating cause • Targeted temperature management Non-shockable (PEA/Asystole) Immediately resume CPR for 2 min Minimise interruptions During CPR • Ensure high quality chest compressions • Minimise interruptions to compressions • Give oxygen • Use waveform capnography • Continuous compressions when advanced airway in place • Vascular access (intravenous or intraosseous) • Give adrenaline every 3–5 min • Give amiodarone after 3 shocks Treat Reversible Causes • Hypoxia • Hypovolaemia • Hypo-/hyperkalaemia/metabolic • Hypothermia • Thrombosis-coronary or pulmonary • Tension pneumothorax • Tamponade-cardiac • Toxins Assess rhythm Consider • Ultrasound imaging • Mechanical chest compressions to facilitate transfer/treatment • Coronary angiography and percutaneous coronary intervention • Extracorporeal CPR Fig. 30.1.2 The advanced life support algorithm. CPR, cardiopulmonary resuscitation; PEA, VF, VT. Reproduced with permission from the Resuscitation Council UK.

30.1 Acute medical presentations 6593 Cardiorespiratory collapse: the patient in extremis See Chapters 17.1 and 17.5. Clinical
features History A patient who is in extremis is unlikely to be able to give a lucid history and may die during (unwise) interrogation, but the following clues may be elicited and be very useful diagnostically: (1) Chest pain—suggests myocardial infarction or other cardiorespiratory catastrophe (2) Chest and back pain—dissection of thoracic aorta must be seriously considered (3) Abdominal pain—suggests ruptured abdominal aortic aneurysm or other intra-abdominal emergency (4) Recent surgery—pulmonary embolism likely (5) High fever/rigors—suggests infective cause (6) Recent travel to relevant area—malaria until proven otherwise Examination Airway and breathing: (1) Is the airway patent? (2) Is the patient making a respiratory effort, and is the chest expanding with it? (3) Is the chest expanding symmetrically? Could there be a tension pneumothorax? (trachea deviated, mediastinum shifted, absent breath sounds on hyperinflated side of the chest; see ‘Upper airway obstruction’) (4) Widespread crackles in the chest—suggests pulmonary oedema in this context (see ‘Pulmonary oedema’). (5) Does the patient look as though they could keep this breathing up for the next 10 min?—If not, the patient is very likely to need respiratory support. Call for assistance from the intensive care unit immediately Circulation: (1) Do the peripheries feel cold or warm?—if warm, sepsis is likely (2) Pulse rate and rhythm—if rate <60/min or >120/min,
consider whether arrhythmia is primary cause of hypotension (3) Blood pressure (BP) • Is there severe postural dizziness, a postural rise in pulse rate (>30 beats/min), or postural drop in BP (>20 mmHg) if the patient is moved from lying to being propped up? These indicate significant intravascular volume depletion in this context • Does BP fall substantially on inspiration? If so, indicates large intrathoracic pressure swings with breathing (likely in upper airway obstruction or asthma) or cardiac tamponade (4) What is the jugular venous pressure (JVP)? • If low, indicates intravascular volume depletion or dilated circulation • If high, suggests primary cardiorespiratory problem General: (1) Rash—purpura suggests meningococcal or other septicaemia (2) Temperature—high fever suggests infection (3) Loss of left radial pulse, or BP lower in left arm than right arm, indicates aortic dissection (4) Abdominal tenderness/peritonism—suggests ruptured abdominal aortic aneurysm or other

intra-abdominal emergency See Table 30.1.1 for further information Immediate management Airway and breathing: (1) Ensure airway is clear: consider oropharyngeal airway (2) Oxygen—high flow, with reservoir bag if needed, to achieve oxygen saturations >92% (3) If tension pneumothorax, decompress immediately (see Chapter 30.2, 'Chest decompression') (4) Give intravenous (IV) naloxone (0.8–2.0 mg repeated at intervals of 2–3 min to a maximum of 10 mg) if there is any suspicion that patient has received opioids (5) Consider elective intubation and ventilation Circulation: Obtain IV access using a safe technique (see Chapter 30.2) Also: begin resuscitation according to volume status as indicated in Table 30.1.2 (1) Insert urinary catheter and monitor fluid input/output hourly in any patient with cardiorespiratory collapse. (2) Give broad-spectrum antimicrobial cover to any patient with unexplained cardiorespiratory collapse, e.g. co-amoxiclav 1.2 g IV 6–8-hrly, as dictated by clinical suspicion of likely pathogen (see 'Septic shock') Key investigations See Table 30.1.1 Further management Determined by underlying condition Table 30.1.1 Examination and investigation of the patient with cardiorespiratory collapse Diagnosis Key finding on examination Key initial investigation Definitive investigations Cardiovascular Myocardial infarction No specific findings likely ECG ECG, cardiac enzymes Arrhythmia Pulse rate and rhythm ECG ECG Aortic dissection Absence or reduction in one or more peripheral pulse, especially left radial Blood pressure lower in left arm than right CXR showing widened mediastinum Imaging of aorta, usually by CT or transoesophageal echocardiography Cardiac tamponade Raised JVP Pulsus paradoxus (pulse becomes impalpable on inspiration in extreme cases) CXR may show globular heart. ECG may show low-voltage complexes or electrical alternans Echocardiography (continued)

 Diagnosis Key finding on examination Key initial investigation Definitive investigations Cardiorespiratory Pulmonary embolus Raised JVP Right ventricular heave Loud P2 Right ventricular gallop rhythm Signs of deep venous thrombosis (DVT) in leg ECG may show features of acute right heart strain Imaging of pulmonary vessels by CT (or ventilation/perfusion scanning, or (rarely) pulmonary angiography) Pulmonary oedema Gallop rhythm, crackles CXR Usually cardiac—ECG, echocardiography Respiratory Tension pneumothorax Tracheal deviation Hyperexpansion of one side of chest Mediastinal shift Absent breath sounds on one side of chest CXR—but should be treated on basis of clinical diagnosis (see text) CXR—but should be treated on basis of clinical diagnosis (see text) Pneumonia May have high fever Signs of consolidation or pleurisy CXR CXR, blood culture, serological tests Asthma Wheezes, but beware of silent chest Response to treatment (β-agonist), but CXR excludes pneumothorax and other respiratory diagnoses Peak flow measurements before and after β-agonist Exacerbation of chronic obstructive pulmonary disease (COPD) Features of COPD A clinical diagnosis, but CXR excludes other respiratory diagnoses See Chapter 18.8 Abdominal Gastrointestinal haemorrhage Usually obvious, but don't forget rectal examination for blood/melaena in the patient with unexplained hypotension A clinical diagnosis Endoscopy Perforated viscus Peritonism Erect CXR to look for free air under diaphragm CT scan or laparotomy, depending on clinical situation Pancreatitis Peritonism Bruising in flanks Serum amylase Imaging of pancreas, usually by CT scan Ruptured abdominal aortic aneurysm Peritonism Palpable aneurysm Bruising in flanks A clinical diagnosis CT scan or laparotomy, depending on clinical situation Sepsis May have high fever May have warm peripheries and bounding pulse, but could be cold and shut down No specific findings likely, but look for rash or localized infection, e.g. abscess Malaria if relevant travel history A clinical diagnosis Blood culture Metabolic Many possible causes, e.g. renal failure, hepatic failure, profound acidosis, but collectively these are rare causes of presentation with cardiorespiratory collapse May have

evidence of organ failure, or of drug overdose May have no specific findings Electrolytes, renal and liver function tests Blood gases As indicated following initial tests Anaphylaxis Facial, tongue, and throat swelling Stridor Wheeze Urticarial rash Skin erythema or extreme pallor A clinical diagnosis Serum mast cell tryptase Specific IgE for suspect allergens See Chapter 17.3 for further discussion COPD, chronic obstructive pulmonary disease; CXR, chest radiograph; GCS, Glasgow Coma Scale; JVP, jugular venous pressure. Notes: (1) Primarily neurological disorders may compromise the airway or ventilation, but rarely cause cardiovascular collapse. If a patient with cardiovascular collapse has a severely depressed conscious level (GCS <8) or focal neurological signs, then the assumption—until proven otherwise—should be that the neurological impairment is secondary to the cardiovascular collapse and not the cause of it. (2) See other sections in this chapter for further details of conditions listed in this table. Table 30.1.1 Continued

30.1 Acute medical presentations 6595 ST-segment elevation acute myocardial infarction (STEMI) See Chapters 16.13.4 and 16.13.5. Clinical
features History (1) Ischaemic chest pain (2) Cardiorespiratory collapse (3) May be nonspecific or silent, especially in elderly people or in diabetics Examination May be normal, but look for: (1) ‘Pump failure’—cool peripheries, hypotension (2) Pulmonary oedema—see ‘Pulmonary oedema’ (3) Cardiac—gallop rhythm, murmurs Immediate management If cardiorespiratory collapse, as described in ‘Cardiorespiratory collapse: the patient in extremis’ Otherwise: (1) Oxygen—if needed, to achieve oxygen saturations >92% (2) Give aspirin 300 mg orally, chewed or dispersed in water (if not given before admission to hospital) (3) Give clopidogrel 300 mg orally (4) Analgesia—give adequate pain relief, e.g. (a) diamorphine by slow IV injection at 1 mg/min, usual maximum initial dose is 5 mg, but may be repeated if necessary, or (b) morphine by slow IV injection at 2 mg/min, usual maximum initial dose is 10 mg, but may be repeated if necessary. Both to be accompanied by appropriate antiemetic, e.g. metoclopramide 10 mg IV over 1–2 min, or cyclizine 50 mg IV over 1–2 min (caution in severe heart failure) (5) Reperfusion therapy—immediate triage to (a) primary percutaneous coronary intervention (PCI), if available
in a timely manner (within 90 min of patient call)
(Table 30.1.3), or (b) thrombolysis, if primary PCI not available or transfer times mean reperfusion may not be achieved within 120 min of symptom onset (Table 30.1.4) Key investigations To establish the diagnosis: (1) ECG—looking for ST-segment elevation and/or (presumed or proven) new left bundle branch block (2) Cardiac biochemical markers (troponins, CK-MB) Other important tests: (1) As indicated by clinical examination, e.g. chest radiograph to look for pulmonary oedema; echocardiography to assess LV function or cause of pansystolic murmur (?mitral valve dysfunction,?ventricular septal defect) (2) Assess modifiable risk factors for ischaemic heart disease, e.g. cholesterol Further management Consider: (1) Antiplatelet agents and anticoagulants • Aspirin (75–325 mg daily)—continue long term (if not contraindicated) • ADP receptor antagonists—e.g. clopidogrel (75 mg daily)—continue for at least 1 month after thrombolysis, or as determined by the type of stent implanted (if not contraindicated) • Glycoprotein IIb/IIIa inhibitors—e.g. abciximab, eptifibatide, tirofiban—are indicated in patients managed with primary PCI, but not after fibrinolysis • Anticoagulants—patients treated with fibrinolytic therapy should receive low molecular weight heparin or fondaparinux (a factor Xa inhibitor) (2) β-Blockade • Early—if no contraindication (e.g. hypotension, heart failure, heart block) give, e.g. atenolol 5 mg IV over 5 min, repeated after 10–15 min • Long term—if no contraindication continue oral β- blockade for at least 2–3 years (3) Angiotensin-converting enzyme (ACE) inhibition (or angiotensin receptor blockade) • Early—start within 24 h in patients who are

normotensive and continue for at least 5–6 weeks • Long term—recommended for any patient with left ventricular dysfunction (4) Lipid lowering—long-term treatment with a statin will benefit most patients with coronary heart disease. (5) Control of diabetes—some evidence supports the use of insulin in hospital to maintain blood glucose concentration <11 mmol/litre (but avoiding hypoglycaemia) and in the early post-hospital phase to maintain good control Table 30.1.2 Determination of volume status and immediate management of the patient with cardiorespiratory collapse Main problem Key clinical signs Immediate management Hypotension Peripheries cool and shut down Postural rise in pulse rate Postural hypotension Low jugular venous pressure Lungs clear Intravenous fluid (0.9% saline or other crystalloid with sodium concentration in range 130–154 mmol/litre) given rapidly (0.5 litre boluses) until there is clear evidence that physical signs are being restored to normal, then slow rate infusion Breathing difficulty High jugular venous pressure Gallop rhythm Basal crepitations Do not give fluid Sit up Consider intravenous loop diuretic and/or venodilator Consider need for ventilation Hypotension and breathing difficulty Peripheries cool and shut down High jugular venous pressure May be gallop rhythm Basal crepitations Will almost certainly need urgent ventilation Call for help from ICU/anaesthetist before the patient suffers cardiorespiratory arrest Trial of fluid infusion may be appropriate: give 250 ml of 0.9% saline or other crystalloid with sodium concentration in range 130–154 mmol/litre, keeping patient under continuous observation and terminating infusion immediately in the event of clinical deterioration ICU, intensive care unit. Notes: (1) All patients should be given high-flow oxygen. (2) Vigorous attempts should be made to diagnose and treat the underlying condition concurrent with efforts to resuscitate. (3) Is resuscitation being effective in restoring organ perfusion? Do not forget the value of the urinary catheter: if the patient is passing urine, then their kidneys are being perfused effectively. (4) If the patient remains hypotensive despite ‘optimization’ of intravascular volume then consideration can be given to the use of inotropes and vasoactive agents: see Chapter 17.6 for further discussion. (continued)

 Notes (1) Treat complications, e.g. venodilator or diuretic for pulmonary oedema. Severe heart failure/shock may require ventilation, inotropes ± intra-aortic balloon pump (2) Patients with diabetes will benefit from good control during admission with acute myocardial infarction and afterwards (3) For all patients: give advice regarding lifestyle issues before and after discharge from hospital—smoking, diet, exercise, management of obesity—also regarding resumption of normal activities. Consider referral to cardiac rehabilitation services (4) Consider need for specialist cardiological opinion and/or investigation by cardiac stress test (e.g. treadmill exercise tolerance test) and/or coronary angiography Table 30.1.4 Thrombolysis in acute myocardial infarction (AMI) Indications Must satisfy three criteria: (1) Typical chest pain at rest for >20 min (2) ST elevation in two contiguous leads (≥1 mm inferiorly, ≥2 mm anteriorly), or (presumed or proven) new left bundle branch block (3) Within 12 h of onset, but consider at 12–24 h if continuing pain Contraindications Absolute contraindications (1) Bleeding—active internal bleeding; proven active peptic ulcer (2) Brain—cerebrovascular accident within the past 6 months (or at any time if haemorrhagic stroke); known intracranial neoplasm or aneurysm (3) Suspected aortic dissection (4) Uncontrolled hypertension—SBP >180 mmHg or DBP >110 mmHg after pain relief and nitrates (5) Pregnancy Relative contraindications (1) Recent (<6 weeks) major trauma/surgery/injury or traumatic resuscitation (>10 min or sufficient to fracture rib) (2) Symptoms suggesting active peptic ulceration (3) Defective haemostasis (4) Lactation/peripartum (5) Severe liver disease/oesophageal varices (6) Severe renal disease (7) Bacterial endocarditis (8) Acute pancreatitis (9) On warfarin with INR outside therapeutic range Note that the following are

not contraindications: (1) Proliferative diabetic retinopathy (2) Previous cardiopulmonary resuscitation, unless this is prolonged (>10 min) or associated with obvious trauma (3) Therapeutic anticoagulation Examples of agents (1) Recombinant tissue-type plasminogen activator, e.g. Alteplase Accelerated regimen (within 6 h of AMI): 15 mg by IV injection, followed by IV infusion of 50 mg over 30 min, then 35 mg over 60 min (lower doses in patients <65 kg). This is the reference standard for comparison of other fibrinolytic agents/regimen Standard regimen (6–12 h from AMI): 10 mg by IV injection, followed by IV infusion of 50 mg over 60 min, then 40 mg over 120 min (lower doses in patients <65 kg) Tenecteplase 30–50 mg (6000–10 000 units, depending on body weight) by IV injection over 10 s. This does not require infusion pump or refrigeration and is particularly suited for prehospital administration as should be given within 6 h of symptom onset Reteplase 10 units intravenously over not more than 2 min, followed 30 min later by another 10 units intravenously over not more than 2 min (2) Streptokinase 1 500 000 units by IV infusion over 60 min. This remains the most widely used fibrinolytic agent internationally because it is relatively cheap DBP, diastolic blood pressure; SBP, systolic blood pressure. Notes: (1) Use of rt-PA is preferred if anterior AMI presenting within 6 h of onset; cardiogenic shock (SBP <80 mmHg); streptokinase given more than 5 days previously; streptokinase allergy. In some healthcare systems use of rt-PA is restricted to younger patients because of cost considerations. (2) Most treatment regimens use 24 h of intravenous heparin as adjunctive therapy when recombinant tissue-type plasminogen activator is used (consult product literature). (3) Problems during streptokinase infusion: see Table 30.1.5. Table 30.1.3 Indications for primary percutaneous coronary intervention (PCI) Primary PCI is the best management for STEMI when it can be performed:a (1) Within 60–90 min of admission (2) By individuals skilled in the procedure (>75 cases/year) (3) In a high-volume centre (>200 cases/year) Primary PCI is specifically indicated when there is: (1) Contraindication to thrombolysis (2) Haemodynamic compromise Primary PCI should be considered as: (3) Salvage procedure after failed thrombolytic therapy a American College Cardiology/American Heart Association guidelines.

30.1 Acute medical presentations 6597 Acute coronary syndrome without ST-segment elevation (unstable angina/non-STEMI) See Chapters 16.13.4 and 16.13.5. Clinical features History (1) Ischaemic chest pain at rest or on minimal exertion (2) Chest tightness/breathlessness Examination • Usually no specific signs, but may be: (1) ‘Pump failure’—cool peripheries, hypotension (2) Pulmonary oedema—breathing difficulty, pulmonary crackles (see ‘Pulmonary oedema’) (3) Cardiac—gallop rhythm, murmurs Immediate management Triage into high-, intermediate-, and low-risk categories • High risk—(1) typical clinical features of ischaemia and ST-segment depression or transient ST-segment elevation; (2) troponin elevation and a high risk score (risk calculator downloadable from https://www.mdcalc.com/timi-risk- score-ua-nstemi); (3) arrhythmias or haemodynamic compromise provoked by ischaemia • Intermediate or low risk—clinical features of acute coronary syndrome and nonspecific ECG changes (T-wave inversion, T- wave flattening, minor conduction abnormalities) • Low risk or an alternative diagnosis—normal ECG, normal biomarkers, normal cardiac examination and normal echo. High-risk category (1) Oxygen—to achieve oxygen saturations >92% (2) Give aspirin 300 mg orally immediately, chewed or dispersed in water (if not given before admission to hospital) (3) Give clopidogrel 300 mg orally (4) Give glycoprotein IIb/IIIa inhibitor—e.g. abciximab, eptifibatide, tirofiban—probably benefits all high- risk patients; definitely indicated in those undergoing revascularization (5) Give anticoagulation—low molecular weight heparin—e.g. enoxaparin 1 mg/kg (100 units/kg) every 12 h, or dalteparin 120 units/kg every 12 h (maximum 10 000 units twice

daily)— or bivalirudin (a direct thrombin inhibitor). Continue for 48–72 h or after coronary angiography and revascularization (6) Give IV or oral β-blocker (see 'ST-segment elevation acute myocardial infarction (STEMI)') unless contraindicated. Consider heart-rate-lowering calcium antagonist (e.g. diltiazem or verapamil) if β-blocker is contraindicated or not tolerated in patient without left ventricular dysfunction (7) Nitrate—give if ongoing pain, e.g. (a) sublingual glyceryl trinitrate (GTN), 0.3–1 mg repeated as required; (b) buccal GTN, up to 5 mg, with tablet placed between upper lip and gum and left to dissolve; (c) IV infusion of isosorbide dinitrate at initial dose of 2 mg/h (increasing as necessary to maximum of 20 mg/h to relieve pain and as limited by hypotension) (8) Analgesia—give adequate pain relief if ongoing pain not relieved by nitrate, e.g. (a) diamorphine by slow IV injection at 1 mg/min (usual maximum initial dose is 5 mg, but may be repeated if necessary), or (b) morphine by slow IV injection at 2 mg/min (usual maximum initial dose is 10 mg, but may be repeated if necessary). Both to be accompanied by appropriate antiemetic, e.g. metoclopramide 10 mg IV over 1–2 min, or cyclizine 50 mg IV over 1–2 min (caution in severe heart failure) (9) Continuing ischaemia or haemodynamic instability— urgent PCI Intermediate-risk category (1) As for high-risk category, except do not give glycoprotein IIb/IIIa inhibitor. Patients who develop high-risk features after initial presentation should be considered for urgent angiography and revascularization (within 24–72 h). Such patients also fulfil guideline criteria for glycoprotein IIb/IIIa inhibitors (initiated prior to angiography) Low-risk category Clinically stable patients with minor or nonspecific ECG abnormalities and a low-risk score (including negative repeat troponin) are at very low risk for in-hospital major cardiac events. Such patients may nevertheless have significant underlying coronary artery disease. They require stress testing or perfusion scanning, ideally prior to discharge Table 30.1.5 Problems during streptokinase infusion Problem Immediate action Further action Common Hypotension (SBP <90 mmHg) Stop infusion until blood pressure recovers Recommence infusion more slowly (to complete over 2 h) OR switch to rt-PA regimen (see Table 30.1.4) Rigors Stop infusion until rigor settles Recommence infusion more slowly (to complete over 2 h) OR switch to rt-PA regimen (see Table 30.1.4) Ventricular fibrillation Cardiovert Continue infusion at usual rate Uncommon Allergic reaction Stop infusion Recommence infusion more slowly if possible (to complete over 2 h) OR switch to rt-PA regimen (see Table 30.1.4) Give hydrocortisone 100 mg IV and chlorpheniramine 10 mg IV Haemorrhage (major) Stop infusion Consider fresh frozen plasma/cryoprecipitate Stroke Stop infusion Urgent CT head (continued)

 Key investigations To establish the diagnosis: (1) ECG—looking for transient ST-segment shift with pain; T- wave changes are less specific and ECG may be normal (2) Cardiac biochemical markers (troponins, CK-MB) Other important tests: As for STEMI (see 'ST-segment elevation acute myocardial infarction (STEMI)') Further management (1) Aspirin (75–325 mg daily)—continue long term (if not contraindicated) (2) Angiotensin-converting enzyme inhibition (or angiotensin receptor blockade)—recommended for any patient with left ventricular dysfunction (3) Lipid lowering—long-term treatment with statin will benefit most patients with coronary heart disease Consider: (4) Clopidogrel (75 mg/day)—consider continuing for 1 year Notes (1) For all patients: give advice regarding lifestyle issues before and after discharge from hospital—smoking, diet, exercise, management of obesity—also regarding resumption of normal activities. Consider referral to cardiac rehabilitation services (2) Consider need for specialist cardiological opinion and/or investigation by cardiac stress test (e.g. treadmill exercise tolerance test) and/or coronary angiography Dissection of the thoracic aorta See Chapter 16.14.1. Clinical features History (1) Chest pain, particularly if of sudden onset, tearing in quality, and radiating to the back (2) Collapse

Examination (1) Patient will usually look very unwell and cool peripherally. BP may be low, normal, or raised. Pulse may be slow. (2) Look for loss/reduction of one or more peripheral pulses: most likely is compromise of the left subclavian artery. Check left radial pulse in comparison with right; measure BP in both arms; any deficit on the left strongly supports the diagnosis of aortic dissection. Examine also for reduction of carotid or femoral pulse(s) (3) Look for signs of new aortic regurgitation—note that the diastolic murmur may be very short (4) Evidence of focal ischaemia, e.g. focal neurological deficit ('stroke') (5) Could the patient have Marfan's syndrome? (risk factor) Immediate management If cardiorespiratory collapse, as described in 'Cardiorespiratory collapse: the patient in extremis' (1) The key to correct management is a high index of clinical suspicion that aortic dissection might be the diagnosis. Most patients with chest pain and circulatory collapse have acute myocardial infarction, the management for which (thrombolysis) could clearly be fatal in the patient with aortic dissection (2) Oxygen—high flow, with reservoir bag if needed, to achieve oxygen saturations >92% (3) Analgesia—give adequate pain relief, e.g. (a) diamorphine by slow IV injection at 1 mg/min (usual maximum initial dose is 5 mg, but may be repeated if necessary) or (b) morphine by slow IV injection at 2 mg/min (usual maximum initial dose is 10 mg, but may be repeated if necessary). Both to be accompanied by appropriate antiemetic, e.g. metoclopramide 10 mg IV over 1–2 min, or cyclizine 50 mg IV over 1–2 min (caution in severe heart failure) Key investigations To establish the diagnosis: (1) CT angiography of chest (2) Transoesophageal echocardiography (3) MRI of chest Other important tests: (1) Chest radiograph—look for widened mediastinum (2) ECG—may have features of acute myocardial infarction (usually inferior) if dissection has compromised a coronary artery (usually right coronary artery) (3) Cardiac biochemical markers—to exclude acute myocardial infarction, but note that elevation of troponin can occur (4) Full blood count, clotting screen, electrolytes, renal and liver function tests—may give a lead to an underlying medical condition and will establish baseline (5) Group and save/cross-match blood Further management (1) Reduce BP using agents that will not cause tachycardia or increase the rate of cardiac ejection, e.g. titrate IV labetalol (initial dose 50 mg bolus, followed by 1–2 mg/ min) or esmolol (50–200 μg/kg/min) to achieve systolic BP <120 mmHg. If BP remains too high, add IV infusion of sodium nitroprusside (0.5–8 μg/kg/min) after β-blockade established (pulse <60/min) (2) Obtain opinion from cardiothoracic surgeon: immediate surgical repair will usually be the best management for patients with dissection of the ascending aorta (Stanford type A) who are in reasonable condition, but medical treatment is generally recommended (as long as the dissection does not progress) when the ascending aorta is spared (type B) Bradycardia See Chapters 16.2.2 and 16.4. Clinical features History (1) Syncope or presyncope (2) Fatigue/breathing difficulty (3) Drugs (especially β-blockers) Examination The most important immediate issue is to decide whether or not the circulation is compromised: is the patient cool peripherally? What are the rate, rhythm, and BP? Is there pulmonary oedema (see 'Pulmonary oedema')? If seen in the presence of bradycardia, note rate and: (1) Abnormal rhythm, e.g. dropped beats in second-degree AV block (2) Other cardiovascular abnormality, e.g. cannon waves in JVP in third-degree (complete) AV block (3) Temperature (hypothermia—see 'Hypothermia') Immediate management Obtain ECG If the patient is haemodynamically compromised: (1) Give atropine, 0.5 mg IV (repeat to maximum of 3 mg) (2) Consider isoprenaline, 1–10 μg/min by IV infusion (3) Consider temporary pacing (see Chapter 30.2, 'Cardiac pacing (temporary)') (4) Consider glucagon 50–150 μg/kg IV in 5% glucose in cases of β-blocker overdose, with precautions to protect the airway in case of vomiting (NB unlicensed indication and dose) Key investigations To establish the diagnosis: 12-lead ECG Other important tests: (1) Electrolytes (particularly potassium) (2) Cardiac biochemical markers (depending on context) (3) Chest

radiograph—look at heart size and for evidence of pulmonary oedema (4) 24 h ECG monitor (if symptoms intermittent and 12- lead ECG not diagnostic) (5) Echocardiography (if clinical suspicion that heart is structurally abnormal) Further management Dependent on diagnosis. If not reversible, likely to require permanent pacing

30.1 Acute medical presentations 6599 Tachycardia See Chapters 16.2.2 and 16.4. Clinical features History (1) Syncope or presyncope (2) Palpitations (3) Fatigue/breathing difficulty (4) Chest pain Examination The most important immediate issue is to decide whether or not the circulation is compromised: is the patient cool peripherally? What are the rate, rhythm, and BP? Is there pulmonary oedema (see 'Pulmonary oedema')? Physical examination is unlikely to aid diagnosis of the particular type of tachycardia, excepting for the presence of an irregularly irregular rhythm in atrial fibrillation (AF), but note the following: (1) Jugular venous pulse—absence of 'a' waves in AF; rapid flutter waves in atrial flutter; cannon waves in ventricular tachycardia (2) First heart sound—variable intensity in AF (3) A dilated heart increases the chance that tachycardia is ventricular in origin Immediate management (1) Obtain ECG (2) If cardiorespiratory collapse, as described in 'Cardiorespiratory collapse: the patient in extremis' (3) For any tachycardia that is poorly tolerated, synchronized DC shock (under deep sedation or general anaesthesia) is the treatment of choice and usually provides rapid relief (4) Management otherwise depends upon clinical context and type of tachycardia General rule—do not give more than one antiarrhythmic drug to a patient without seeking specialist advice; if a first-line antiarrhythmic drug fails, the appropriate treatment will often be to proceed to DC cardioversion Key investigations To establish the diagnosis: (1) 12-lead ECG (see Table 30.1.6) (2) Uncertain of the diagnosis of a broad complex tachycardia? See Table 30.1.7 (3) IV adenosine (administered as described later in this table)—transient AV block may (a) reveal (but rarely terminate) atrial tachycardia/fibrillation/flutter; (b) terminate atrioventricular nodal re-entry (AVNRT) and atrioventricular re-entry tachycardias (AVRT); (c) usually have no effect on ventricular tachycardia Other important tests: (1) Electrolytes (particularly potassium) (2) Cardiac biochemical markers (depending on context) (3) Chest radiograph—look at heart size and for evidence of pulmonary oedema (4) 24 h ECG monitor (if symptoms intermittent and
12-lead ECG not diagnostic) (5) Echocardiography (if clinical suspicion that heart is structurally abnormal) (6) Thyroid function tests (in atrial fibrillation) Further management if severe haemodynamic compromise Atrial fibrillation/flutter • DC cardioversion, or • Amiodarone, 300 mg in 30–60 min followed by
900 mg/24 h until sinus rhythm restored (into central venous catheter), or • Sotalol, 2 mg/kg IV over 30 min Atrioventricular nodal re-entry (AVNRT) and atrioventricular re-entry tachycardias (AVRT) (supraventricular tachycardias, SVTs) • Adenosine, 6 mg by fast IV injection, if necessary followed by 12 mg (also by fast IV injection) after 1–2 min, and then by a further 12 mg (also by fast IV injection) after a further 1–2 min (NB contraindicated in those with asthma, and patients taking dipyridamole are very sensitive, requiring reduced initial dose of 0.5–1 mg). Monitor/record ECG continuously. • Verapamil, 5–10 mg by slow IV injection over 2–3 min is an alternative in patients with asthma, but NOT in those who might have ventricular tachycardia, or in those who are receiving β-blockers Ventricular tachycardia • DC cardioversion (see 'Cardiac arrest') Further management if no severe haemodynamic compromise Atrial fibrillation/flutter Duration <48 h or transoesophageal echocardiography shows no intracardiac thrombus: • Consider prompt chemical or synchronized DC cardioversion • Flecainide (class 1 C) 2 mg/kg IV over 30 min if there is no evidence of ischaemic heart disease or left ventricular dysfunction • Amiodarone or sotalol

(class III) can be used to restore sinus rhythm and maintain it • Digoxin is useful for rate control only but will not restore sinus rhythm. If digoxin is ineffective in controlling ventricular rate, and cardioversion is unsuccessful or inappropriate, consider adding verapamil or β-blocker. Duration >48 h or thrombus on transoesophageal echocardiography: • Anticoagulate for 4–6 weeks before synchronized DC cardioversion Note Atrial fibrillation arising in the context of intercurrent illness is usually best managed by treatment of the underlying medical condition and with digoxin to control ventricular rate. The patient is likely to return to sinus rhythm when the underlying condition has resolved. Atrioventricular nodal re-entry (AVNRT) and atrioventricular re-entry (AVRT) tachycardias (supraventricular tachycardias, SVTs) • Vagal stimulation by respiratory manoeuvres (Valsalva), prompt squatting, or pressure over one carotid sinus (but not the latter in those with recent ischaemia, digoxin toxicity, or in elderly patients) • Adenosine if vagal stimulation fails • Other options include verapamil, β-blocker, flecainide, sotalol, or amiodarone Ventricular tachycardia • Consider synchronized DC cardioversion • Lidocaine (lignocaine) 100 mg as IV bolus over a few min followed immediately by infusion of 1–4 mg/min • Other antiarrhythmics that can be used include amiodarone, sotalol, procainamide and disopyramide—but seek expert help Torsade de pointes This form of ventricular tachycardia requires particular treatment: • Discontinue predisposing drugs and avoid empirical antiarrhythmic drug treatment • Give magnesium sulphate, 8 mmol of magnesium over 10–15 min, repeated once if necessary • If torsade is associated with bradycardia and pauses, consider isoprenaline infusion or overdrive atrial/ ventricular pacing to increase heart rate

Section 30 Acute medicine 6600 Pulmonary oedema See Chapter 16.5.2. Clinical features History (1) Breathing difficulty (2) Orthopnoea, paroxysmal nocturnal dyspnoea Other cardiac symptoms: (3) Palpitations (4) Chest pain (5) Ankle oedema (6) Any previous cardiac history Examination (1) How unwell is the patient? If very ill, see ‘Cardiorespiratory collapse: the patient in extremis’ (2) Respiratory rate, cyanosis, peripheral circulation (cold, clammy), pulse rate and rhythm (?arrhythmia, see ‘Bradycardia’ and ‘Tachycardia’), BP (often elevated, but may be normal or low), JVP (likely to be elevated), apex beat (displaced in congestive cardiac failure), heart sounds (gallop rhythm, murmurs), crackles and/or wheezes in chest, peripheral oedema (suggests biventricular failure in this context) (3) Pulse oximetry Immediate management If cardiorespiratory collapse, as described in ‘Cardiorespiratory collapse: the patient in extremis’ (1) Position the patient ‘trunk up, legs down’ (2) Oxygen—high flow, with reservoir bag if needed, to achieve oxygen saturations >92% (3) Give furosemide 40–80 mg IV If not improving rapidly: (4) Give either: • Diamorphine by slow IV injection at 1 mg/min (usual maximum initial dose is 5 mg, but may be repeated if necessary), or • Morphine by slow IV injection at 2 mg/min (usual maximum initial dose is 10 mg, but may be repeated if necessary) • Both to be accompanied by appropriate antiemetic, e.g. metoclopramide 10 mg IV over 1–2 min (not cyclizine in severe heart failure) (5) Unload with IV nitrate, e.g. isosorbide dinitrate 2–20 mg/h (6) Consider continuous positive airway pressure (CPAP) mask, noninvasive ventilation, or tracheal intubation and intermittent positive pressure ventilation (IPPV) Key investigations To establish the diagnosis: Chest radiograph Other important tests: (1) ECG—look for arrhythmia or acute myocardial infarction (2) Cardiac biochemical markers (including troponin and NT-proBNP) (3) Echocardiography—visualization of left ventricular size and function, also of other structural abnormalities, e.g. valve dysfunction Table 30.1.7 A practical clinical approach to broad complex tachycardia Clinical Note Working diagnosis History Myocardial infarction, ischaemic heart disease, or congestive heart failure present VT ECG Features in Table 30.1.6 present VT Effect of adenosine

Inconclusive VT (Given as described in ‘Tachycardia’) Reversion of tachycardia AVNRT or AVRT (SVTs). May also reveal (but unlikely to revert) atrial flutter or fibrillation AVNRT, atrioventricular nodal re-entry tachycardia; AVRT, atrioventricular re-entry tachycardia; SVT, supraventricular tachycardia. Notes (1) Wrongly diagnosing an SVT is potentially disastrous, whereas manoeuvres to treat VT are unlikely to compromise the patient with SVT. (2) History—patients with VT can have paroxysmal self-terminating episodes that are indistinguishable from those reported by patients with SVT. (3) Examination—the haemodynamic state of the patient cannot be used to differentiate between VT and SVT: patients with VT can be haemodynamically stable, and those with haemodynamic compromise can have SVT. Table 30.1.6 ECG criteria to distinguish VT from SVT with aberrant conduction Feature favouring diagnosis of VT Notes AV dissociation—capture/fusion beats The most reliable criterion for VT Both occur rarely, but their presence usually secures the diagnosis of VT Wide QRS complex QRS width (s) Predictive value for VT (%) <0.12 14 0.12–0.14 43

> 0.14 100 Concordance across chest leads QRS complexes all positive or all negative is reliable pointer to VT Extreme left axis deviation and/or a definite axis shift compared with previous ECGs Strong indicator of VT AV, atrioventricular; SVT, supraventricular tachycardia, VT, ventricular tachycardia.

30.1 Acute medical presentations 6601 (4) Invasive monitoring, e.g. pulmonary artery flow-directed (Swan–Ganz) catheterization—to be considered only if the patient is failing to respond or when there is genuine doubt about cardiac filling pressures or diagnosis. A pulmonary capillary wedge pressure >18 mmHg supports the diagnosis of cardiogenic pulmonary oedema Further management Depending on clinical context: (1) Acute myocardial infarction—see ‘ST-segment elevation acute myocardial infarction (STEMI)’ (2) Arrhythmia—see ‘Bradycardia’ and ‘Tachycardia’ (3) Acute mechanical cause—e.g. aortic incompetence, mitral regurgitation, ventricular septal defect—may require surgical intervention Deep venous thrombosis and pulmonary embolus See Chapters 16.16.1 and 16.16.2. Clinical features History Deep venous thrombosis (DVT): (1) Calf/leg pain (2) Calf/leg swelling (3) Features to suggest pulmonary embolus (PE) PE: (1) Shortness of breath, developing over hours, days, or (sometimes) weeks (2) Pleuritic chest pain, haemoptysis (lung infarction, peripheral emboli) (3) Circulatory collapse (massive PE) (4) Features to suggest DVT Deep venous thrombosis and pulmonary embolus: (1) Previous episodes of DVT and/or PE (2) Risk factors—immobilization, recent surgery, previous episodes, malignancy, travel, family history, etc. Examination DVT: (1) Calf/leg swelling—measure circumference 10 cm below tibial tuberosity: difference between sides of >1.5 cm likely to be significant (2) Calf tenderness; palpable cord; positive Homan’s sign (3) Dilated superficial veins; leg feels warmer than the other (4) Check for signs of PE (5) Consider alternative diagnoses—especially Baker’s cyst, cellulitis, haematoma in muscle PE: (1) May be no abnormal signs (2) Tachypnoea (50–70% of cases), crackles (18–50%), tachycardia (24–30%), pleural rub (<10%) (3) Circulatory collapse with cool peripheries, hypotension, and cyanosis. Look particularly for signs of right heart strain: elevated JVP, parasternal heave, S3 over right ventricle, loud P2 (4) Check for signs of DVT (5) Consider alternative diagnoses—especially pneumonia, musculoskeletal pain, pneumothorax Notes (1) Low-grade fever is common in both DVT and PE (2) In cases of DVT or PE—perform rectal/pelvic examination (before discharge from hospital) Immediate management (1) If cardiorespiratory collapse, as described in ‘Cardiorespiratory collapse: the patient in extremis’. Note that patients

with massive PE require volume expansion even though their JVP is elevated (2) If index of clinical suspicion for PE is high, give treatment dose of low molecular weight heparin pending the results of investigation Key investigations To establish the diagnosis: Tests commonly used to demonstrate the presence of thrombus/embolus are as follows: • DVT—venous ultrasonography, (contrast venography) • PE—contrast-enhanced spiral CT scan, (lung ventilation/ perfusion (VQ) scan, pulmonary angiogram) Other important tests: PE: (1) ECG—commonest abnormality is sinus tachycardia
and/or nonspecific ST-segment or T-wave abnormalities. Look for signs of right heart strain, e.g. T-wave inversion in V1/V2, S1Q3T3, axis shift (2) Chest radiograph—look for atelectasis or pulmonary parenchymal abnormality, also pleural effusion. May be normal (3) Arterial blood gases—look for hypoxia; but normoxia does not exclude PE DVT and PE: (1) Full blood count, electrolytes, renal and liver function tests—may give a lead to an underlying medical condition and will establish baseline (2) At a later stage, a thrombophilia screen may be appropriate, also investigations dictated by clinical findings or investigations detailed earlier in this table Clinical decision- making Many patients referred for medical opinion have a low probability of having DVT or PE and not all require imaging to exclude DVT or PE. Follow management algorithms as follows: • DVT—see Table 30.1.8 • PE—see Table 30.1.9 Further management (1) Anticoagulation with low molecular weight heparin (typical dose 200 IU/kg subcutaneous once daily, but see manufacturer's instructions) or standard (unfractionated) heparin (Table 30.1.10) until oral anticoagulation with warfarin (Table 30.1.11) or a direct oral anticoagulant (DOAC, Table 30.1.12) is established (2) In cases with circulatory collapse consider thrombolysis, e.g.: • Streptokinase by IV infusion of 250 000 units over 30 min, then 100 000 units/h for 24 h, or • Tissue plasminogen activator (alteplase), 10 mg by IV infusion over 1–2 min, followed by 90 mg over 2 h (maximum 1.5 mg/kg in patients of <65 kg) (3) In cases with circulatory collapse and contraindication to thrombolysis, consider catheter extraction or fragmentation of embolus, or surgical embolectomy Notes (1) No monitoring of low molecular weight heparin treatment is required, excepting if used in patients with chronic kidney disease when monitoring of anti-Xa levels is required. (2) Methods of reversing anticoagulation are shown in Table 30.1.13 Table 30.1.8 Pretest clinical probability scoring system (Well's criteria) and care pathway for the patient with suspected DVT (a) Pretest probability score Criteria Score Active cancer +1 Paralysis, plaster cast +1 Bed rest >3 days, surgery within 4 weeks +1 Tenderness along veins +1 Entire leg swollen +1 Calf swollen >3 cm +1 Pitting oedema +1 Collateral veins +1 Alternative diagnosis likely –2 Pretest probability Low 0 Moderate 1–2 High ≥3 (continued)

 Table 30.1.10 A schedule for intravenous infusion of standard (unfractionated) heparin to obtain an APTT ratio of 1.5–2.5 (1) Measure APTT at start of therapy (2) Give IV loading dose of 80 IU/kg by bolus injection, followed by (3) IV infusion of heparin at 18 IU/kg per h—dilute 25 000 units heparin to 50 ml total volume with 0.9% saline (making solution of 500 IU/ml) and give at the following rate: Body weight (kg) Initial rate (ml/h) 50 1.8 60 2.2 70 2.5 80 2.9 90 3.2 100 3.6 120 4.4 (4) Check APTT 6 h after start of treatment and then at least once daily, adjusting the infusion rate according to the APTT as follows:

> 7.0 Stop for 30 min and then reduce by 1.0 ml/h (check APTT 4 h later) 5.1–7.0 Reduce by 1.0 ml/h (check APTT 4 h later) 4.1–5.0 Reduce by 0.6 ml/h (check APTT 4 h later) 3.1–4.0 Reduce by 0.2 ml/h 2.6–3.0 Reduce by 0.1 ml/h 1.5–2.5

No change 1.2–1.4 Increase by 0.4 ml/h <1.2 Increase by 0.8 ml/h (check APTT 4 h later) APTT, activated partial thromboplastin time. Note (1) An alternative (but less well tried) regimen is to give unfractionated heparin (250 IU/kg) subcutaneously every 12 h, adjusting the dose according to the APTT measured 6 h after dosing. Table 30.1.9 Pretest clinical probability scoring system and care pathway for the patient with suspected PE (a) Pretest probability score Criteria Score Clinical signs and symptoms of DVT (objectively measured leg swelling and pain with palpation in the deep vein system) 3.0 Heart rate >100/min 1.5 Immobilization ≥3 consecutive days (bed rest except to access bathroom) or surgery in previous 4 weeks 1.5 Previous objectively diagnosed PE or DVT 1.5 Haemoptysis 1.0 Malignancy (cancer patients receiving treatment within 6 months or receiving palliative treatment) 1.0 PE as likely or more likely than alternative diagnosis (based on history, physical examination, chest radiograph, ECG, and blood tests) 3.0 Pretest probability Low <2 Unlikely ≤4 Likely 4 High 6 (b) Management algorithm Pretest probability score Action Result Further action 0 or 1 Perform D-dimer* Negative No further investigation Positive Perform ultrasonography 2 or more Do not perform D-dimer* Perform ultrasonography Negative Withhold treatment and repeat ultrasonography in 1 week. If serial ultrasonography is negative, PE rarely occurs Positive Diagnosis of DVT established DVT, deep venous thrombosis; PE, pulmonary embolism. Notes (1) Pretest probability score from Wells et al. (1997)—see Chapter 16.16.1. (2) * If high-sensitivity D-dimer testing is available then patients with a pretest probability score of 2 can be offered D-dimer testing, with no further investigation if this test is negative. (3) If the physician’s judgement is that DVT is very likely in a particular case, then they should proceed to investigations directed at detecting thrombus in leg veins whatever the scoring algorithm would suggest. If the result of ultrasonography is negative, and repeat ultrasonography in 1 week is also negative, pulmonary embolism rarely occurs. (4) All patients who are discharged with ‘DVT excluded’ should be given written information describing how they can be reassessed if symptoms worsen or fail to settle over the next few days. 2 or more Do not perform D-dimer Perform CTPA Negative Positive PE is excluded Diagnosis of PE established DVT, deep venous thrombosis; PE, pulmonary embolism. Notes (1) Pretest probability score from Wells et al. (2001). Ann Intern Med 135, 98–107. http://www.annals.org/content/135/2/98.full.pdf+html (2) If CTPA is not available or is contraindicated, then an alternative strategy is to image with ventilation-perfusion lung scanning: (a) normal scan—PE is excluded; (b) low/intermediate probability scan—scan is not diagnostic and further action determined by the pretest probability as follows: (i) if pretest probability is low (score <2), then perform bilateral venous ultrasonography—if this is negative, PE can be considered excluded without further testing; (ii) if pretest probability is high (score 2 or more), and the patient has adequate cardiopulmonary reserve, then serial ultrasonography of the leg veins over 10–14 days may be performed—if this is negative, PE rarely occurs. If cardiopulmonary reserve is inadequate,

> proceed to a definitive diagnostic test for PE (CTPA or pulmonary angiography). (c) High probability scan—diagnosis of PE established. (3) If the physician's judgement is that PE is very likely in a particular case, then they should proceed to investigations directed at detecting PE, whatever the scoring algorithm would suggest. (4) All patients who are discharged with 'PE excluded' should be given written information describing how they can be reassessed if symptoms worsen or fail to settle over the next few days. Table 30.1.8 Continued (b) Management algorithm Pretest probability score Action Result Further action <2 Perform D-dimer Negative No further investigation Positive Perform CT pulmonary angiography (CTPA)

30.1 Acute medical presentations 6603 Table 30.1.11 A warfarin induction regimen Days 1 and 2 Day 3 Day 4 INR Dose INR Dose Give 5 mg each evening if baseline INR <1.4 <1.5 10 mg <1.6 10 mg 1.5–2.0 5 mg 1.6–1.7 7 mg 2.1–2.5 3 mg 1.8–1.9 6 mg 2.6–3.0 1 mg 2.0–2.3 5 mg

> 3.0 0 mg 2.4–2.7 4 mg 2.8–3.0 3 mg 3.1–3.5 2 mg 3.6–4.0 1 mg 4.0 0 mg and seek advice on further management and seek advice on further management Table 30.1.12 Direct oral anticoagulants (DOACs) Class of drug Drug Usual dose for treatment of venous thromboembolism Note Direct thrombin inhibitor Dabigatran 150 mg twice daily Heparin given for first 5 days Direct Xa inhibitors Rivaroxaban 15 mg twice daily for 3 weeks, then 20 mg od Heparin not required Apixaban 10 mg twice daily for 1 week, then 5 mg twice daily Heparin not required Edoxaban 60 mg once daily (patient >60 kg) 30 mg once daily (patient <60 kg) Heparin given for first 5 days Table 30.1.13 Reversal of anticoagulation Anticoagulant Method Notes Standard (unfractionated) heparin (1) Stop heparin (2) Give protamine by slow IV injection: 1 mg neutralizes 100 units of heparin if given within 15 min of heparin. Give less if a longer time has elapsed because heparin is rapidly excreted. Maximum dose of protamine is 50 mg (1) There is no point in giving FFP or other clotting concentrates: they do not contain heparin-neutralizing activity (2) Excess protamine is anticoagulant LMWH (1) Stop heparin (2) Administer protamine by slow IV injection, maximum 50 mg. This is less effective at neutralizing the effect of LMW heparin than it is for standard heparin. There is no good evidence on which to base dosage (1) There is no point in giving FFP or other clotting concentrates: they do not contain heparin-neutralizing activity (2) Excess protamine is anticoagulant Warfarin Immediate reversal (e.g. patient has major bleeding with high INR) (1) Stop warfarin (2) Vitamin K 5 mg (IV) (3) FFP 15 ml/kg (IV), or PCC 50 IU/kg (IV). (4) Recheck INR (1) Large volumes of FFP (up to 2 litres) can be required to effect complete reversal of warfarin (2) PCC should be used for life-threatening bleeding (3) Continue warfarin in lower dose if risk/benefit considerations indicate that continued anticoagulation is justified when INR back in therapeutic range Controlled reversal (e.g. high INR but patient is not bleeding or has minor

bleeding only) (1) INR <8. Stop warfarin. Re-check INR in 3 days (2) INR 8–12. Stop warfarin. Give vitamin K 2.5 mg PO or 0.5 mg IV. INR rechecked in 24 h should show a fall (3) INR >12. Stop warfarin. Give vitamin K 5 mg PO or 1 mg IV. INR rechecked in 24 h should show a fall Dabigatran Idarucizumab 2.5 g IV; two doses within no more than 15 min (total 5 g) Rivaroxaban Apixaban Edoxaban Andexanet alfa—granted final approval by FDA in January 2019 and conditional marketing authorisation in EC in April 2019 but robust evidence of efficacy is lacking (main clinical trial gave bolus 400–800 mg over 15–30 min followed by infusion of 480–960 mg over 2 h) FFP, fresh frozen plasma; LMWH, low molecular weight heparin; PCC, prothrombin complex concentrates; PO by mouth.

Section 30 Acute medicine 6604 Cardiac tamponade See Chapter 16.8. Clinical features History (1) Shortness of breath or circulatory collapse, but there are no specific symptoms (2) Can follow acute myocardial infarction, aortic dissection, cardiac trauma (including iatrogenic with cardiac catheterization) (3) There may be evidence of a condition that can cause pericardial effusion, e.g. tuberculosis, cancer, advanced renal failure Examination The key to making this rare but very important (because treatable) diagnosis is to consider it in any patient with unexplained cardiorespiratory collapse. Signs of tamponade are: (1) Grossly elevated JVP—which may rise further on inspiration (Kussmaul's sign) (2) Pulsus paradoxus—an exaggerated fall in systolic BP on inspiration (normal <10 mmHg), but a rapid screening test for severe cases is to ask 'Does the radial pulse disappear on inspiration'? Evidence of a (large) pericardial effusion, although these will not be present unless there is a pre-existing effusion (3) Increased area of cardiac dullness (4) Quiet heart sounds Immediate management If the patient is in extremis proceed as in 'Cardiorespiratory collapse: the patient in extremis' (1) Give sodium chloride 0.9% 500 ml by rapid IV infusion, to support BP (2) Perform or arrange for immediate/urgent pericardial aspiration (see Chapter 30.2, 'Pericardiocentesis') Key investigations To establish the diagnosis: (1) Echocardiography • The most sensitive test for the presence of pericardial fluid • Diastolic collapse of right ventricle or right atrium indicates severe circulatory embarrassment (2) Cytology and culture of pericardial fluid Other important tests: (1) Chest radiograph—look for globular heart (almost invariably with clear lung fields) (2) ECG—look for low voltage QRS complexes and electrical alternans (in large pericardial effusion) and for evidence of acute myocardial infarction Further management As determined by underlying condition Hypertensive emergencies (accelerated/'malignant' hypertension) See Chapter 16.17.5. Clinical features History (1) Headache (2) Blurring of vision (3) Drowsiness (4) Epileptic fits Examination (1) BP—will usually be grossly elevated with diastolic pressure >130 mmHg, but note that accelerated hypertension can occur at lower pressures than this and the diagnosis is established not by a particular elevation of BP but by signs of fibrinoid necrosis (2) Ocular fundi • Grade III retinopathy: flame-shaped superficial haemorrhages, 'dot and blot' haemorrhages, cotton wool spots (retinal microinfarcts), hard exudates • Grade IV retinopathy: as grade III + papilloedema • Note that there is no difference in management or prognosis of patients with grade III or grade IV disease (3) Urine—stix testing shows proteinuria and haematuria, microscopy may show red blood cell casts Also look for signs of: (4) Pulmonary oedema—see 'Pulmonary oedema' (5) Aortic dissection—see 'Dissection of the thoracic aorta' (6) Scleroderma—scleroderma renal crisis Immediate management In an uncomplicated case: (1) Admit to hospital, or commence treatment, initiate investigations and

follow-up within a few days in an ambulatory care setting (2) Avoid strenuous activity (3) No smoking (causes an acute rise in BP) (4) Aim to lower diastolic pressure into range 100–105 mmHg over 2–3 days using: • Atenolol 25–50 mg orally, or • Nifedipine 10–20 mg of modified release preparation orally (tablets, not sublingual) • Further dosing determined by response • Maximum initial fall in BP should not exceed 25% of presenting value In a complicated case (aortic dissection, epileptic fitting, acute pulmonary oedema, oral medication not possible): (1) Admit to hospital (2) Bed rest (3) No smoking (4) Aim to lower diastolic pressure to less than 100–110 mmHg over several hours (depending on clinical context) using: • Labetalol, initial bolus of 20 mg IV, then at 0.5–2 mg/min, or • Sodium nitroprusside (IV) at initial dose of 0.25–0.5 µg/ kg per min, increasing up to 8–10 µg/kg per min. This must only be given to patients with aortic dissection after
β-blockade has been established with, e.g. esmolol
(50–200 µg/kg per min) Key investigations To establish the diagnosis: Accelerated hypertension is a clinical diagnosis Other important tests: (1) ECG—looking for evidence of left ventricular hypertrophy and acute myocardial ischaemia (2) Chest radiograph—looking for heart size, pulmonary oedema, and (if chest/back pain) for aortic dissection (3) Electrolytes and renal function—if serum creatinine

> 250 µmol/litre renal function is likely to deteriorate further (at least in the short term) (4) 'Autoimmune/vasculitic' serology—ANCA, ANA, etc.— for evidence of multisystem disorder that can present with accelerated phase hypertension and which (if present) will require specific treatment (5) CT angiography of chest if aortic dissection suspected (or other imaging, see 'Dissection of the thoracic aorta') Further management When acute emergency is controlled, all patients who have suffered from accelerated phase hypertension require thorough investigation for secondary causes of hypertension Anaphylactic shock See Chapter 17.3. Clinical features History (1) Premonitory aura—apprehension, light-headedness, dizziness, tingling, or itching of skin (2) Facial, tongue, or throat swelling (3) Stridor or wheeze (4) Syncope or collapse (5) Exposure to precipitant—foodstuffs (e.g. peanuts), hymenopteran stings, drugs (e.g. parenteral penicillins) Examination (1) Cyanosis (2) Hypotension (3) Facial, tongue, or throat swelling (4) Stridor or wheeze (5) Urticaria, angio-oedema, skin erythema, or extreme pallor

 Immediate management (1) Stop any potential causative agent immediately (2) Oxygen—high flow, with reservoir bag if needed, to achieve oxygen saturations >92% (3) Adrenaline (epinephrine) • Give 0.3–0.5 ml of 1:1000 adrenaline (0.3–0.5 mg) intramuscularly into lateral thigh, repeated every 5–10 min as needed If this is ineffective, or if the patient is about to die: • Give 5 mg adrenaline (5 ml of undiluted 1:1000 adrenaline) nebulized with oxygen, and • Make up 1:100 000 preparation of adrenaline by diluting 0.5 mg adrenaline (0.5 ml of 1:1000 adrenaline) to total of 50 ml with 0.9% saline and give at 0.5–1.5 ml/min, titrated according to clinical response (4) Fluid—give 0.9% saline or other crystalloid with sodium concentration in range 130–154 mmol/litre, 10–20 ml/kg, as rapid IV infusion if patient is hypotensive Second line therapy—can be considered after cardiorespiratory stability has been

achieved (but no strong evidence that they are required): (5) H1-blocker, e.g. chlorpheniramine 10–20 mg IV, repeated up to 40 mg in 24 h (change to oral when patient tolerates) (6) H2-blocker, e.g. ranitidine 50 mg IV three times daily (change to oral when patient tolerates) (7) Steroid, e.g. hydrocortisone 1.5–3 mg/kg IV, then repeated four times daily (change to oral prednisolone 40 mg daily when patient tolerates) (8) β2-Agonist, e.g. salbutamol 5 mg (repeated as necessary) via oxygen-driven nebulizer if bronchospasm is a persistent problem Key investigations To establish the diagnosis: (1) Anaphylaxis is a clinical diagnosis (2) Mast cell tryptase—immediately after resuscitation, after 1–2 h, and after 24 h (or convalescent) Other important tests: ECG, chest radiograph, electrolytes, renal function, arterial blood gases (depending on context) Further management (1) Patients must be observed for 4–6 h after full recovery before discharge from immediate medical care (2) Determination of allergen (if any)—refer to allergy services; advice regarding avoidance; MedicAlert bracelet (3) Instruction regarding self-injection of adrenaline and supply of appropriate medication, e.g. EpiPen Respiratory Acute on chronic respiratory failure See Chapters 17.5, 18.8, and 18.15. Clinical features History (1) Chronic respiratory condition—usually chronic obstructive pulmonary disease (2) Recent increase in breathlessness (3) Evidence of infection—fever, sweats, increased sputum production, increased sputum purulence (4) ‘Cor pulmonale’—worsening ankle oedema Examination (1) Cyanosis (2) Respiratory rate (3) Temperature (4) Evidence of CO_2 retention—drowsiness, asterixis, metabolic flap (5) Chest signs—of chronic respiratory condition, of infection, and exclude pneumothorax (6) Signs of cor pulmonale—elevated JVP, right ventricular heave, right ventricular gallop, loud P2, congested liver, ascites, peripheral oedema (7) Check peak expiratory flow rate if patient is able to use peak expiratory flow recorder (8) Check pulse oximetry. Is the patient getting exhausted? Remember that a ‘normal’ respiratory rate in the patient who looks very tired may mean that they are close to death Immediate management The patient who is extremely ill If the patient is in extremis, proceed as in ‘Cardiorespiratory collapse: the patient in extremis’, with the exception that a high concentration of inspired oxygen should NOT be given to patients who are KNOWN to have acute on chronic respiratory failure. If the patient is known to have chronic respiratory failure: (1) Give controlled oxygen (24–28% or 1–2 litres/min by nasal prongs), aiming to achieve Pao_2 >8 kPa (60 mmHg) or Sao_2 >90% without CO_2 retention or acidosis (2) Initiate other aspects of management listed later in this table (3) Check arterial blood gases, adjusting inspired oxygen concentration if allowed by clinical response, Pao_2, $Paco_2$, and pH (pH, not hypoxia, is the most important factor related to survival in patients with acute on chronic respiratory failure) Consider need for ventilatory support: • Noninvasive positive pressure ventilation (NIV)— particularly in patients with exacerbation of chronic obstructive pulmonary disease who have persistent respiratory acidosis (pH <7.35) despite controlled oxygen therapy and maximal medical therapy—proceeding if required and if appropriate to • Endotracheal intubation and intermittent positive pressure ventilation Note—if it is uncertain whether or not a patient has acute on chronic respiratory failure, then high concentration oxygen should be given to all patients who are extremely ill. All such patients require continued close monitoring of their clinical state and arterial blood gases, allowing (among other things) detection of the few who will have acute on chronic respiratory failure and lose their respiratory drive in response to high concentration oxygen The patient who is moderately unwell (1) Give controlled oxygen (24–28% or 1–2 litres/min by nasal prongs), aiming to achieve Pao_2 >8 kPa (60 mmHg) or Sao_2 >90% without CO_2 retention or acidosis. Check arterial blood gases after 30–60 min (2) Give nebulized β2-agonist, e.g. salbutamol 2.5–5 mg, terbutaline 5–10 mg, using air as the driving gas, repeated as required, while continuing to deliver oxygen by nasal prongs at 1–2 litre/min (3) Give nebulized anticholinergic, e.g. ipratropium bromide 500 µg

(can be combined with β2-agonist), repeated as required (4) Give corticosteroid, e.g. hydrocortisone 100 mg IV twice daily or prednisolone 30 mg orally once daily (continued for 7–14 days) (5) Give antibiotic that will cover likely respiratory pathogens if two of the following symptoms are present—increased breathlessness, increased sputum volume, or increased sputum purulence, e.g. amoxicillin 250 mg orally three times daily or (if allergic to penicillin) clarithromycin 250–500 mg orally twice daily (IV if oral administration not possible) (6) Give diuretic, e.g. furosemide 40–80 mg IV, if evidence of fluid overload (7) Consider aminophylline, loading dose (in patient not previously treated with theophylline) of 5 mg/kg given IV over 20 min, then an infusion of 0.5 mg/kg per h aiming for serum concentration in the range 10–20 mg/litre (8) Consider need for ventilatory support, usually by NIV, if patient does not improve Note—use IV fluids to correct and prevent dehydration Key investigations To establish the diagnosis: (1) Chest radiograph—looking for focal consolidation and to exclude pneumothorax (2) Sputum culture To determine severity and monitor response to treatment: (3) Arterial blood gases (4) Serial measurements of peak flow Other important tests: (1) Full blood count (2) Electrolytes, renal and liver function (3) ECG (continued)

Section 30 Acute medicine 6606 Further management (1) Optimization of treatment for chronic pulmonary condition, usually chronic obstructive pulmonary disease (2) Emphasize need to stop smoking Tension pneumothorax See Chapters 17.1 and 18.17. Clinical features History (1) Collapse with extreme difficulty in breathing Examination (1) Patient looks as though they are about to die (2) Gasping respiratory effort (3) Cyanosis (4) Chest looks asymmetrical, being prominent on side of tension (5) Tracheal deviation, away from side of tension (6) Mediastinal shift, away from side of tension, most reliably detected by percussion of cardiac dullness (7) Chest is silent on side of tension, the only breath sounds being heard in the opposite axilla Immediate management Insert needle to decompress chest; see Chapter 30.2, ‘Chest decompression’ Key investigations To establish the diagnosis: (1) Tension pneumothorax is a clinical diagnosis to be treated immediately without delay for investigation Note: • The signs of tension pneumothorax are not subtle, but you will not make the diagnosis unless you consider it and seek the presence of the signs listed earlier in this table • If a patient appears to be dying and you think that they might have a tension pneumothorax, then—after calling for help and initiating resuscitation (see ‘Cardiac arrest’)—there is nothing to be lost (and potentially much to be gained) from an attempt at chest decompression Other important tests: Chest radiograph will confirm diagnosis of pneumothorax after decompression Further management Insertion of chest drain (see Chapter 30.2, ‘Chest drain’) after tension has been relieved Upper airway obstruction See Chapter 18.5.1. Clinical features History (1) Extreme difficulty in breathing (2) Coughing/choking (3) Noisy breathing (4) Difficult/unable to speak (5) ‘Something stuck’ Examination (1) Extreme but ineffective respiratory effort (2) Cyanosis (3) Drooling (cannot swallow saliva) (4) Stridor Immediate management (1) If cough ineffective, give five back blows with patient leaning forward (to ensure object is projected from mouth rather than forced further down the airway if it moves). (2) If back blows ineffective then give five abdominal thrusts (Heimlich manoeuvre) if the patient has inhaled a foreign body: • Patient sitting or standing—rescuer stands or kneels behind patient, encircling the patient’s waist with their arms, placing one fist just above the navel (well below xiphoid process) and using their other hand to press the fist into the patient’s abdomen with a quick upward thrust. Repeat as necessary • Patient lying—place patient on their back. Rescuer kneels astride patient and puts the palm of one hand between the navel and xiphisternum, places their other hand on top of this, and pushes upwards and inwards (3) If abdominal thrusts (Heimlich manoeuvre) is inappropriate or has

failed, continue to alternate back blows and chest thrust or: • If there is time and you have the expertise—spray the pharynx with local anaesthetic (e.g. 5% cocaine and adrenaline) and examine the pharynx and upper airway by indirect laryngoscopy to establish the cause of obstruction and allow (if possible) its removal (with finger sweep under direct vision or long-handled forceps) or passage of an endotracheal tube • If there is time and you are not experienced in upper airway management—call immediately for help from anaesthetic or ear, nose, and throat (ENT) colleagues • If there is no time—call cardiac arrest team Key investigations To establish the diagnosis: • Upper airway obstruction is a clinical diagnosis Other important tests: As dictated by cause of obstruction Further management As dictated by cause of obstruction; see Chapter 30.2, 'Cricothyroidotomy' Asthma See Chapter 18.7. Clinical features History (1) Worsening asthma (2) Increasing difficulty in breathing (3) Decrease in exercise tolerance (4) Increasing wheeze (5) Chest tightness (6) Cough (7) Difficulty in speaking (8) Fall in self-monitored peak flow (9) Failure to obtain improvement with use of regular β2-agonist (10) Precipitating factor—exposure to known precipitant, e.g. exercise, cold air, dusty environment, upper respiratory tract infection Examination Moderate uncontrolled acute asthma: (1) Breathlessness (2) Wheeze (3) Chest tightness (4) Peak flow 50–70% of predicted or personal best Acute severe attack: (1) Cannot complete sentences in one breath (2) Increased respiratory rate (>25 breaths/min) (3) Use of accessory muscles of respiration (4) Tachycardia (>110/min) (5) Peak flow <50% of predicted or personal best Life-threatening asthma: (1) Exhaustion, confusion, or coma (2) Inability to speak (3) Cyanosis (4) Bradycardia or hypotension (5) Silent chest (6) Peak flow <33% of predicted or personal best (or unrecordable) Notes (1) A 'normal' respiratory rate is consistent with the patient being near to death if they are exhausted (2) Always check carefully for signs of pneumothorax (3) Always check pulse oximetry (4) Asking the patient to count out loud as far as they can on a single breath provides a rapid, quantitative, and repeatable measure of respiratory function

30.1 Acute medical presentations 6607 Immediate management If cardiorespiratory collapse, as described in 'Cardiorespiratory collapse: the patient in extremis' Moderate uncontrolled acute asthma: (1) β2-Agonist via spacer and mask or nebulizer (see later in this table) (2) Oral prednisolone 30 mg once daily (3) Inhaled steroids—commence or increase dose Acute severe attack: (1) Oxygen—high flow, with reservoir bag if needed, to achieve oxygen saturations >92% (2) Salbutamol 2.5–5 mg or terbutaline 5–10 mg via oxygen-driven nebulizer, repeated up to every 15–30 min as needed, and then 4-hrly (3) Steroids—hydrocortisone 200 mg IV four times daily or prednisolone 30–60 mg orally once daily Life-threatening attack or patient failing to improve: (1), (2), and (3) as for acute severe attack (4) Add ipratropium 0.5 mg to nebulized β2-agonist (5) Consider magnesium sulphate 1.2–2 g IV over 20 min (6) Consider aminophylline, loading dose (in patient not previously treated with theophylline) of 5 mg/kg given IV over 20 min, then an infusion of 0.5 mg/kg per h aiming for serum concentration in the range 10–20 mg/ litre. Omit loading dose if patient already taking oral theophylline (7) Consider IV salbutamol (3–20 μg/min) or terbutaline (1.5–5 μg/min) infusion Notes (1) Mechanical ventilation—if the patient is deteriorating, call for help from the intensive care unit sooner rather than later. Elective endotracheal intubation and positive pressure ventilation is better than that done after cardiorespiratory arrest—indications are hypoxia (Pao2 <8 kPa) despite Fio2 60%, hypercapnoea (Paco2 >6 kPa), exhaustion with feeble respiratory effort, confusion/ drowsiness, unconsciousness, respiratory arrest (to be avoided if possible) (2) Fluids—give IV fluids to correct and prevent intravascular volume depletion/dehydration Key investigations To establish the diagnosis: Acute asthma is a clinical diagnosis Other important tests: (1) Chest radiograph—exclude pneumothorax (2) Arterial blood gases—markers for life-threatening

asthma being normal or high Paco2 (>5 kPa), low pH or high H+, severe hypoxia (Pao2 <8 kPa) in spite of high-flow oxygen treatment (3) Electrolytes, renal and liver function, full blood count Further management (1) Optimization of long-term asthma management (2) Education regarding how to recognize severe attacks and how to respond when they develop Pneumonia See Chapter 18.4.2. Clinical features History (1) Breathing difficulty (2) Flu-like prodrome (3) High fever, sweats, rigors (4) Pleuritic chest pain (5) Sputum production (but note that this is not expected in atypical pneumonia) (6) Travel (7) Pet birds Examination (1) Severity of illness—exhaustion, use of accessory muscles and inability to talk in sentences all indicate severe illness and probable need for management on high dependency unit/intensive care unit (2) Vital signs—temperature, pulse, BP—also peripheral perfusion (hot or cold) (3) Respiratory —cyanosis, respiratory rate, focal lung signs (consolidation, pleural rub, pleural effusion) (4) Sputum—inspect if any produced (5) Pulse oximetry Determination of severity (1) Can be estimated using the six-point CURB-65 score, with one point scored for each of (a) Confusion; (b) Urea

> 7 mmol/litre; (c) Respiratory rate >30/min; (d) Systolic Blood pressure <90 mmHg; (e) Diastolic Blood pressure <60 mmHg; (f) age >65 years. (2) Depending on CURB-65 score, the risk of mortality or need for intensive care unit admission is as follows: score 0, 0.7%; score 1, 3.2%; score 2, 13%; score 3, 17%; score 4, 41.5%; score 5, 57% Immediate management If cardiorespiratory collapse, as described in ‘Cardiorespiratory collapse: the patient in extremis’ (1) Oxygen—high flow, with reservoir bag if needed, to achieve oxygen saturations >92% (2) Appropriate antimicrobial agent British Thoracic Society guidelines for treatment of community-acquired pneumonia: • Mild/moderate pneumonia (CURB-65 score of 0– 2)—oral therapy with extended-spectrum penicillin (e.g. amoxicillin 500 mg three times daily) alone or with a macrolide (e.g. clarithromycin 500 mg twice daily). Omit the penicillin in patients with penicillin allergy • Severe pneumonia (CURB-65 score of 3 or more)—IV therapy with a broad-spectrum β-lactamase stable antibiotic (e.g. co-amoxiclav 1.2 g three times daily) plus a macrolide (e.g. clarithromycin 500 mg twice daily). In penicillin-allergic patients, a second- (e.g. cefuroxime) or third-generation (e.g. ceftriaxone) cephalosporin can be used instead of co-amoxiclav • Suspected legionnaire’s disease—fluoroquinolone (e.g. ciprofloxacin 500 mg twice daily PO) and macrolide (e.g. clarithromycin 500 mg twice daily PO) plus consider adding oral rifampicin (0.6–1.2 g daily in two to four divided doses) In areas/countries where there is serious concern that Streptococcus pneumoniae may be resistant to penicillin and other agents: • Mild/moderate pneumonia (CURB-65 score of 0–2)— second- or third-generation cephalosporin (e.g. cefotaxime 1 g IV twice daily) plus macrolide (e.g. erythromycin 500 mg orally or IV four times daily or clarithromycin 500 mg IV twice daily), or fluoroquinolone (e.g. levofloxacin 500 mg orally or IV once or twice daily) alone • Severe pneumonia (CURB-65 score of 3 or more)— second/third-generation cephalosporin (e.g. cefotaxime 1 g IV twice daily) plus macrolide (e.g. erythromycin 500 mg IV four times daily or clarithromycin 500 mg IV twice daily), or second-/third-generation cephalosporin (e.g. cefotaxime 1 g IV twice daily) plus fluoroquinolone (e.g. levofloxacin 500

> mg IV twice daily) Notes (1) If staphylococcal pneumonia is suspected, add flucloxacillin 1 g IV four times daily (or vancomycin if methicillin-resistant Staphylococcus aureus is proven or suspected) (2) See Chapters 18.4.3 and 18.4.5 for discussion of antimicrobial treatment of patients with hospital-acquired pneumonia or pneumonia in immunocompromised patients (3) Give IV fluids to maintain adequate intravascular volume/hydration Key investigations To establish the diagnosis: (1) Chest radiograph—looking for focal consolidation (lobar pneumonia) or more widespread interstitial shadowing (2) Blood culture (3) Sputum culture (4) Urinary pneumococcal antigen and legionella antigen tests To establish severity: Arterial blood gases—if patient is very ill or pulse oximetry shows oxygen saturations <92% (continued)

 To establish risk of empyema: Sampling of parapneumonic effusion—empyema or clear fluid with pH <7.2 require early and effective drainage of pleural fluid Other important tests: Full blood count, electrolytes, renal and liver function, C-reactive protein Further management Follow-up chest radiograph to ensure complete resolution at 6 weeks Gastrointestinal and hepatological Upper gastrointestinal haemorrhage See Chapter 15.4.2. Clinical features History (1) Haematemesis or ‘coffee-ground’ vomiting (2) Melaena (3) Presyncope (4) Indigestion or reflux or medication for these symptoms (5) Retching or vomiting before haematemesis (consider Mallory–Weiss tear) (6) Previous upper gastrointestinal investigation or surgery (7) To suggest recent development of anaemia (8) Drugs that predispose to upper gastrointestinal haemorrhage—aspirin, nonsteroidal anti-inflammatory agents (NSAIDs), anticoagulants (9) Risk factors for, or presence of, chronic liver disease (consider varices) (10) Anorexia and weight loss (consider malignancy) Examination (1) State of circulation—temperature of peripheries, pulse rate, BP, JVP (2) Mucous membranes—chronic anaemia (3) Evidence of chronic liver disease—jaundice and other manifestations (consider varices) (4) Evidence of portal hypertension—especially splenomegaly (consider varices) (5) Lymphadenopathy—especially in left supraclavicular fossa (consider malignancy) (6) Abdomen—for epigastic mass (consider malignancy) (7) Rectal examination—for blood/melaena; haemorrhoids (as evidence of portal hypertension) Notes (1) The most reliable signs of intravascular volume depletion are severe postural (sitting vs lying, if standing not possible) dizziness, a postural rise in pulse rate of >30 beats/min, postural hypotension (>20 mmHg fall in systolic BP), and a low JVP (2) Clinical assessment of severity, see Table 30.1.14 (3) Most likely diagnoses are peptic ulcer (35–50%), erosive disease (10–15%), oesophagitis (10%), Mallory–Weiss tear (5–10%) and oesophageal varices (5–10%). No cause can be established in 5–15% of cases Immediate management If cardiorespiratory collapse, as described in ‘Cardiorespiratory collapse: the patient in extremis’ (1) Establish IV access with one or more large-bore peripheral venous cannulae (look in the antecubital fossae in the patient who is shut down). If you cannot do this, then insert a femoral venous catheter (see Chapter 30.2, ‘Femoral vein cannulation’). DO NOT ATTEMPT TO INSERT AN INTERNAL JUGULAR OR SUBCLAVIAN VENOUS CATHETER INTO A PATIENT WHO OBVIOUSLY HAS SEVERE INTRAVASCULAR VOLUME DEPLETION (see Chapter 17.1 for discussion) (2) If clinical evidence of intravascular volume depletion, give 1000 ml of IV fluid (0.9% saline) as fast as possible. Repeat clinical examination. If the patient still has intravascular volume depletion, give a further 500 ml of fluid as fast as possible. Repeat cycle until arterial pressure and JVP restored towards normal, then

slow down rate of infusion. Use blood instead of saline as soon as it is available (3) Cross-match blood for transfusion (4) Consider need for urgent upper gastrointestinal endoscopy once resuscitated (5) If oesophageal varices—see Table 30.1.15 Also: (1) Oxygen—high flow, with reservoir bag if needed, to achieve oxygen saturations >92% (2) Insert urinary catheter and monitor fluid input/output hourly in any patient with substantial gastrointestinal haemorrhage—a satisfactory urine output is the best gauge of adequate resuscitation (3) Correct any coagulopathy—see 'Deep venous thrombosis and pulmonary embolus', Table 30.1.3 (iatrogenic over anticoagulation) and 'Disseminated intravascular coagulation' (4) Nurse to avoid aspiration, and do not insert nasogastric tube, which makes this more likely Key investigations To establish the diagnosis (and also potentially therapeutic): Upper gastrointestinal endoscopy: • Within 24 h of admission in anyone with a substantial gastrointestinal bleed • Urgently (once resuscitated) if oesophageal varices are suspected or the patient is actively bleeding See Table 30.1.14 for assessment of risk of rebleeding and mortality after endoscopy Other important tests: (1) Full blood count—but remember that the initial haemoglobin concentration is a poor estimate of the volume of acute blood loss (2) Electrolytes, renal and liver function tests (3) Coagulation screen (4) To pursue possibility and causes of chronic liver disease (if clinically indicated) Further management (1) Immediately inform surgical colleagues of all cases of substantial gastrointestinal haemorrhage (2) Dependent on cause of haemorrhage, e.g.: • Acid suppression for ulcer healing—high-dose IV proton pump inhibitor, e.g. omeprazole 80 mg bolus followed by 8 mg/h for 72 h • Eradication of H. pylori Table 30.1.14 Risk of rebleeding and mortality following upper gastrointestinal haemorrhage (Rockall score) Variable Score 0 1 2 3 Age (years) <60 60–79 ≥80 Shock 'No shock' 'Tachycardia' 'Hypotension' Systolic BP ≥100 ≥100 <100 Pulse <100 ≥100

30.1 Acute medical presentations 6609 Table 30.1.15 Management of bleeding from oesophageal varices Resuscitation As described in 'Upper gastrointestinal haemorrhage' Coagulopathy Correct if present: Give vitamin K, 1 mg IV Maintain platelet count >25 × 109/litre Give 2 units of FFP for every 4 units of blood or packed cells Pharmacological measures to reduce haemorrhage Consider: • Vasopressin, 20 units IV over 15 min, followed by 20 U/h IV • Terlipressin, 2–4 mg IV bolus, followed by 1–2 mg IV every 4–6 h as needed for up to 72 h • Octreotide 50 µg IV bolus, followed by 50 µg/h IV for 5 days Note: Nitrates are often given (sublingually, as transdermal patch, or intravenously) concurrently with vasopressin to reduce side-effects Urgent endoscopy Banding or sclerotherapy can stop bleeding, hence immediate liaison with specialist gastroenterological/hepatological services is essential in cases of suspected variceal haemorrhage Sengstaken–Blakemore tube Consider if: Haemorrhage is torrential Other factors prevent safe emergency endoscopy Antibiotics Prophylactic antibiotics for patients with suspected or confirmed variceal bleeds FFP, fresh frozen plasma. Lower gastrointestinal haemorrhage See Chapter 15.4.2. Clinical features History (1) Haemorrhoids (2) Abdominal pain—if long-standing and intermittent may suggest diverticular disease, if severe may indicate mesenteric ischaemia (3) Previous lower gastrointestinal investigation or surgery (4) To suggest recent development of anaemia (5) Anorexia, weight loss, recent alteration in bowel habit (consider malignancy) (6) Drugs that predispose to gastrointestinal haemorrhage—aspirin, NSAIDs, anticoagulants (7) Risk factors for, or presence of, chronic liver disease (consider rectal varices) (8) Family history—colonic polyps/neoplasia, hereditary haemorrhagic telangiectasia Examination (1) State of circulation—temperature of peripheries, pulse rate, BP, JVP (2) Mucous membranes—chronic anaemia (3) Jaundice—suggests malignancy or chronic liver disease (4) Lymphadenopathy—suggests malignancy (5) Abdomen—for localized tenderness, peritonism, or

palpable mass (6) Rectal examination—for piles and blood (7) Peripheral vasculature—generalized disease increases likelihood of mesenteric ischaemia (8) Telangiectasias on skin or mucosae Notes (1) The most reliable signs of intravascular volume depletion are severe postural (sitting vs lying, if standing not possible) dizziness, a postural rise in pulse rate of

> 30 beats/min, postural hypotension (>20 mmHg fall in systolic BP), and a low JVP Observed re-bleeding and mortality by risk score Score 0 1 2 3 4 5 6 7 8+ Rebleed (%) 4.9 3.4 5.3 11.2 14.1 24.1 32.9 43.8 41.8 Deaths no rebleed (%) 0 0 0.3 2.0 3.5 8.1 9.5 14.9 28.1 Deaths with rebleed (%) 0 0 0 10.0 15.8 22.9 33.3 43.4 52.5 Deaths total (%) 0 0 0.2 2.9 5.3 10.8 17.3 27.0 41.1 Variable Score 0 1 2 3 Comorbidity No major comorbidity Cardiac failure Renal failure Ischaemic heart disease Liver failure Any major comorbidity Disseminated malignancy Diagnosis Mallory–Weiss tear All other diagnoses Malignancy of upper gastrointestinal tract No lesion identified and no stigmata of recent haemorrhage Major stigmata of recent haemorrhage None or dark spot only Blood in upper gastrointestinal tract Adherent clot Visible or spurting vessel Table 30.1.14 Continued (continued)

Section 30 Acute medicine 6610 (2) Most likely diagnoses are diverticulosis (35%), colonic polyp or cancer (15%), inflammatory bowel disease (15%), benign anorectal conditions (10%), and angiodysplasia (10%). Immediate management If cardiorespiratory collapse, as described in ‘Cardiorespiratory collapse: the patient in extremis’ (1) Establish IV access—as in ‘Upper gastrointestinal haemorrhage’ (2) If clinical evidence of intravascular volume depletion, resuscitate as described in ‘Upper gastrointestinal haemorrhage’ (3) Cross-match blood for transfusion Also: (4) Oxygen—high flow, with reservoir bag if needed, to achieve oxygen saturations >92% (5) Insert urinary catheter and monitor fluid input/output hourly in any patient with substantial gastrointestinal haemorrhage—a satisfactory urine output is the best gauge of adequate resuscitation (6) Correct any coagulopathy—see ‘Deep venous thrombosis and pulmonary embolus’, Table 30.1.3 (iatrogenic overanticoagulation) and ‘Disseminated intravascular coagulation’ Key investigations To establish the diagnosis: In all patients: (1) Proctoscopy and rigid sigmoidoscopy As required: (2) Colonoscopy (3) Mesenteric angiography Other important tests: (1) Full blood count (2) Electrolytes, renal and liver function tests, coagulation screen, inflammatory markers (3) To pursue possibility and causes of chronic liver disease (if clinically indicated) Further management (1) Inform surgical colleagues of all cases of substantial gastrointestinal haemorrhage immediately (2) Dependent on cause of haemorrhage Acute colitis See Chapters 15.12 and 15.18. Clinical features History (1) Bowel motions—frequency and type (blood, mucus, pus) (2) Abdominal pain (3) Rapidity of onset (4) Systemic features—fever, malaise, anorexia (5) Previous episodes/known colitic disease (6) Recent diet (contaminated or infected food) (7) Have close contacts also been ill? (8) Recent antibiotic treatment (consider Clostridium difficile) (9) Use of NSAIDs (10) Associated vomiting (11) Travel (12) Risk factors for HIV (in some cases) Examination (1) State of circulation—temperature of peripheries, pulse rate, BP, JVP (2) Signs of toxicity—fever (3) Mucous membranes—chronic anaemia, ulceration, candida (4) Abdomen—for distension, localized tenderness, peritonism or palpable mass, or altered bowel sounds (absent, reduced) (5) Rectal and perineal examination—for fistulas and nature of stool (blood, pus) (6)

Peripheral vasculature—generalized disease increases likelihood of ischaemic colitis (7) Peripheral oedema—suggests hypoproteinaemia and chronic disease in this context Notes The most reliable signs of intravascular volume depletion are severe postural (sitting versus lying, if standing not possible) dizziness, a postural rise in pulse rate of >30 beats/min, postural hypotension (>20 mmHg fall in systolic BP), and a low JVP Immediate management If cardiorespiratory collapse, as described in ‘Cardiorespiratory collapse: the patient in extremis’ (1) Fluid and potassium resuscitation as necessary—see ‘Upper gastrointestinal haemorrhage’ and ‘Hypokalaemia’ (2) Consider giving antibiotics—most cases of acute colitis do not require antimicrobial therapy and settle with rehydration and time, the results of stool culture and rectal biopsy (which should be available in 24–48 h) being used to guide further treatment decisions. However, patients who are very ill with marked systemic symptoms and bloody diarrhoea (indicating probable colitis) should be given antimicrobial therapy pending culture results. Treat empirically with, e.g. ciprofloxacin (500–750 mg orally twice daily, or 200–400 mg IV twice daily) and metronidazole (400 mg orally three times daily or 500 mg IV three times daily), or—in parts of the world where gastrointestinal pathogens are likely to be resistant to fluoroquinolones— with azithromycin 250–500 mg four times daily (3) Consider C. difficile colitis—if this is likely (e.g. patient has recently been exposed to antibiotic treatment and no other cause of colitis apparent), consider starting vancomycin (125–500 mg orally four times daily) until results of testing for C. difficile toxin are available. (3) In cases of known ulcerative or Crohn’s colitis (and to be considered in those with new and undiagnosed presentations of colitis), give steroids to those who are very ill, e.g. hydrocortisone 100 mg IV every 6 h and 100 mg as rectal drip twice daily Note the features of a severe acute attack of ulcerative colitis (Table 30.1.16) Key investigations To establish the diagnosis: In all patients: (1) Abdominal radiograph—to assess extent of inflammation and to exclude toxic megacolon (required before proctoscopy/sigmoidoscopy), and erect chest radiograph— looking for air under diaphragm (perforation) (2) Flexible or rigid sigmoidoscopy and rectal biopsy (3) Stool—microscopy, culture and testing for C. difficile toxin, also for ova, cysts, and parasites if relevant travel history (4) Blood cultures Other important tests: (1) Full blood count (2) Group and save or cross-match blood (3) Electrolytes, renal and liver function tests, inflammatory markers, coagulation screen Further management (1) Inform surgical colleagues of all cases of acute colitis, urgently if radiography shows perforation or toxic dilatation (2) Nurse with appropriate barrier precautions (if possible) until infective cause excluded (3) Further management dependent on cause of colitis (4) Note that suspected or proven food poisoning and typhoid are notifiable diseases in the UK Table 30.1.16 Features that indicate a severe acute attack of ulcerative colitis Bowels Open >6 times per day, with blood in the motions Pulse

> “ 100/min Fever 38° C Albumin <30 g/litre C-reactive protein 45 mg/dl Abdominal radiograph Toxic megacolon Mucosal islands Dilated small bowel

30.1 Acute medical presentations 6611 Acute hepatic failure See Chapter 15.21.5. Clinical features Definitions (1) Acute hepatic failure is hepatocellular jaundice, hypertransaminasaemia, and prolongation of the prothrombin time associated with an acute liver disease (2) Fulminant hepatic failure is acute liver failure with hepatic encephalopathy, most definitions specify that this must occur within a particular time (variable) from the onset of clinical evidence of liver disease (usually jaundice) History (1) Jaundice—not always present in fulminant hepatic failure (2)

Confusion/drowsiness—note timing of onset of mental changes in relation to jaundice (3) Relevant to cause of acute liver failure, e.g. paracetamol overdose, full drug history (prescribed and nonprescribed), risk factors for viral hepatitis (4) Is there a background of chronic liver disease?—alcohol, risk factors for viral hepatitis (5) Autoimmune conditions (associated with autoimmune chronic active hepatitis) (6) Family history (Wilson's disease is a rare cause of fulminant hepatic failure) Examination (1) State of circulation—vital signs are normal in the early stages. Tachycardia and hypotension occur later. Hypertension and bradycardia are very late and sinister signs of cerebral oedema (2) Jaundice (3) Liver—usually tender, but normal size or only slightly enlarged in acute hepatic failure. If hepatomegaly consider hepatic venous obstruction (Budd–Chiari), malignant infiltration, chronic liver disease (4) Ascites—if substantial consider Budd–Chiari syndrome (5) Encephalopathy • Grade 1—mild confusion, irritability, decreased attention • Grade 2—drowsiness, lethargy, inappropriate behaviour • Grade 3—somnolent but rousable, disorientated • Grade 4—coma (6) Signs of chronic liver disease Notes Focal neurological signs are not expected in acute hepatic failure. If present, they suggest a focal cerebral lesion, most likely haemorrhage in this context Immediate management If cardiorespiratory collapse, as described in 'Cardiorespiratory collapse: the patient in extremis' Acute hepatic failure: (1) Oxygen—high flow, with reservoir bag if needed, to achieve oxygen saturations >92% (2) Treat/prevent hypovolaemia—give 4.5% serum albumin IV to keep central venous pressure at +10 cmH2O. Give systemic vasopressor support (e.g. epinephrine, norepinephrine, dopamine) if fluid replacement fails to maintain mean arterial pressure of 50–60 mmHg. (3) Treat/prevent hypoglycaemia—give 20% glucose IV (central line) at 10–20 ml/h (monitor BM stix regularly) (4) Give prophylactic broad-spectrum antibiotic, e.g. cefotaxime 1 g IV twice daily (5) Give prophylaxis against gastrointestinal stress ulceration, e.g. ranitidine (150 mg orally twice daily, 50 mg IV three times daily) (6) Give N-acetylcysteine by IV infusion: • Paracetamol overdose: 150 mg/kg in 200 ml 5% dextrose over 15 min, then 50 mg/kg in 500 ml 5% dextrose over 4 h, then 100 mg/kg in 1000 ml 5% dextrose over 16 h • Other diagnosis: 150 mg/kg in 1000 ml 5% dextrose over 24 h (7) Give corticosteroids, e.g. prednisolone 40–60 mg/day, if acute liver failure is due to autoimmune hepatitis. Hepatic encephalopathy: • Fluid and electrolyte balance—maintain carefully. Avoid/treat dehydration, hypoglycaemia, hypokalaemia, hypophosphataemia (2) Minimize absorption of nitrogenous substances. The following treatments may be given: • Enemas (MgSO4 or phosphate) to encourage bowel emptying • Disaccharide laxative, e.g. lactulose 30–50 ml three times daily, dosage then adjusted to produce 2–3 soft stools daily • Broad-spectrum poorly absorbed antibiotic, e.g. neomycin 1 g four times daily by mouth (3) If grade 3 or 4 encephalopathy, also • Intubate and ventilate • Give parenteral feeding Notes (1) Hyponatraemia is common and due to water excess rather than sodium deficiency. It should be treated with fluid restriction and not by infusion of saline (2) If there is a history of chronic high alcohol intake or malnourishment, give thiamine IV BEFORE giving glucose to avoid risk of precipitating Wernicke's encephalopathy, e.g. Pabrinex IV high-potency injection, 10 ml (2 ampoules) over 10 min (repeated three times daily) (3) Insert urinary catheter and monitor fluid input/output hourly in any patient with acute hepatic failure (4) Cerebral oedema: • Avoidance—avoid overfilling with IV fluids • Treatment—nurse in quiet room with trunk and head elevated at 40°; consider transfer to facility where intracranial pressure can be monitored; consider mannitol 1 g/kg as IV bolus of 20% solution (if plasma osmolality <315 mosmol/kg and the patient is not oliguric), repeated 4-hrly (0.5 g/kg) if previous infusion induced a diuresis Key investigations To establish the presence of acute liver failure: (1) Liver blood tests—bilirubin, transaminases (alanine aminotransferase, aspartate aminotransferase, γ-glutamyl transferase) (2) Prothrombin time/coagulation screen To establish the cause of liver disease: If no

history of paracetamol overdose (1) Hepatitis B core IgM, hepatitis A IgM, liver autoantibodies, immunoglobulins (2) Abdominal ultrasound and Doppler of hepatic veins— looking for size/echogenicity of liver, splenomegaly, signs of Budd–Chiari (3) If <40 years: serum copper and caeruloplasmin; ophthalmic examination for Kayser–Fleischer rings (Wilson's disease) Notes (1) Tap ascites if present—microscopy, culture, and sensitivity. Culture/swab blood, urine, nasal, high vagina (2) Do not correct coagulopathy unless the patient is bleeding: the prothrombin time is an important prognostic indicator. If bleeding, or to cover invasive procedures, give vitamin K 10 mg IV, fresh frozen plasma and platelets, and maintain haematocrit 30–35% by blood transfusion. (3) Where the prothrombin time (in s) is greater than the time after a paracetamol overdose (in h), there is a substantial risk of developing acute liver failure Other important tests: (1) Full blood count (2) Glucose, renal function tests, amylase (3) Arterial blood gases Further management (1) Discuss all cases of acute hepatic failure with a specialist (transplant) centre (see Table 30.1.17): urgent orthotopic liver transplantation may be required and appropriate (2) Dependent on cause of hepatic failure

Section 30 Acute medicine 6612 The acute abdomen See Chapter 15.4.1. Clinical features History (1) Abdominal pain—duration, constant or colicky,
where is it worst (point with one finger), radiation (2) Gastrointestinal symptoms—anorexia, nausea, vomiting, diarrhoea, constipation (precisely when
were the bowels last open), flatus, blood in vomit
or stool (3) Urinary symptoms—frequency, pain on micturition, haematuria (4) Gynaecological symptoms—last menstrual period, vaginal discharge (5) To suggest sepsis—sweats, fevers, rigors (6) History of gastrointestinal problems—indigestion, peptic ulceration, gallstones, pancreatitis (7) History of atheromatous vascular disease—ischaemic heart disease, cerebrovascular disease, peripheral vascular disease (increase the likelihood of bowel ischaemia or of abdominal aortic aneurysm, also
relevant to surgical risk) Examination (1) State of circulation—temperature of peripheries, pulse rate, BP, JVP (2) Signs of toxicity—fever (3) Foetor (4) Abdomen: • Inspection—distension, movement on respiration • Palpation—tenderness, guarding, rigidity, rebound tenderness, palpable mass • Auscultation—bowel sounds • Check all hernial orifices and abdominal aorta (5) Rectal examination—for tenderness and nature
of stool, blood in stool (6) Vaginal examination—tenderness, pelvic mass (7) Test urine for blood (8) Pregnancy test if relevant Note The likely cause of abdominal pain depends on the context. Cases presenting in the community that require assessment in hospital will generally be referred directly to surgical services, and many will have 'obvious' diagnoses such as appendicitis. Patients presenting to medical services or who develop abdominal pain when already on a medical ward will generally be older and with multiple comorbidities, and are much more likely to have intestinal vascular events or obstruction due to malignancy Immediate management If cardiorespiratory collapse, as described in 'Cardiorespiratory collapse: the patient in extremis' (1) Establish IV access—as described in 'Upper gastrointestinal haemorrhage' (2) If clinical evidence of intravascular volume depletion, resuscitate as described in 'Upper gastrointestinal haemorrhage' (3) Urgent liaison with surgical colleagues (4) Analgesia—give adequate pain relief, e.g.: • NSAID: e.g. diclofenac 75 mg intramuscularly, repeated after 30 min if necessary • Opioid: e.g. morphine 5 mg subcutaneously plus 5 mg intramuscularly, repeated if necessary and accompanied by appropriate antiemetic, e.g. metoclopramide 10 mg IV over 1–2 min, or cyclizine 50 mg IV over 1–2 min (5) Nasogastric tube—when there is continued vomiting and/or suspected intestinal

obstruction (6) Urinary catheter Key investigations To establish the diagnosis: (1) Supine abdominal radiograph—is there intestinal obstruction (seldom indicates cause)? Is there a urinary stone (CT preferred imaging technique)? (2) Erect chest radiograph—is there gas under the diaphragm indicating intestinal perforation? (3) Serum amylase—a substantial increase suggests pancreatitis (4) Abdominal CT scan—increasingly used in the management of patients with acute abdominal pain (5) Abdominal ultrasound—when acute gallbladder disease is suspected Note Patients with generalized peritonitis require an urgent laparotomy provided that pancreatitis has been excluded. Do not delay: if the patient requires resuscitation, then make arrangements for theatre while initiating resuscitation and continue to resuscitate in the anaesthetic room. Do not wait 'until the patient is a bit better' before involving anaesthetic and surgical colleagues Other important tests: (1) Full blood count (2) Group and save or cross-match blood (3) Electrolytes, renal and liver function tests (4) Coagulation screen Further management Dependent on the cause of the acute abdomen Notes (1) Adhesive small-bowel obstruction may resolve with conservative management (2) Remember rare 'medical' causes of abdominal pain, e.g. pneumonia, shingles, drugs (digoxin), diabetes, sickle cell crisis, porphyria, familial Mediterranean fever—remember also that these are rare: if in doubt, diagnose a common condition Table 30.1.17 King's College criteria for transplant listing of patients with acute liver failure in case of paracetamol overdose Criteria Comment Arterial pH <7.3—regardless of presence or absence of hepatic encephalopathy A patient satisfying any one of the three criteria should be considered for transplant listing All of the following: INR >6.5 Creatinine >300 μmol/litre Hepatic encephalopathy grade 3–4 Lactate >3.5 mmol/litre (4 h after resuscitation) or >3 mmol/litre (12 h after resuscitation) Note—any patient who is coming close to meeting any of these criteria should be discussed urgently with a specialist (transplant) centre

30.1 Acute medical presentations 6613 Renal Acute kidney injury See Chapter 21.5. Clinical features History (1) There are no specific features to suggest acute kidney injury: presentation is dominated by the precipitating condition (2) Previous renal or urinary tract disease (3) Drugs, prescribed and nonprescribed (4) Evidence of multisystem disease (5) Always seek the results of previous tests of renal function Examination (1) State of circulation—temperature of peripheries, pulse rate (+ postural change), BP (+ postural change), JVP (2) Evidence of infection—fever, localizing signs (3) Breathing—evidence of pulmonary oedema or acidosis (Kussmaul) (4) Abdominal—is the bladder palpable? (obstruction) (5) Rectal—is there pelvic malignancy? (obstruction) (6) General—signs indicating multisystem disorder: rash, joints, eyes, nose. Are muscles swollen/tender? (rhabdomyolysis) Note The most reliable signs of intravascular volume depletion are severe postural (sitting vs lying, if standing not possible) dizziness, a postural rise in pulse rate of >30 beats/min, postural hypotension (>20 mmHg fall in systolic BP), and a low JVP Immediate management If cardiorespiratory collapse, as described in 'Cardiorespiratory collapse: the patient in extremis' Treatment of life-threatening complications: (1) Hyperkalaemia—see 'Hyperkalaemia' (2) Pulmonary oedema—see 'Pulmonary oedema', but note that diuretics are not likely to induce diuresis in the context of acute kidney injury (3) Severe acidosis, causing circulatory compromise (4) 'Gross uraemia', causing encephalopathy or bleeding Note Aside from immediate life-saving medical treatments, patients with these features will need urgent renal replacement therapy (preferably by haemodialysis or haemofiltration, as dictated by clinical context) unless their renal function can be restored rapidly Resuscitation: (1) Optimization of intravascular volume—many patients presenting with acute kidney injury will be volume deplete Establish IV access—as in 'Upper gastrointestinal haemorrhage' If clinical evidence of intravascular

volume depletion, resuscitate as described in ‘Upper gastrointestinal haemorrhage’ (2) Oxygen—high flow, with reservoir bag if needed, to achieve oxygen saturations >92% Make diagnosis of cause of renal failure: (1) Is it acute or chronic?—previous biochemical measurements; renal size on ultrasonography (small kidneys indicate chronic disease) (2) Is it due to urinary obstruction?—history of lower urinary tract symptoms, haematuria, urinary stones etc.; dilated pelvicalyceal system on ultrasonography (but beware of obstruction without dilatation) (3) Is it due to renal inflammation?—dipstick proteinuria and haematuria; urinary red cell casts (4) Is it due to prerenal failure/acute tubular necrosis?— clinical context; evidence of circulatory compromise/ intravascular volume depletion Notes (1) Stop all drugs that can be haemodynamically deleterious to renal function unless there is a very pressing indication for them, e.g. nonsteroidal anti-inflammatory drugs, angiotensin-converting enzyme inhibitors, angiotensin II receptor blockers; also stop all nephrotoxic agents (e.g. aminoglycosides) and substitute nontoxic alternatives (2) Insert urinary catheter and monitor fluid input/output hourly in any patient with acute kidney injury—remove after 24 h if the patient is anuric/oliguric Key investigations To establish the diagnosis: Renal function tests—acute kidney injury is usually diagnosed clinically on the basis of rapid rise in serum creatinine Other important tests: (1) ECG—looking for manifestations of hyperkalaemia (2) Electrolytes—especially potassium (3) Full blood count, coagulation screen, liver function tests (4) Creatine kinase (rhabdomyolysis) (5) Blood and other cultures—if clinically indicated (6) Autoimmune/vasculitic screen (anti-glomerular basement membrane, ANCA, ANA, immunoglobulins, cryoglobulins)—if clinically indicated (7) Ultrasonography of urinary tract—to determine renal size and look for evidence of obstruction (8) Chest radiograph—looking for pulmonary oedema or (less likely) evidence of lung haemorrhage in pulmonary- renal syndrome (9) Arterial blood gases—quantitate acidosis Further management Dependent on the cause of acute kidney injury Notes (1) When intravascular volume has been restored to normal (JVP clearly visible/central venous pressure in normal range; no postural rise in pulse rate or drop in BP), fluid input should then be given in equal volume to measured output of urine and other fluids, plus an allowance (500–1000 ml/day) for insensible losses. The prescription of fluid should be refined on the basis of (at least) twice-daily clinical examination and daily measurement of the patient’s weight (2) The patient is likely to have acute kidney injury due to renal inflammation if there is significant (2+) proteinuria and haematuria—urgent referral to a renal specialist is required. Precise diagnosis of glomerulonephritis, tubulointerstitial nephritis, or vasculitis will probably require renal biopsy, with irreversible renal failure occurring in some patients in whom diagnosis is delayed (3) If imaging suggests urinary obstruction, then this requires urgent relief, e.g. by urethral catheterization, suprapubic catheterization, or percutaneous antegrade nephrostomy as appropriate Rhabdomyolysis See Chapter 21.5. Clinical features Rhabdomyolysis is the breakdown of muscle fibres, when leakage of potentially toxic cellular contents into the circulation can lead to hypovolaemia, acidosis, hyperkalaemia, acute kidney injury, and disseminated intravascular coagulation. History Muscular symptoms: (1) Pain, tenderness—focal or generalized (2) May be none (continued)

 Related to cause: (1) Focal muscle damage: • Obvious—e.g. crush injury, high-voltage electrical injury • Not so obvious—e.g. ischaemic injury following arterial embolus to limb; pressure damage following prolonged immobilization (commonly coma) (2) Generalized muscle damage: • Excessive muscular activity—severe exercise—e.g. marathon running; prolonged epileptic fitting (see ‘Status epilepticus’) • Infections—septicaemia—see ‘Septic shock’; viral myositis—e.g. influenza • Toxins—prescribed drugs—e.g. HMG CoA reductase

inhibitors; substance abuse—e.g. alcohol, barbiturates, opioids, methanol, ethylene glycol (antifreeze), cocaine, amphetamine, ecstasy (MDMA), lysergic acid diethylamide (LSD); other—e.g. snake bite, spider (black widow) bite, bee sting (multiple), carbon monoxide, toluene, hemlock (quail that have eaten hemlock) • Heatstroke (see 'Heat stroke'); malignant hyperpyrexia (see 'Heat stroke'); neuroleptic malignant syndrome (see 'Heat stroke') • Myopathies—consider particularly if rhabdomyolysis occurs without clear precipitant; metabolic—ask for history of intermittent muscular fatigue/pain, e.g. McCardle's syndrome; inflammatory—e.g. polymyositis • Metabolic/endocrine—hypothyroidism; electrolyte disturbance—e.g. hypokalaemia; diabetic ketoacidosis Examination General: (1) Vital signs—temperature, pulse rate, BP, respiratory rate (2) Full physical examination (3) Inspection of urine—looks dark brown ('Coca Cola') For cause of rhabdomyolysis: (1) Muscles—are any swollen or tender? Is there a compartment syndrome? (2) Ischaemia—are legs and arms well perfused? Can you feel all peripheral pulses? (3) Pressure damage—look especially at the back of the head, spine, pelvis, and heels—pressure sores indicate likelihood of pressure damage to muscles (4) Systemic condition—rash—septicaemia (common), dermatomyositis (very rare); slow relaxing tendon jerks (hypothyroidism) Immediate management As for acute kidney injury: see 'Acute kidney injury' To prevent rhabdomyolysis from leading to renal failure: (1) Restore intravascular volume rapidly: see 'Upper gastrointestinal haemorrhage' (2) Monitor—urine output—urethral catheter; urinary pH—dipstick (3) Fluid—encourage brisk diuresis (urine output c.200 ml/ h) by giving 0.9% saline or other crystalloid with sodium concentration in range 130–154 mmol/litre at initial rate of 1–2 litre/h, reducing to restrict urine output to 200–300 ml/ h or at first sign of pulmonary oedema (4) Consider alkali—e.g. 1.26% sodium bicarbonate (=150 mmol/litre each of sodium and bicarbonate) at 25 ml/h—adjust rate to achieve urinary pH >7. (5) Consider mannitol—1 g/kg as 20% solution IV over 30–60 min (6) Consider diuretic—if urine output remains low,
e.g. furosemide 40 mg (push)–500 mg (over 2 h) IV Notes (1) If urine output remains low, then infusion of fluid as described here will inevitably lead to overload—fluid infusion must be stopped before pulmonary oedema develops. Then proceed as for acute kidney injury (see 'Acute kidney injury') (2) Myoglobin is more soluble at elevated pH, but there is no substantial clinical evidence that mannitol/alkaline diuresis provides better outcome than saline diuresis. (3) Close monitoring of serum electrolytes, particularly potassium and calcium, is required. Do not correct hypocalcaemia with calcium (risk of inducing/worsening metastatic calcification) Key investigations To establish the diagnosis: (1) Urine—dipstick test positive for blood, but microscopy shows no red blood cells (2) Blood—creatine kinase—grossly elevated (>10 000 IU/ litre, with lesser elevation not diagnostic in the absence of other supporting evidence) Other important tests: (1) ECG—look for features of hyperkalaemia (see 'Hyperkalaemia') (2) Electrolytes—potassium (hyperkalaemia is potentially life-threatening and may develop rapidly; see 'Hyperkalaemia'), calcium (hypocalcaemia), phosphate (hyperphosphataemia) (3) Biochemical screen—renal function; liver blood
tests (elevated transaminases from muscle); LDH (elevated) (4) Full blood count; coagulation screen (risk of disseminated intravascular coagulation) (5) As dictated by clinical suspicion—e.g. blood cultures, thyroid function tests, muscle biopsy Further management (1) Dependent on the cause of rhabdomyolysis (2) Compartment syndrome—measure compartment pressure; fasciotomy if elevated Metabolic and endocrine Hypoglycaemia See Chapter 13.9.2. Clinical features History (1) Coma (2) Epileptic fitting (3) Confusion and/or delirium (4) Focal neurological signs (including hemiplegia, uncommon) The patient may not be able to give any useful history: obtain as much information as possible from others in attendance (relatives, friends, ambulance crew, bystanders, etc.). Ask in particular regarding: (1) Diabetes mellitus (2) Patient self-medication, and access to

insulin/oral hypoglycaemic agents (3) Previous episodes (4) Alcohol and food consumption (5) Other medical conditions Examination Immediate priorities: (1) Airway, breathing, circulation (2) Glasgow Coma Score (3) Bedside stick test for blood glucose Other features: (4) Typically very pale and shut down peripherally with a cold sweat (5) Evidence that the patient is diabetic: search for MedicAlert bracelet/necklace, medication (insulin, oral hypoglycaemic agents), documentation (glucose monitoring, outpatient clinics), sites of insulin injection (6) Evidence of chronic liver disease or endocrine disorder Immediate management If cardiorespiratory collapse, as described in 'Cardiorespiratory collapse: the patient in extremis' (1) Give glucose to symptomatic patient after establishing hypoglycaemia (<2.5 mmol/litre) by bedside stick test, as follows: • Patient alert and cooperative: give glucose 10–20 g by mouth (2 teaspoons sugar, or 3 sugar lumps, or one 23 g oral ampoule of Hypostop gel)

30.1 Acute medical presentations 6615 • If impaired consciousness and not protecting airway: give glucose 20–25 g IV, e.g. 100 ml of 20% or 50 ml of 50% glucose (dextrose monohydrate) (note that 50% dextrose is viscous and irritant if extravasated, hence it must be given through a large-bore needle/cannula into a large vein, because of which many protocols now advocate using glucose 20%). • If impaired consciousness, not protecting airway and IV access not possible: give glucagon 1 unit (= 1 mg) intramuscularly (2) Repeat blood glucose measurement after 10 min and repeat glucose administration if still hypoglycaemic Notes (1) Hypoglycaemic symptoms are unusual if the plasma glucose is >2.5 mmol/litre, but the threshold varies from person to person, hence it is appropriate to administer one dose of glucose IV (100 ml of 20% or 50 ml of 50% glucose (dextrose monohydrate)) to any patient with impaired consciousness whose plasma glucose is <3.0 mmol/litre (2) Give hydrocortisone 100 mg IV if recovery delayed beyond 20 min (3) Consider complication of cerebral oedema if patient does not recover as expected—refer to (neurological) intensive care; management requires infusion of glucose to keep within range 5–10 mmol/litre, IV mannitol, IV dexamethasone Key investigations To establish the diagnosis: Blood glucose—take sample through cannula before giving IV glucose: hypoglycaemia defined by glucose concentration <3 mmol/litre, acute symptoms possible at <2.5 mmol/litre Other important tests: (1) Serum sample for insulin and C-peptide levels— hypoglycaemia in a known diabetic is unlikely to require further investigation, but if the situation is not clear cut, then a serum sample should be taken before IV glucose (or intramuscular glucagon) is administered to determine whether hypoglycaemia is due to endogenous or exogenous insulin (2) Full blood count, clotting screen, electrolytes, creatinine, liver/bone blood tests—routine screen (3) Blood and other cultures—if clinical suspicion of sepsis (4) Tests for endocrine disease—adrenocortical insufficiency, hypothyroidism, hypopituitarism—if clinically appropriate (5) Salicylate level—if possibility of overdose (6) Chest radiograph—?aspiration in any patient who has been unconscious Further management Dependent on the cause of hypoglycaemia Notes (1) Hypoglycaemia may recur—patients who have been given IV glucose and recovered from hypoglycaemia should be observed for at least 12 h, longer if they have taken long acting insulin/oral hypoglycaemic agents (2) Education—most cases of hypoglycaemia occur in known diabetics and can be avoided by the patient checking their blood glucose and responding appropriately in the event of warning signals Diabetic ketoacidosis See Chapter 13.9.1. Clinical features History (1) Polyuria and polydipsia (2) Drowsiness (3) To suggest precipitating condition—often infection, but can be any acute illness (4) Monitoring and treatment of diabetes (in known diabetics)—in particular recent details of blood glucose measurements and medication with insulin or oral hypoglycaemic agents Examination (1) State of circulation/dehydration—temperature of peripheries, skin turgor, pulse rate, BP, tongue

and mucous membranes, eyes, JVP (2) Breathing—in particular for indication of acidosis (Kussmaul) and for smell of ketones (3) Glasgow Coma Score (4) Evidence of infection—fever, localizing signs, including careful examination of feet and skin for ulceration/sepsis Notes (1) The most reliable signs of intravascular volume depletion are severe postural (sitting vs lying, if standing not possible) dizziness, a postural rise in pulse rate of >30 beats/min, postural hypotension (>20 mmHg fall in systolic BP), and a low JVP (2) Examine carefully for evidence of long term complications of diabetes, but not in the immediate emergency setting Immediate management If cardiorespiratory collapse, as described in 'Cardiorespiratory collapse: the patient in extremis' (1) Restoration of intravascular volume/hydration (patients will typically have a total body fluid deficit of 3–6 litres): • Establish IV access—as in 'Upper gastrointestinal haemorrhage' • Give 0.9% saline 1–2 litre in 2 h, then 1 litre in 4 h (with potassium, see later in this table), then 4 litres in 24 h (each with potassium, see later in this table) Notes (i) If hypotensive and shut down peripherally—give 1 litre of 0.9% saline as fast as possible before starting fluid regimen detailed earlier in this table (ii) When blood glucose 10–14 mmol/litre, switch from 0.9% saline to 10% dextrose infusion at 125 ml/h until eating normally (while continuing IV insulin infusion) (iii) If serum sodium >150 mmol/litre then check osmolality and replace 0.9% saline with 0.45% saline only if osmolality not falling (2) Correction of electrolyte imbalance • All patients will have a very substantial deficit in body potassium, even though serum potassium concentration will usually be elevated at presentation. Replace potassium as follows, monitoring the serum concentration every few hours: Serum potassium (mmol/litre) Potassium (mmol) added to each litre of fluid replacement <3.5 40 and review in 1 h 3.5–5.0 40

> 5.0 None and review in 2 h (3) Correction of hyperglycaemia • Give insulin (Actrapid 50 units mixed in 50 ml of 0.9 % saline) IV at a fixed rate of 0.1 U/kg per h Note—if not possible to give controlled infusion of IV insulin, then give 20 U soluble insulin IM, followed by 5–10 U intramuscularly each hour, titrated according to response (4) Correction of acidosis—acidosis will correct with restoration of circulating volume and administration of insulin and there is some evidence that giving bicarbonate may do harm. Only consider giving sodium bicarbonate (1.26% solution, 500 ml by IV infusion over 1 h) if there is profound acidosis (e.g. arterial pH <7.0) that is thought to be causing circulatory compromise Also: (1) Empty the stomach with nasogastric tube if patient has nausea or vomiting—gastroparesis/acute gastric dilatation is a particular risk in diabetic ketoacidosis, with a high risk of vomiting and aspiration, which can be fatal (2) Give prophylaxis against venous thromboembolism (high risk) with low molecular weight heparin, e.g. enoxaparin 40 mg by subcutaneous injection once daily And: Treat any precipitating condition vigorously. Note that surgical attention may be required, in particular when there is foot sepsis (continued)

 Note: hyperosmolar hyperglycaemic state (HHS) (previously termed hyperosmolar nonketotic state (HONK)): • Typically occurs in elderly patients with type 2 diabetes • Glucose often >50 mmol/litre • Hypernatraemia common (often Na >155 mmol/litre) • Not ketoacidotic (by definition) • Plasma osmolality >320 mosmol/kg, calculated as 2 × (Na

- K) + urea + glucose (all measured in mmol/litre) • Give 0.9% saline as for diabetic ketoacidosis; monitor osmolality and replace 0.9% saline with 0.45% saline only if osmolality is not falling • Replace potassium as for diabetic ketoacidosis • Insulin—rehydration alone will usually lower blood glucose; if blood glucose not falling by 4–6 mmol/litre per h then start intravenous insulin at fixed rate of 0.05 units/kg per h Key investigations To establish the diagnosis: (1) Blood glucose (2) Stick test of urine for ketones Other important tests: (1) Serum electrolytes (2) Arterial blood gases (3) Full blood count, renal and liver function tests (4) 'Infection screen'—chest radiograph, urine and blood culture, swab any potentially infected site (5) ECG (may have silent infarct) Further management Education—most cases of diabetic ketoacidosis occur in known diabetics and can be avoided. The key issue to emphasize is that illness increases insulin requirements, hence diabetics who are ill: (1) Still need to take insulin, even if they are not eating (2) Should check their blood glucose regularly (up to every 2 h or so) (3) Should give themselves frequent appropriate doses of short-acting insulin if their blood glucose starts to rise (4) Should have access to a phone number that they can call for advice if they run into problems Metabolic acidosis See Chapter 12.11. Clinical features History In the acute medicine context presents nonspecifically with: (1) Altered conscious level (2) Circulatory collapse (3) Hyperventilation Key points to establish: (1) In what circumstances was the patient found? (2) History of diabetes mellitus, particularly if treated with metformin (3) History of chronic kidney disease (4) Overdose—most commonly salicylates (5) Consumption of poison—e.g. ethylene glycol, methanol, antifreeze Notes Medical conditions that can cause profound metabolic acidosis (with normal anion gap, see 'Key investigations') include: (1) Severe diarrhoeal illness (2) Renal tubular acidosis Examination (1) State of circulation—temperature of peripheries, pulse rate, BP, JVP (2) Breathing—in particular for indication of acidosis (Kussmaul) and for smell of ketones (3) Glasgow Coma Score Immediate management If cardiorespiratory collapse, as described in 'Cardiorespiratory collapse: the patient in extremis' (1) Oxygen—high flow, with reservoir bag if needed, to achieve oxygen saturations >92% (2) Restoration of intravascular volume: • Establish IV access—as in 'Upper gastrointestinal haemorrhage' • If clinical evidence of intravascular volume depletion, resuscitate as described in 'Upper gastrointestinal haemorrhage' (3) Consider bicarbonate infusion—this is a contentious issue: if acidosis is severe (pH <7.0) and there is circulatory compromise, give IV sodium bicarbonate—e.g. 1.26% solution, 500 ml by IV infusion over 1 h (75 mmol of bicarbonate), or an equivalent amount of bicarbonate as a more concentrated solution if the patient is fluid overloaded); then assess clinical response and repeat arterial blood gases Note Correction of metabolic acidosis requires careful attention to serum potassium concentration: profound hypokalaemia can occur if this is neglected Key investigations To establish the diagnosis: (1) Arterial blood gases—show metabolic acidosis (by definition) (2) Plasma glucose and stick test for urinary ketones—to exclude diabetic ketoacidosis (see 'Diabetic ketoacidosis') (3) Plasma salicylate concentration—to exclude overdose (4) Serum creatinine and urea—to exclude renal failure and uraemic acidosis (5) Serum electrolytes—acidosis may be associated with hypokalaemia or hyperkalaemia, but with profound deficit in total body potassium in both situations. Close monitoring required. (6) Blood lactate concentration—many types of severe illness are associated with lactic acidosis, especially overwhelming sepsis (7) Serum bicarbonate concentration (8) Calculate the anion gap: are there unusual anions in the blood? The blood 'anion gap',

calculated as (Na+ + K+) − (Cl– + HCO3 –), usually equals 10–18 mmol/litre. If there is acidosis with a high anion gap, then there must be an unmeasured substance in the blood, in which case discuss measurement of specific toxins with a clinical biochemist if there is diagnostic doubt Other important tests: (1) Full blood count, clotting screen, electrolytes, liver and bone blood tests—routine screen (2) Blood paracetamol level (rarely causes profound acidosis, but combined overdoses are common)— depending on clinical suspicion (3) Serum sample—for toxicological analysis; depending on clinical suspicion (4) Chest radiograph—consider aspiration in any patient with a depressed conscious level (5) Abdominal radiograph—in cases of unexplained normal anion gap acidosis; renal tubular acidosis may be associated with nephrocalcinosis Further management Dependent on the cause of metabolic acidosis Hyperkalaemia See Chapters 21.2.2 and 21.5. Clinical features History (1) Hyperkalaemia does not produce specific symptoms. Patients may sometimes develop ‘odd feelings’ in their muscles, but these are rarely dramatic. (2) Cardiac arrest (3) Context—almost always occurs in the context of acute kidney injury or chronic kidney disease Examination (1) Hyperkalaemia does not produce specific signs (2) Cardiac arrhythmia

30.1 Acute medical presentations 6617 Immediate management If there are ECG changes that are more severe than tenting of the T waves: • Give 10 ml of 10% calcium gluconate by slow IV injection, repeated as necessary until ECG shows clear evidence of returning towards normal If ECG changes are not severe, or after giving calcium gluconate: (1) Give 10–20 units of soluble insulin in 100 ml of 20% or 50 ml of 50% glucose (dextrose monohydrate) IV over 20 min, or (2) Give nebulized β2-agonist, e.g. salbutamol 10 mg These treatments will lower serum potassium concentration by 1–2 mmol/litre over 20–30 min and buy a few hours of time, but hyperkalaemia will recur unless the cause can be treated rapidly, hence consider: (3) Urgent referral to nephrological services for renal replacement therapy Notes IV infusion of sodium bicarbonate 50–100 mmol (c.300– 600 ml of 1.26% solution or c.50–100 ml of 8.4% solution) can treat hyperkalaemia in the setting of severe acidosis. In other cases it has no advantage over insulin/dextrose or β2-agonist and has the disadvantages of not only requiring a substantial sodium/fluid load (a problem in those who are already overloaded), but also that concentrated solutions are chemically irritant and hence must be administered through central venous lines. Key investigations To establish the diagnosis: (1) ECG—the following changes occur progressively as the plasma potassium concentration rises: • Tenting of T waves • PR interval lengthens, P wave diminishes before disappearing, and QRS complex widens • ‘Sine wave’ pattern (2) Serum potassium—hyperkalaemia defined by concentration

> “ 5.5 mmol/litre, but <7 mmol/litre rarely life-threatening Note The morphology of the ECG determines the risk of hyperkalaemia to the individual patient better than the absolute level of serum potassium Other important tests: (1) Renal function tests (2) To determine cause of acute kidney injury—if clinical context is appropriate (see ‘Acute kidney injury’) Further management (1) Ion exchange resins, e.g. calcium resonium 15 g in water three or four times daily by mouth (with concurrent prescription of a laxative), or 30 g in methylcellulose solution given as an enema, retained for 9 h and then removed by irrigation—these can

be helpful in patients with persistent (but not life-threatening) hyperkalaemia who would not otherwise require renal replacement therapy. Note, however, that ion exchange resins take at least 4 h to have any effect and are not a useful emergency treatment for hyperkalaemia. (2) Stop all drugs that might exacerbate hyperkalaemia unless there is a very pressing need for them and no alternative is available, e.g. potassium supplements, potassium-sparing diuretics, angiotensin-converting enzyme inhibitors, angiotensin II receptor antagonists, trimethoprim, heparin (3) Dependent on the cause of hyperkalaemia Hypokalaemia See Chapter 21.2.2. Clinical features History (1) In almost all cases of hypokalaemia there are no symptoms (or only nonspecific symptoms) attributable to the low plasma potassium concentration (2) Cardiac arrhythmia (rare) (3) Muscular paralysis (very rare) (4) Relevant to cause of hypokalaemia Examination (1) Hypokalaemia does not produce specific signs (2) Cardiac arrhythmia (3) Muscular paralysis (very rare) Immediate management Emergency treatment is rarely required If life-threatening cardiac arrhythmia or muscular paralysis: • Give 40 mmol of potassium IV via volumetric pump over 1 h, then repeat measurement of serum potassium concentration and adjust rate of potassium infusion as appropriate If thyrotoxic periodic paralysis: • Give propranolol 3 mg/kg orally Key investigations To establish the diagnosis: (1) Serum potassium—hypokalaemia defined by concentration <3.5 mmol/litre, severe <3.0 mmol/litre Other important tests: (1) ECG—looking for flattening of the T wave, depression of the ST segment, and the development of a prominent U wave, also for arrhythmia (2) To determine cause of hypokalaemia—see Chapter 21.2.2 Further management Dependent on the cause of hypokalaemia Hyponatraemia See Chapter 21.2.1. Clinical features History (1) Does not produce specific symptoms (2) Altered consciousness, epileptic fitting (3) Relevant to cause of hyponatraemia Examination (1) Glasgow Coma Score (2) Fluid status: • Intravascular volume depletion—low JVP, postural hypotension/rise in pulse rate • Clinically normal volume status • Volume expansion—peripheral oedema Immediate management of chronic asymptomatic hyponatraemia Do not aim to correct rapidly (1) If intravascular volume depletion—give 0.9% saline IV until intravascular volume restored, then restrict water intake (2) If euvolaemic or hypervolaemic—restrict fluid intake to 1000 ml/day. Provide swabs to moisten the mouth and give the fluid allowance as ice cubes in aliquots throughout the day. Immediate management of acute symptomatic hyponatraemia • Severe cerebral oedema with active seizures or respiratory failure—give 3% saline, 100 ml IV over 10 min (if 3% saline not available, then give 1 ml/kg (maximum 50 ml) of 8.4% sodium bicarbonate); repeat until serum sodium increased by 2–4 mmol/litre or clinical improvement, then proceed as for: • Hyponatraemic encephalopathy with seizures (inactive), decreased GCS, headache, nausea, or vomiting—give 3% saline at 1 ml/kg/per h (or 1.8% saline at 1.7 ml/kg per h) by volumetric infusion pump • Check serum sodium every 2 h during infusion of hypertonic saline • Stop hypertonic saline when patient is symptom-free or serum sodium has increased by 15–20

> mmol/litre in the initial 48 h of therapy Notes (1) Do not attempt rapid correction of serum sodium concentration into the normal range (probably increases risk of central pontine myelinolysis) (continued)

Section 30 Acute medicine 6618 (2) No algorithm can accurately predict how much hypertonic saline a patient requires to correct hyponatraemia, or what the response of a particular patient will be to a given volume of hypertonic saline— hence the requirement for very close monitoring of serum sodium (3) Steroids—if glucocorticoid deficiency is possible, then give steroid replacement immediately, e.g. hydrocortisone 100 mg IV 6-hrly, until the diagnosis is excluded Key investigations To establish the diagnosis: Serum sodium—hyponatraemia defined by concentration <130 mmol/litre; severe symptoms unlikely at

> 120 mmol/litre Other important tests: (1) Plasma and urinary osmolality (2) Urinary sodium concentration Further management (1) Stop diuretic (if relevant) (2) Dependent on the cause of hyponatraemia Hypercalcaemia See Chapter 13.4. Clinical features History (1) Does not produce specific symptoms (2) Acute hypercalcaemia—general malaise, anorexia, thirst, polyuria, constipation. In severe cases vomiting, confusion, coma. (3) Chronic hypercalcaemia—urinary stones, abdominal pain, mental disturbance (4) Relevant to cause of hypercalcaemia Examination (1) Acute hypercalcaemia does not produce specific signs (2) Fluid status: • Intravascular volume depletion—postural hypotension/ rise in pulse rate, low JVP • Dehydration—reduced skin turgor, dry mucous membranes (3) Evidence of malignancy Immediate management If cardiorespiratory collapse, as described in ‘Cardiorespiratory collapse: the patient in extremis’ (1) Restoration of intravascular volume (if necessary)—as described in ‘Upper gastrointestinal haemorrhage’ (2) Saline diuresis—give 0.9% saline IV at a rate of 1 litre/ 6 h until calcium restored towards normal, assuming adequate urinary output (monitor carefully, and examine the patient regularly for signs of fluid overload). Give loop diuretic, e.g. furosemide 40–80 mg orally or IV twice daily, if urine output slow to increase. Watch carefully for signs of pulmonary oedema, particularly in elderly patients and those with heart disease, and stop saline if this develops. When diuresis initiated: (2) Bisphosphonate, e.g. disodium pamidronate (60–90 mg by IV infusion at a rate of 1 mg/min) or zoledronic acid (4 mg IV) Also: Glucocorticoids, e.g. hydrocortisone 100 mg IV three times daily or prednisolone 40–60 mg orally daily, if hypercalcaemia is due to sarcoidosis, vitamin D toxicity, or haematological malignancy Notes (1) Consider glucocorticoid deficiency—if this is possible, then give steroid replacement immediately, e.g. hydrocortisone 100 mg IV 6-hrly, until the diagnosis is excluded (2) Consider dialysis with low-calcium (or zero-calcium, if available) dialysate if hypercalcaemia fails to respond to saline, furosemide and bisphosphonate (also in patients with renal failure) Key investigations To

> establish the diagnosis: (1) Serum calcium—hypercalcaemia defined by concentration >2.6 mmol/litre, acute symptomatic cases usually >3.0 mmol/litre. Other important tests: (1) Full blood count, electrolytes, renal and liver function tests (2) Serum PTH, immunoglobulins; protein electrophoresis of serum and urine (3) Chest radiograph (4) Directed by clinical suspicion of malignancy Further management Dependent on the cause of hypercalcaemia Addisonian crisis See Chapter 13.5.1. Clinical features History (1) Cardiovascular collapse (2) Context of nonspecific symptoms compatible with glucocorticoid deficiency: tiredness, weakness, dizziness, anorexia, weight loss, nausea, vomiting, diarrhoea, abdominal pain. May have salt craving (3) Related to cause—personal or family history of autoimmune/endocrine disease, steroid usage (and cessation), tuberculosis, recent flank pain (?adrenal haemorrhage/infarction) (4) Context of symptoms related to hypopituitarism (may be present in secondary but not primary adrenal insufficiency)—infertility, oligo-/amenorrhoea, poor libido (luteinizing hormone/follicle-stimulating hormone deficiency); weight gain, cold intolerance (thyroid- stimulating hormone deficiency); hypoglycaemia (growth hormone deficiency) (5) May occur in context of septicaemia Examination (1) State of circulation—temperature of peripheries, pulse rate, BP, JVP (2) Hyperpigmentation—palmar creases, scars, and buccal mucosae (present in primary but not secondary adrenal insufficiency) (3) Loss of axillary and pubic hair in women (4) Vitiligo Immediate management If cardiorespiratory collapse, as described in ‘Cardiorespiratory collapse: the patient in extremis’ (1) Restoration of intravascular volume—give 0.9% saline IV as described in ‘Upper gastrointestinal haemorrhage’ (2) Steroid, e.g. hydrocortisone 100 mg IV (give immediately, then every 6 h; give intramuscularly if IV not possible) Key investigations To establish the diagnosis: (1) Serum cortisol and ACTH—taken at the time of venous cannulation for resuscitation (2) Short Synacthen test—performed later Other important tests: (1) Electrolytes (hyponatraemia, hyperkalaemia), glucose (hypoglycaemia), renal function tests (elevated urea), calcium, full blood count (2) Autoantibodies (adrenal, thyroid, intrinsic factor) (3) Thyroid function tests (4) Plasma renin activity—to assess mineralocorticoid status (high renin in primary adrenal insufficiency; not high in secondary adrenal insufficiency, where mineralocorticoid reserve is normal) (5) Chest radiograph—small heart,?evidence of tuberculosis (6) Adrenal CT scanning (if not available, abdominal radiograph— adrenal calcification suggests tuberculosis)

30.1 Acute medical presentations 6619 Further management (1) Long-term steroid replacement therapy: usually hydrocortisone (30 mg/day in divided doses), also fludrocortisone (50–150 µg/day) if mineralocorticoid deficient (2) Education—patients need to know that they will require increased steroid dosage at times of intercurrent illness. All patients should be advised to carry a steroid card and wear a MedicAlert bracelet. Thyrotoxic crisis See Chapter 13.3.1 Clinical features History (1) May have partially treated thyrotoxicosis (but many cases previously undiagnosed) (2) Compatible with thyrotoxicosis: weight loss, palpitations, heat intolerance, sweating, diarrhoea, tremor,

agitation/anxiety/irritability (3) Precipitant of thyrotoxic crisis—acute illness or trauma, particularly if directed toward thyroid gland, e.g. radio- iodine treatment, iodinated contrast dyes, thyroid surgery (4) Personal or family history of autoimmune/endocrine disease Examination (1) Hyperpyrexia (>38.5° C) and profuse sweating (2) Jaundice (3) Extreme restlessness, confusion, psychosis, eventually progressing to coma (4) Cardiac arrhythmia—particularly fast atrial fibrillation. Eventually cardiorespiratory collapse. (5) Signs of thyroid disorder—goitre, eye signs of Graves' disease Immediate management Thyrotoxic crisis is a potentially fatal disorder that requires immediate treatment on the basis of clinical suspicion • If cardiorespiratory collapse—as described in 'Cardiorespiratory collapse: the patient in extremis' • Restoration of intravascular volume—as described in 'Upper gastrointestinal haemorrhage' • Oxygen—high flow, with reservoir bag if needed, to achieve O2 saturations >92% Give: (1) Antithyroid drug: propylthiouracil is better than carbimazole in thyrotoxic crisis (but do not wait for hours to obtain propylthiouracil if carbimazole is available) • Propylthiouracil 600 mg orally or via nasogastric tube given immediately, then 250 mg every 6 h (may also be given rectally if severe vomiting prevents oral/nasogastric route), or • Carbimazole 20 mg orally or via nasogastric tube given immediately, then 20 mg every 6 h (2) Iodide, starting 1 h after the antithyroid drug • Aqueous iodine oral solution, e.g. Lugol's (iodine 5%, potassium iodide 10% in purified water) 5 drops orally or via nasogastric tube every 6 h • Ipodate (oral cholecystographic agent) 500 mg every 12 h (3) Propranolol, 2 mg IV or 40 mg orally every 4 h; careful monitoring required (4) Steroid—dexamethasone 2 mg every 6 h (5) Active cooling—cooling blankets, antipyretics (use paracetamol, not aspirin, which displaces thyroid hormone from thyroid-binding globulin) Consider: (6) Digoxin for atrial fibrillation—may need larger dose than usual (7) Diuretics for pulmonary oedema Also: (1) Specific treatment of precipitating event (if possible), e.g. antibiotics for infection Key investigations To establish the diagnosis: Thyroid function tests—these confirm the diagnosis of hyperthyroidism, but note that the diagnosis of thyrotoxic crisis is made on clinical grounds. The severity of disturbance of the thyroid function tests does not correlate with the clinical picture. Other important tests: (1) Full blood count, electrolytes, renal and liver function tests, calcium (2) Autoantibodies (adrenal, thyroid, intrinsic factor) (3) ECG—arrhythmia, especially atrial fibrillation (4) Chest radiograph—pulmonary oedema, infection Further management Dependent on the cause of thyrotoxicosis Pituitary apoplexy See Chapter 13.2.1. Clinical features History Most commonly: (1) Sudden-onset retro-orbital headache (2) Visual disturbance—field defect and/or diplopia Sometimes: (3) Nausea and vomiting (4) Meningism (5) Altered conscious level Also: (6) Compatible with hypopituitarism or hyperprolactinaemia: lethargy, reduced libido, oligomenorrhoea/amenorrhoea, impotence, galactorrhoea Examination (1) Glasgow Coma Score (2) Vision—acuity and fields (3) Eye movements—looking for ophthalmoplegia (4) Signs of underlying pituitary disease, e.g. acromegaly, are rarely present Immediate management (1) If cardiorespiratory collapse, as described in 'Cardiorespiratory collapse: the patient in extremis' (2) Oxygen—high flow, with reservoir bag if needed, to achieve oxygen saturations >92% On clinical suspicion of diagnosis: (1) Serum cortisol—to establish baseline retrospectively (2) Serum prolactin (3) Assume anterior pituitary dysfunction and give corticosteroid, e.g. hydrocortisone 100 mg IV (immediately, then every 6 h) Key investigations To establish the diagnosis: MRI scan of pituitary fossa—looking for haemorrhage into pituitary adenoma or other tumour Other important tests: (1) Electrolytes (hyponatraemia common), glucose,
renal function, calcium, full blood count, coagulation screen (2) Anterior pituitary function—baseline tests:
cortisol, thyroid function tests, prolactin, luteinizing hormone, follicle-stimulating hormone,

oestrogen/ testosterone Further management All cases require: (1) Full endocrine evaluation (2) Management dependent on hormonal deficiencies and the cause of pituitary apoplexy: Prolactin <1500 mU/litre—if vision is severely affected— urgent surgical decompression; if vision is not severely affected—consider surgical decompression within 1 week (improves visual and endocrine outcomes) Prolactin >1500 mU/litre (suggests prolactinoma)—a conservative (nonsurgical) approach may be adopted if there is no progressive visual or neurological deficit and prolactin levels are very high; start immediate treatment with dopamine agonist such as bromocriptine or cabergoline

Section 30 Acute medicine 6620 Acute porphyria See Chapter 12.5. Clinical features History Intermittent episodes of: (1) Acute abdominal pain, vomiting and constipation; diarrhoea also occurs; most attacks in women—these usually occur in luteal phase premenstrually (2) Mental changes including hallucinations and anxiety— evidence of autonomic and peripheral neuropathy (2) Severe proximal limb and/or back pain (3) Altered urine colour in relation to attacks: occasionally red or even purple-like permanganate solution—turns brown-red on standing, especially on exposure to light (4) Seizures, coma (5) Psychiatric disturbance: anxiety, depression, hallucinations Notes (1) Family history—nearly all the acute porphyrias are dominantly inherited, but many carriers are latent (history of family illness as detailed in 'History') (2) Photosensitive skin eruption (exposed areas)—in variegate and hereditary coproporphyria (which can cause acute neurovisceral attacks) but not in acute intermittent porphyria (3) Precipitant—alcohol, sex steroids, other drugs, anaesthetic agents, starvation, recent infection, dental procedures or surgery (4) Patients may present with prolonged attacks lasting weeks or even months which require intensive care management and where an acute episode has been perpetuated as a result of medication administered (in good faith), e.g. for treatment of seizures, depression or severe pain. Recovery from such an illness may be prolonged and require intensive rehabilitation. Examination (1) Mental state—distressed, often very anxious (mistrustful, suspecting disbelief), disorientated, hallucinations. (2) Cardiovascular—sinus tachycardia (may be marked), volatile hypertension—features of autonomic neuropathy (3) Abdominal—may have signs indistinguishable from those of the acute 'surgical' abdomen, but tenderness is usually lacking; signs of previous gynaecological or surgical procedures (which may not have revealed significant obvious pathology) may be seen. (4) Neurological—Glasgow Coma Score (if appropriate), motor neuropathy (axonal type), respiratory muscle weakness with respiratory failure, extensor plantar reflexes. Immediate management • If cardiorespiratory collapse—as described in 'Cardiorespiratory collapse: the patient in extremis' • If coma—as described in 'Coma' • Monitor ventilatory capacity (FEV1, as for acute inflammatory polyneuritis (Guillain–Barré)) • Oxygen—high flow, with reservoir bag if needed, to achieve oxygen saturations >92% • Check serum sodium twice daily in first instance (fulminant hyponatraemia) (1) Drugs—stop all known precipitating drugs, hormones and over-the-counter agents, especially any that have recently been prescribed or consumed/applied (e.g. lead- contaminated cosmetics, drinks or stimulants) It is generally best to consult a reliable updated Safe Drugs list when prescribing for patients either with a history of acute porphyria or at risk as a first-degree relative of an affected patient or member of a family known to be affected. In the UK, the Welsh Medicines Information Centre can provide this useful information https://www.wmic.wales.nhs.uk/specialist-services/ drugs-in-porphyria In addition to the UKPMIS list of SAFE drugs, the European Porphyria Initiative (EPI) website, http://www.porphyria- europe.com, contains more detailed information on prescribing in acute porphyria, including information on common prescribing problems (anaesthesia, pain relief, hormonal contraception). A full list of drugs

and a review of their safety can be found at http://www.drugs-porphyria.org (in the USA the American Porphyria Foundation provides a similar reference service—http://www.porphyriafoundation.com/ testing-and-treatment/drug-safety-in-acute-porphyria). (2) Diet—give high-carbohydrate diet, by nasogastric supplementation if appropriate, which suppresses haem biosynthesis more effectively if supplemental haem arginate also given. (3) Haem arginate (Normosang)—if patient unable to eat, seriously unwell or with sustained attack, then always give parenteral haem arginate 3 mg/kg once daily for 4 days (maximum 250 mg daily) by IV infusion in 0.9% saline over at last 30 min using inline filter. Protect from light and do not administer this agent other than freshly diluted immediately before use. Normosang (a similar but not identical preparation) is available in the USA as lyophilized hematin (Pan-hematin). Notes (1) Supplies of haem arginate can be obtained from Orphan Europe Ltd as Normosang (http://www.orphan- europe.com, +44 1491 414 333, info.ukorphan-europe. com), also from the on-call pharmacist at the University College of Wales Hospital, Cardiff (029 2074 7747); St James' University Hospital, Leeds (0113 243 3144 or 0113 283 7010); St Thomas' Hospital, London (020 7188 7188) (2) Seizures—pose difficulties since many anticonvulsants rapidly precipitate or worsen porphyric attacks: temazepam, lorazepam, and midazolam are probably safe (3) Analgesia—morphine and pethidine can be used (4) Distress/agitation—chlorpromazine can be used (5) Hypertension/extreme tachycardia—propranolol, labetalol can be used (6) Dextrose—some authorities have in the past advised administration of IV dextrose, 5% or 20%, to suppress haem biosynthesis, but this carries the risk of exacerbating/ precipitating hyponatraemia (see 'Other important tests'). Do not use if patient is hyponatraemic. Monitor serum sodium closely if used Key investigations To establish the diagnosis: Detection of porphyrin precursors (5-aminolaevulinate (ALA) and porphobilinogen (PBG)) in fresh urine (which may rarely become red/purple/brown on standing) Other important tests: (1) Electrolytes—there may be profound hyponatraemia. Monitor serum sodium at least daily in the acute phase and correct appropriately (2) Full blood count, renal and liver function tests, calcium (3) ECG Further investigation to exclude serious abdominal or neurological disease will be determined by clinical presentation, especially if excretion of haem precursors is repeatedly within the reference range for healthy individuals. Patients with an established attack develop an ischaemic cortical and subcortical cerebral vasculopathy detectable by MRI which is usually transient but may cause subacute or long-standing neurological deficits with diffuse sub-cortical ischaemic changes and even death (4) Amylase/chest and abdominal radiograph/CT abdomen/senior surgical opinion (5) MRI/CT brain; lumbar puncture Note In a patient with known porphyria, the reproducible absence of excess PBG or ALA in the urine as determined by a reliable laboratory in freshly obtained samples that have been appropriately transferred to the laboratory and protected from light renders acute porphyria a very unlikely cause of the current illness

 Further management (1) Seek expert advice to establish diagnosis and provide appropriate counselling to family members (2) MedicAlert bracelet important as warning to health care personnel in the future (3) Advise patient to stop smoking since it appears that this is associated with increased frequency of recurrent acute porphyric attacks Neurological Coma See Chapter 24.5.5. Clinical features History Coma is defined as a Glasgow Coma Score (GCS) <8, hence the patient will not be able to give any useful history. Obtain as much information as possible from others in attendance (relatives, friends, ambulance crew, bystanders, etc.) or from notes (referring physician, paramedics). Ask in particular regarding: (1) The circumstances in which the patient was found (2) Alcohol consumption (3) Diabetes mellitus (4)

Epilepsy (5) Drugs of abuse, in particular opioids (6) Head injury (7) Regular medications (8) Past medical history Examination Initial survey: (1) Airway, breathing, circulation (2) Fingerprick stick test for blood glucose (?hypoglycaemia) (3) Check for small pupils and slow respiratory rate (?opioid overdose) (4) Check temperature (?hypothermia) (5) Head to toe screen (6) Look for MedicAlert bracelet or necklace (7) Glasgow Coma Score (Table 30.1.18) Further examination: (1) State of circulation—temperature of peripheries, pulse rate, BP, JVP (2) Respiratory—look for evidence of aspiration (3) Neurological: • Focal/lateralizing signs—a structural lesion is likely if these are present • Meningism • Movements (can be subtle)—status epilepticus (4) Tongue biting or incontinence of urine—suggest (but do not prove) epilepsy (5) Back of head and neck—for bruising or bleeding to suggest head injury (6) Ears and nose—for bleeding or cerebrospinal fluid leak to suggest basal skull fracture (7) Search pockets etc. for clues—e.g. anticonvulsant tablets Immediate management If cardiorespiratory collapse—as described in 'Cardiorespiratory collapse: the patient in extremis' (1) Nurse in recovery position (when injury to neck excluded) (2) Oxygen—high flow, with reservoir bag if needed, to achieve oxygen saturations >92% (3) Airway—patients with a GCS <8 are likely to need endotracheal intubation to protect and maintain their airway if they do not respond to glucose or naloxone. This is obligatory if they need to be moved from an area where they can be given intensive nursing care to one where they cannot, e.g. CT scanner. Consider oropharyngeal airway, but do not attempt to force one in to a patient who resists (which means that they are protecting their airway) (4) Intravenous access—insert cannula (5) Consider and treat specific diagnoses • Hypoglycaemia—give 100 ml of 20% or 50 ml of 50% glucose (dextrose monohydrate) IV if blood glucose <2.5 mmol/litre • Opioid overdose—give naloxone 0.4–2 mg IV if this is a possible diagnosis • Hypothermia—start rewarming if temperature <35° C Key investigations To establish the diagnosis: (1) Blood glucose (2) CT brain—if diagnosis not clinically apparent and patient not improving rapidly. Look for: • Extradural, subdural, subarachnoid, or intracerebral haemorrhage • Signs of raised intracranial pressure • Focal ischaemia (may not be visible on early scan) (3) Blood film for malaria—if relevant travel history Other important tests: (1) Electrolytes (hyponatraemia), renal and liver function tests, calcium (hypo- or hypercalcaemia), full blood count (2) ECG—note that 'ischaemic' changes can occur in subarachnoid haemorrhage (3) Chest radiograph—?aspiration pneumonia (4) Arterial blood gases—if diagnosis not clear, or if oxygen saturations <92% on air (5) Sepsis screen—selected cases (6) Lumbar puncture—selected cases, after CT has excluded raised intracranial pressure (7) EEG—selected cases; consider nonconvulsive status Further management Dependent on the cause of coma Acute confusional state See Chapters 24.4.1 and 26.5.1. Clinical features History Is the patient confused?: (1) Establish that the patient is not dysphasic rather than confused (2) Abbreviated Mental Test (AMT) score—a score of 6 or less is likely to indicate impaired cognition • Age • Time (to nearest hour) • What year is it? • Name of institution • Recognition of two persons (can the patient identify your job and that of a nurse?) • Date of birth (day and month) • Year of First World War • Name of present monarch • Count backwards from 20 to 1 (3) Assessment of attention and concentration, which are typically impaired in acute confusional states: • Count backwards from 100 in 7's (93, 86, etc.) • Count backwards from 40 in 4's (36, 32, etc.) • Count backwards from 20 in 2's (18, 16, etc.) • Count backwards from 20 (19, 18, etc.) Obtaining a history: The patient who is confused cannot (by definition) give an accurate and reliable account of themselves, hence get as much information as possible from others in attendance (relatives, friends, ambulance crew, bystanders, etc.) or from notes (referring physician, paramedics). Ask in particular regarding: (1) The situation in which the patient was found (2) Any recent change in health, in particular: • Symptoms to suggest infection •

Medications—especially any recent change (continued)

Section 30 Acute medicine 6622 (3) Previous cognitive function (4) Alcohol consumption—consider intoxication, withdrawal, Wernicke's encephalopathy (5) Drugs of abuse (if relevant) (6) Regular medications (7) Past medical history (8) Social circumstances Examination (1) General appearance—well-presented clothing and cleanliness indicates an acute problem or an assiduous carer (2) Nutritional state—reflects previous weeks/months (3) Hydration state—reflects previous 48 h (4) Full physical examination—look in particular for: • Temperature—pyrexia or hypothermia • Pulse rate, BP, JVP—hypotension from any cause can lead to confusion • Evidence of sepsis—in particular chest, urine, cellulitis • Neurological—focal signs (indicating a focal neurological lesion, most commonly stroke), head injury, Wernicke's encephalopathy • Evidence of organ failure—cardiac, respiratory, hepatic, renal • Urinary retention or faecal impaction • Hip or pelvic fracture Immediate management If cardiorespiratory collapse, as described in 'Cardiorespiratory collapse: the patient in extremis' Oxygen—high flow, with reservoir bag if needed, to achieve oxygen saturations >92% Hypoglycaemia—give 100 ml of 20% or 50 ml of 50% glucose (dextrose monohydrate) IV if blood glucose <2.5 mmol/litre (1) Fluids—encourage oral intake, but if IV fluids are required, then insert venous cannula into flat site and bandage carefully (2) Treat any obvious precipitating condition—if none apparent then consider initiating antibiotic treatment for, e.g. urinary infection, on a 'best guess' basis (e.g. co- amoxiclav 250/125 mg orally or 1.2 g IV three times daily, but note local hospital antibiotic policy) (3) Anticipate and avoid problems: • Do not exacerbate confusion—nurse in lit room (darkness makes confusion worse), expose to limited number of staff (many people 'popping in' increase confusion), enlist assistance from relatives/carers/ friends (a sensible person that the patient knows can be enormously helpful) • Pressure areas—appropriate mattress • Urine—try to avoid catheterization if possible (will make any infection harder to clear), but need to strike a difficult balance with concern for skin/ pressure areas • Bowels—suppositories, laxatives, enemas as required • Venous thromboembolism—low molecular weight heparin, e.g. enoxaparin 20 mg subcutaneously once daily (4) Sedation—try to avoid if possible, but if necessary use risperidone 0.25 mg orally twice daily (increased in steps of 0.25 mg twice daily on alternate days to 0.5–1 mg twice daily) or haloperidol 0.75–1.5 mg orally/intramuscularly two to three times daily. (Dosage of both drugs appropriate for elderly patients—higher doses likely to be required for younger patients) Key investigations To establish the diagnosis: These will be guided by any clinical leads, but as nonspecific presentation is common, the following are advisable in almost all patients: (1) Fingerprick stick test for blood glucose (2) Oxygen saturation—check arterial blood gas if oxygen saturations <92% on air (3) Blood screen—full blood count, electrolytes, renal and liver function tests, calcium, phosphate, cardiac enzymes, glucose, thyroid function, inflammatory marker (C-reactive protein or ESR) (4) Sepsis screen—urine dipstick test, urine and blood culture (5) Chest radiograph (6) ECG Other important tests: Guided by clinical findings or results of screening investigations, e.g. new focal neurological signs—imaging of brain by CT scan or MRI Further management Dependent on the cause of confusion Acute stroke See Chapter 24.10.1. Clinical features History May be difficult to obtain, particularly if the patient has dysphasia. If this is the case, get as much information as possible from others in attendance (relatives, friends, ambulance crew, bystanders, etc.) (1) Focal neurological deficit—usually of sudden onset (2) Previous episodes—stroke, transient ischaemic attack, amaurosis fugax (3) Risk factors (4) Other medical conditions (5) Medications (6) Normal level of functioning—do they need help with activities of daily living? (7) Social circumstances Examination (1) Airway, breathing, circulation (2) Neurological •

Glasgow Coma Score (Table 30.1.18) • Nature of focal deficit (Table 30.1.19) (3) Cardiovascular—pulse rate and rhythm (?atrial fibrillation), BP, carotid bruits, cardiac murmurs, absent peripheral pulses Immediate management If cardiorespiratory collapse—as described in 'Cardiorespiratory collapse: the patient in extremis' (1) Nurse in recovery position if impairment of consciousness (2) Oxygen—high flow, with reservoir bag if needed, to achieve oxygen saturations >92%. Consider oropharyngeal airway. (3) Establish IV access (4) Exclude hypoglycaemia—check fingerprick stick
test for blood glucose and if <3 mmol/litre give
100 ml of 20% or 50 ml of 50% glucose (dextrose monohydrate) IV. (5) Consider thrombolysis—if time of onset can be
clearly determined, and if the patient presents to
centre with appropriate facilities within 4.5 h of onset (Table 30.1.20, 30.1.21) (6) Reverse anticoagulation—if haemorrhagic stroke and patient receiving anticoagulation (Table 30.1.13) Notes (1) Urgent neurosurgical assessment is required for patients with large cerebellar infarcts or haemorrhages, those with hydrocephalus, and for some cases with intracerebral haemorrhage (2) There is no proven benefit for drugs in the limitation of neural damage, including corticosteroids, nimodipine, plasma volume expanders, barbiturates, or glutamate receptor antagonists: these (and similar agents) should only be given in the context of ethically approved clinical trials

30.1 Acute medical presentations 6623 Key investigations To establish the diagnosis: CT or MRI brain—also to distinguish between infarction and haemorrhage Other important tests: (1) Full blood count, electrolytes, renal and liver function tests, calcium, inflammatory markers (C-reactive protein or ESR), coagulation screen (2) ECG—look for arrhythmia or signs of recent myocardial infarction (3) Chest radiograph—?aspiration pneumonia (4) Echocardiography; ultrasound/Doppler examination of carotid arteries—in selected cases Further management Short term: (1) Nursing and physiotherapy—protect pressure areas, attention to bladder and bowels, prevent contractures, aid recovery of function, psychological support (2) Hydration/nutrition—if swallowing impaired, stop oral feeding and start IV fluids (3) Blood pressure—this is commonly elevated immediately after a stroke, but cerebral autoregulation is impaired and aggressive attempts to reduce it are likely to cause more harm than good. There is much debate regarding best treatment: • Ischaemic stroke—if BP >220/130 mmHg then most physicians would treat—e.g. using modified-release nifedipine 10 mg orally or IV labetalol (see 'Accelerated ('malignant') hypertension')—but some would only do so if there was evidence that the hypertension were causing acute organ damage • Haemorrhagic stroke—if BP >180/110 mmHg then most physicians would treat—e.g. using modified-release nifedipine 10 mg orally or IV labetalol (see 'Accelerated ('malignant') hypertension') (4) Venous thromboembolism—high risk: use compression stockings (5) Antiplatelet therapy—usually aspirin 300 mg once daily—should be started to prevent recurrence as soon as haemorrhage has been excluded (6) Blood glucose—use IV sliding scale of insulin (see 'Diabetic ketoacidosis') to obtain good control in diabetics Medium/long term: (1) Rehabilitation and social support as required (2) Control of vascular risk factors—hypertension, hyperlipidaemia, cessation of cigarette smoking (3) Consider imaging of the carotid arteries in all patients who have made a reasonable recovery from a carotid territory stroke: endarterectomy may be indicated
Table 30.1.18 Glasgow Coma Scale Eye opening Score Verbal Score Motor (best response in any limb) Score Spontaneously 4 Orientated 5 Obeys commands 6 To speech 3 Confused speech 4 Localizes to pain 5 To pain 2 Words 3 Withdraws to pain 4 None 1 Sounds 2 Flexor (decorticate) response to pain 3 None 1 Extensor (decerebrate) response to pain 2 None 1 Notes: (1) The

Glasgow Coma Score is obtained by adding the best eye, verbal and motor responses together: minimum = 3, maximum = 15, coma = 8 or less, significant deterioration = fall by 2 points or more. (2) Painful stimulation: rub knuckles on sternum, squeeze pencil or biro against nail bed. Do not use methods that might lead to bleeding or bruising, which includes supraorbital pressure. Reprinted from The Lancet, Vol. 304, Teasdale G, Jennett B, Assessment of Coma and Impaired Consciousness: A Practical Scale, pp 81–84. Copyright (1974), with permission from Elsevier. Table 30.1.19 A practical classification of stroke (the Oxfordshire Community Stroke Subclassification System) Total anterior circulation stroke syndrome (TACS) Large cortical stroke in middle cerebral artery, or middle and anterior cerebral artery territories New higher cerebral dysfunction (e.g. dysphasia, dyscalculia, visuospatial disorder) + Homonymous visual field defect + Ipsilateral motor and/or sensory deficit involving two out of three of face, arm, or legs Partial anterior circulation stroke syndrome (PACS) Cortical stroke in middle or anterior cerebral artery territories Two out of three components of TACS or New higher cerebral dysfunction alone or Motor/sensory deficit more restricted than those classified as LACS (e.g. monoparesis) (continued)

Section 30 Acute medicine 6624 Table 30.1.20 Thrombolysis for stroke Parameter Comment Preconditions Do not thrombolyse unless The physician and other carers are trained and experienced in the administration of thrombolysis to stroke patients and are working in a centre with appropriate facilities The time of onset of stroke is known—if it was noticed when the patient woke from sleep, then the time of going to sleep is regarded as the time of onset Haemorrhagic stroke has been excluded by brain CT scan Thrombolysis can be started within 4.5 h of stroke onset Stroke deficit Exclude mild strokes Dysphasia alone Hemianopia alone Inattention alone Ataxia alone Exclude very severe strokes Clinical—no response to painful stimulation; NIH stroke score >25 (Table 30.1.21) Imaging shows large volume of ischaemia Other considerations Do not thrombolyse if Patient heavily dependent on others for personal care before stroke Rapidly resolving neurological deficit Generalized seizure since onset of stroke History of stroke in last 3 months History of intracerebral bleed at any time Major surgery or haemorrhage in last 3 weeks BP >180/105 mmHg on repeated readings. Consent From patient or next of kin—advise 10–20% chance of benefit vs 3% risk of significant bleed Thrombolysis Drug Recombinant tissue plasminogen activator (rt-PA, Alteplase) 0.9 mg/kg IV, with 10% of dose given as initial bolus, the remainder infused over 60 min Other care Manage patient in acute stroke unit bed (or coronary care unit/high dependency unit) Check GCS, pulse and BP, every 15 min Do not give aspirin or other antiplatelet agents/anticoagulants for 24 h BP, blood pressure; GCS, Glasgow Coma Score. Total anterior circulation stroke syndrome (TACS) Lacunar stroke syndrome (LACS) Subcortical stroke due to small-vessel disease Pure motor stroke or Pure sensory stroke or Sensorimotor stroke or Ataxic hemiparesis or Dysarthria and clumsy hand Note that evidence of higher cortical involvement or disturbance of consciousness excludes a lacunar syndrome Posterior circulation stroke syndrome (PCS) Ipsilateral cranial nerve palsy with contralateral motor/sensory deficit or Bilateral motor and/or sensory deficit or Disorder of conjugate eye movement or Cerebellar dysfunction without ipsilateral pyramidal involvement (which would be an ataxic hemiparesis and classified as LACS) or Isolated homonymous visual field defect Table 30.1.19 Continued

30.1 Acute medical presentations 6625 Table 30.1.21 National Institutes of Health (NIH) stroke scale Domain Response Scale Maximum score Level of consciousness Keenly responsive 0 3 Arousable by minor stimulation 1 Requires repeated stimulation to attend and/or strong/painful stimulation to

make nonstereotyped movements 2 Unresponsive or reflex responses only 3 Verbal response to questions What month is it? How old are you? Answers both questions correctly 0 2 Answers one question correctly 1 Answers neither question correctly 2 Motor response to command (pantomime) Open and close your eyes Open and close your (nonparetic) hand Performs both tasks correctly 0 2 Performs one task correctly 1 Performs neither task correctly 2 Gaze Only horizontal movements tested Voluntary or oculocephalic (reflex) Normal 0 2 Partial gaze palsy—gaze is abnormal in one or both eyes, but forced deviation or total gaze paresis is not present 1 Forced deviation or total gaze palsy not overcome by oculocephalic manoeuvre 2 Visual fields Tested by confrontation No visual loss 0 3 Partial hemianopia 1 Complete hemianopia 2 Bilateral hemianopia (blind) 3 Facial palsy Ask (pantomime) patient to show teeth, raise eyebrows and close eyes Normal 0 3 Minor paralysis—flattened nasolabial fold; asymmetry on smiling 1 Partial paralysis—total or near total paralysis of lower face 2 Total paralysis—absence of movement of upper and lower face (one or both sides) 3 Motor arm Extend arms (palms up) at 90° (if sitting) or 45° (if supine) No drift 0 4 for right arm + 4 for left arm Drift—within 10 s, but arm does not hit bed or other support 1 Some effort against gravity 2 No effort against gravity—arm falls 3 No movement 4 Motor leg Hold leg at 30° (always tested with patient supine) No drift 0 4 for right leg + 4 for left leg Drift—within 5 s, but leg does not hit bed 1 Some effort against gravity 2 No effort against gravity—leg falls 3 No movement 4 Limb ataxia Finger-nose test Heel–shin test Absent 0 2 Present in one limb 1 Present in two limbs 2 Sensory Pinprick Other noxious stimuli Normal 0 2 Mild/moderate sensory loss—pinprick is less sharp or dull on the affected side 1 Severe/total sensory loss—patient is not aware of being touched on the face, arm and leg 2 Language Describe what is happening in the picture (provided) Name items on naming sheet (provided) Read list of sentences (provided) Normal 0 3 Mild-to-moderate dysphasia—obvious loss of fluency or comprehension 1 Severe dysphasia—all communication fragmentary 2 Mute, global aphasia 3 Dysarthria Read or repeat words from list (provided) Spontaneous speech None 0 2 Mild-to-moderate—can be understood with some difficulty 1 Severe—unintelligible speech 2 National Institutes of Health (NIH) stroke scale Details available from https://www.ninds.nih.gov/sites/default/files/NIH_Stroke_Scale.pdf (text version) or https://www.ninds.nih. gov/sites/default/files/NIH_Stroke_Scale_Booklet.pdf (graphical version).

Section 30 Acute medicine 6626 Subarachnoid haemorrhage See Chapter 24.10.1. Clinical features History (1) Presentation is very variable: typically severe headache (‘worst ever’) of sudden onset, but can vary from minor symptoms to collapse/coma or sudden death (2) Previous episodes; recent unusual headache (3) Risk factors—hypertension, cigarette smoking, alcohol (binge drinking), adult polycystic kidney disease, connective tissue disorders (some) Examination (1) Airway, breathing, circulation (2) Glasgow Coma Score (3) Focal neurological signs—in particular: • Third nerve palsy—posterior communicating artery aneurysm • Sixth nerve palsy—posterior fossa aneurysm, but usually a false localizing sign • Bilateral leg weakness—anterior communicating artery aneurysm • Dysphasia/hemiparesis—middle cerebral artery aneurysm (4) Neck rigidity (5) Retinal haemorrhages (6) Cardiovascular—arrhythmia, hypertension Immediate management If cardiorespiratory collapse—as described in ‘Cardiorespiratory collapse: the patient in extremis’ (1) Nurse in recovery position if impairment of consciousness (2) Oxygen—high flow, with reservoir bag if needed, to achieve oxygen saturations >92%. Consider oropharyngeal airway. (3) Establish IV access and resuscitate if volume depleted or dehydrated: maintain total fluid input of 3 litres/day (4) Bed rest for all patients (5) Nimodipine 60 mg orally every 4 h, started within 4 days of subarachnoid haemorrhage and continued for 21 days, should be given to all patients with

subarachnoid haemorrhage who are not hypotensive (systolic BP <110 mmHg). This is to prevent ischaemic neurological deficit. (6) Blood pressure—as with acute stroke there is much debate regarding best treatment. Most specialists advocate intervention at >180/110 mmHg (as for haemorrhagic stroke, see ‘Acute stroke’), with IV labetalol commonly employed (see ‘Accelerated (‘malignant’) hypertension’). (7) Analgesia—paracetamol, codeine if required (8) Anxiety—short-acting benzodiazepine if required Key investigations To establish the diagnosis: (1) CT brain, without contrast, taking thin cuts through the base (2) Lumbar puncture—perform not earlier than 12 h after the ictus if CT normal: look for xanthochromia after centrifugation of cerebrospinal fluid Other important tests: (1) Electrolytes, renal and liver function tests, full blood count, coagulation screen (2) ECG—note that ‘ischaemic’ changes can occur in subarachnoid haemorrhage (3) Chest radiograph—?aspiration pneumonia Further management (1) Neurosurgical referral—if GCS = 12 or more, or GCS <12 with space-occupying intracranial haemorrhage or hydrocephalus, then surgery should be considered in patients with proven intracranial aneurysms, hence discuss with neurosurgical colleagues with a view to arranging four- vessel angiography (CT angiograms may be done first, and sometimes instead) (2) Bowels—keep stools soft with adequate oral fluid intake and laxative if required (particularly if codeine given) Status epilepticus See Chapter 24.5.1. Clinical features Definition Traditionally defined as continuous seizure for more than 30 min or serial (two or more) discrete seizures between which there is incomplete recovery of consciousness. More recent definitions recommend aggressive treatment of any seizure lasting more than 5 min History The patient will not be able to give any useful history. Obtain as much information as possible from others in attendance (relatives, friends, ambulance crew, bystanders etc.). Ask in particular regarding: (1) Loss of consciousness, usually with obvious fitting (2) The circumstances in which the patient was found (3) Past history of epilepsy (4) Alcohol consumption (5) Any possible drug abuse (6) Diabetes mellitus (7) Regular medications (8) Any other medical history Examination Initial survey: (1) Airway, breathing, circulation (2) Signs of injury—especially of tongue, which can compromise breathing (3) Respiratory—?aspiration (4) Glasgow Coma Score (5) MedicAlert bracelet/necklace Further examination: (1) Vital signs—temperature, pulse rate, BP (2) Neurological: • Pupil size and reactions • Other brainstem signs • Symmetry of tone and reflexes in the limbs • Neck stiffness • Note that focal signs may indicate focal pathology, but can be seen as a postictal phenomenon (i.e. Todd’s paresis) (3) Search pockets, etc. for clues—e.g. anticonvulsant tablets Immediate management If cardiorespiratory collapse—as described in ‘Cardiorespiratory collapse: the patient in extremis’ (1) Place in recovery position (if possible) (2) Oxygen—high flow, with reservoir bag if needed, to achieve oxygen saturations >92%. Consider oropharyngeal airway, but do not try to insert one against resistance, i.e. when the patient is actually fitting. (3) Establish IV access. (4) Fingerprick stick test for blood glucose—give 100 ml of 20% or 50 ml of 50% glucose (dextrose monohydrate) IV if glucose <3 mmol/litre (5) Anticonvulsant—first-line treatments: • Lorazepam 0.1 mg/kg IV (usually a 4 mg bolus) at 2 mg/min—this is the first-line treatment of choice and can be repeated once after 5 min • Diazepam 10–20 mg IV at a rate of 5 mg/min. This may be repeated after 30–60 min if necessary, and can be followed by infusion (add 10–40 mg of diazepam to 100 ml of 5% dextrose to make a solution containing 0.1–0.4 mg/ml) at a rate of e.g. 5 mg/h, adjusted according to clinical response, but with maximum dose of 3 mg/kg body weight over 24 h (6) Anticonvulsant—second-line treatments. If seizure activity still continues, consider: • Fosphenytoin, 15 mg phenytoin-equivalent (PE)/kg body weight (fosphenytoin 1.5 mg = phenytoin 1 mg) by IV infusion at a rate of 150 mg PE/min, followed by 4–5 mg PE/kg daily in 1–2 divided doses. Dose adjusted according to clinical response and trough plasma phenytoin levels. This is the second-line treatment of choice.

30.1 Acute medical presentations 6627 • Phenytoin, 15 mg/kg body weight by IV infusion at a rate not exceeding 50 mg/min, followed by 100 mg every 6–8 h. Dose adjusted according to clinical response and trough plasma phenytoin levels (7) Anticonvulsant—third-line treatments. If seizure activity still continues, consider: • Phenobarbital (phenobarbitone), 10 mg/kg by IV infusion at a rate of not more than 50–100 mg/min, maximum dose 1000 mg. Note that this treatment may lead to respiratory depression. This is the third-line treatment of choice • Valproate, 25 mg/kg by IV infusion at a rate of 3–6 mg/kg per min • Paraldehyde, 5–10 ml by deep intramuscular injection (not more than 5 ml at any one site), or 10–20 ml administered by enema as a 10% solution in physiological saline or mixed with an equal volume of olive oil. Note that this treatment is only to be used if other treatments detailed earlier are not available (8) Anaesthesia—if seizure activity still continues after first-, second-, and third-line treatments (or earlier if required to achieve adequate airway protection/ ventilation): • Call anaesthetist and arrange admission to intensive care unit for anaesthesia with thiopentone, propofol, or midazolam. Ventilate with EEG monitoring until clinical and EEG epileptic activity ceases Note: thiamine—give Pabrinex IV high potency over 10 min if suspicion of alcohol withdrawal Key investigations To establish the diagnosis: Status epilepticus is a clinical diagnosis, although EEG is used to diagnose the very rare condition of nonconvulsive status in a patient with unexplained coma Other important tests: (1) Fingerprick stick test for blood glucose—should be performed in all patients The requirement for further investigation depends on the context: the patient who is known to have epilepsy with frequent prolonged seizures does not require extensive investigation after each and every one. In other cases: (2) Glucose, electrolytes, renal and liver function tests, calcium, creatinine kinase, anticonvulsant level (if appropriate) And consider: (3) Arterial blood gases (4) Chest radiograph—?aspiration (5) ECG (6) Sepsis screen (7) Toxicology screen (8) CT or MRI brain (9) Lumbar puncture—only after imaging to exclude raised intracranial pressure or intracerebral mass Further management Dependent on the cause of status epilepticus Acute spinal cord dysfunction See Chapters 24.13.1 and 24.13.2. Clinical features History The immediate clinical priority is to exclude spinal cord compression: (1) Motor symptoms—weakness; all limbs (quadriparesis) or legs only (paraparesis) (2) Sensory symptoms—numbness, loss of sensation, tingling, incoordination (sensory ataxia) (3) Autonomic—sphincter (particularly bladder) disturbance Causes of cord compression: (1) Nature of onset (sudden/gradual) and subsequent progression give important clues to likely cause, e.g. acute onset suggests trauma/mechanical or vascular pathology (2) Back pain (3) Intervertebral discs—any previous problem? (4) Malignancy—any known previous, or any features to suggest this diagnosis, e.g. anorexia, malaise, weight loss (5) Infection—sweats, fevers, rigors. Tuberculosis. Risk factors for osteomyelitis or abscess, e.g. previous septicaemia (particularly staphylococcal), IV drug abuse, haemodialysis Other causes of spinal cord dysfunction: • History to support the diagnosis of a demyelinating condition Examination (1) Motor—look for increased tone, weakness, and hyperreflexia below the site of the lesion. Do the plantars go up or down? Note that in acute lesions there may be flaccidity (‘spinal shock’), later replaced by spasticity (2) Sensory—is there a sensory level, which can be suspended? In particular, check for sensory loss in the saddle area, which would suggest a cauda equina lesion (3) Bladder—is this palpable? Causes of cord compression: (1) General examination for signs of malignancy—e.g. cachexia, clubbing, lymphadenopathy, pallor, jaundice, chest/abdominal examination, pelvic mass (2) Suggestion of infective cause—temperature Other causes of spinal cord dysfunction: • Features to suggest a demyelinating condition, e.g. optic atrophy, internuclear ophthalmoplegia Immediate management (1) Nurse on pressure-relieving mattress (2) Relieve urinary retention with urethral catheter (if appropriate) (3) Emergency imaging and consultation with neurosurgical colleagues (4)

If spinal cord compression, specific treatment depends on precise diagnosis: • Disc protrusion—surgical decompression • Metastasis—high-dose steroids (e.g. methylprednisolone) and radiotherapy • Abscess—surgical decompression/drainage; antimicrobials. For an immunocompetent patient with a pyogenic abscess give IV antimicrobials as follows: third-generation cephalosporin, e.g. cefotaxime 1–2 g 12-hrly plus flucloxacillin 1–2 g 6-hrly plus metronidazole 500 mg 8-hrly. Modify regimen when microbiological results are available. • Spinal cord tumours (rare)—neurosurgical intervention may be appropriate Note Acute spinal cord injury—consider methylprednisolone 30 mg/kg as IV bolus over 1 h, followed by 4.0 mg/kg per h for 23 h (but this treatment is contentious) Key investigations To establish the diagnosis: MRI spine, performed as an emergency (if this is not available, discuss best available imaging modality with radiological colleagues, e.g. CT scan, myelography) Other important tests: (1) Full blood count, electrolytes, renal/liver/bone function tests, inflammatory markers, coagulation screen (2) Chest radiograph—is there malignancy? Other tests as dictated by clinical suspicion, e.g. blood cultures, myeloma screen, autoimmune/vasculitic serology, MRI brain, visual/sensory/auditory evoked potentials, cerebrospinal fluid examination Further management Dependent on the cause of spinal cord dysfunction

Section 30 Acute medicine 6628 Acute inflammatory polyneuritis (Guillain–Barré) See Chapter 24.16. Clinical features History (1) Sensory symptoms— paraesthesia and numbness, begin distally and ascend symmetrically (2) Motor symptoms —weakness, usually ascending (but can sometimes be proximal), symmetrical. Muscle pain is common (particularly lower back or interscapular) (3) Site of symptoms—legs usually worst affected, but sometimes arms; facial, bulbar, and ocular muscles may be involved (4) Progression—usually occurs over days (no longer than 4 weeks, by definition), but can sometimes be more rapid (5) Preceding illness—patients often have upper respiratory tract or diarrhoeal illness (especially Campylobacter jejuni) in the few weeks prior to onset Examination (1) Motor—reduced tone; lower motor neuron weakness, distal > proximal; areflexia. May have facial involvement and ophthalmoplegia (Miller–Fisher syndrome) (2) Sensory—glove and stocking sensory disturbance, often mild (3) Respiratory—respiratory failure due to muscle weakness is an avoidable cause of death: check forced vital capacity and monitor frequently (4) Autonomic—look for variable pulse rate, variable arterial pressure, intestinal ileus, urinary retention (5) Papilloedema—a rare feature Immediate management (1) Respiratory: • Consider elective assisted ventilation sooner rather than later if the patient is tiring • Note that tracheal suction can trigger hypotension or bradycardia in the presence of autonomic dysfunction (2) Cardiac: • Monitor ECG • Arrhythmias can be fatal—treat as appropriate • Use antihypertensive drugs with extreme caution (if at all) in the face of autonomic dysfunction (3) Fluids: • If gag reflex impaired—stop oral feeding and start IV fluids • Will need to consider percutaneous endoscopic gastrostomy feeding as an early option (4) Nursing and physiotherapy: • Keep chest clear • Protect pressure areas • Attention to bladder and bowels • Prevent contractures: move all joints through their full range of movement daily • Aid recovery of function • Psychological support: emphasize that most cases recover well (5) Pain—give NSAIDs as required. Consider amitriptyline, carbamazepine, gabapentin (6) Compression stockings and low molecular weight heparin (e.g. enoxaparin 40 mg subcutaneously once daily)—to reduce the risk of venous thromboembolism (7) Intravenous immunoglobulin, 0.4 g/kg body weight/day, for 5 days—give to all patients, excepting those with very mild disease (8) Plasma exchange—consider in severe/refractory cases Key investigations To establish the diagnosis: Acute inflammatory polyneuritis (Guillain–Barré syndrome) is primarily a clinical diagnosis: investigation may confirm it, but initial management is

dictated by clinical suspicion (1) Nerve conduction studies—the earliest abnormality is impersistence or absence of F waves. Peripheral demyelination starts proximally in the nerve roots, hence distal conduction velocities and motor latencies are often normal early in the illness, even when there is profound weakness (2) Lumbar puncture—look for elevated protein (but cells <50/μl)) (3) Anti-GQ1b antibodies—present in all cases that are associated with ophthalmoplegia Other important tests: Relevant to cause: (1) Stool culture and serology for Campylobacter jejuni (2) Serology for atypical pneumonias (3) Cerebrospinal fluid analysis for viral infection Need to exclude: • Acute intermittent porphyria—see 'Acute porphyria' General (1) Full blood count, electrolytes, renal and liver function tests, plasma calcium, magnesium and phosphate concentrations (2) ECG (3) Chest radiograph Further management Dependent on the nature of any residual disability. Significant weakness remains in about 10% of cases, especially those with the axonal form of disease. Myasthenia gravis See Chapter 24.18. Clinical features History Myasthenic crisis: (1) Breathing difficulty due to muscular weakness in a patient with myasthenia Presentation of myasthenia: (2) Muscular weakness—droopy eyelid(s)/double vision; difficulty chewing, swallowing, talking (nasal speech), holding the head up; limb weakness (3) Diurnal variation—symptoms less severe in the morning, getting worse as the day goes on (4) Exacerbating factors—intercurrent illness, pregnancy, menses, (some) drugs Examination Myasthenic crisis: (1) Exhaustion (2) Ineffective respiratory effort (3) Inability to clear airway secretions (4) Cyanosis (5) Low vital capacity Also: (1) Check for focal lung signs Myasthenia: • Muscular weakness that becomes worse with repetitive effort (fatiguability) Immediate management Respiratory failure caused by muscular weakness in a patient with myasthenia can be due to a myasthenic crisis (attributable to the disease itself) or rarely to an overdose of anticholinesterases (cholinergic crisis). These cannot reliably be distinguished on clinical grounds, hence safe management consists of: (1) Airway, breathing, circulation (2) Intubate and ventilate (3) Stop all anticholinesterases If there is specialist expertise, and in conjunction with someone skilled in intubation, then edrophonium chloride, 2 mg by IV injection, can be used to discriminate between underdosage and overdosage of cholinergic drugs

 Key investigations To establish the diagnosis: Myasthenic crisis is a clinical diagnosis To establish the diagnosis of myasthenia gravis: (1) Edrophonium chloride (Tensilon) test—after pretreatment with atropine (0.6 mg IV), give edrophonium 2 mg IV and look for transient improvement in e.g. ptosis, diplopia, dysarthria; if no improvement after 1–2 min give edrophonium 8 mg IV and watch for effect (limited sensitivity and specificity) (2) Serum acetylcholine receptor antibodies—highly specific (present in 85% of patients with generalized myasthenia) (3) Electromyography—look for increased jitter, also decremental response to repetitive nerve stimulation (good sensitivity and specificity) Other important tests: In myasthenic crisis: (1) Arterial blood gases (2) Chest radiograph (3) Electrolytes, renal and liver function tests, calcium, phosphate, full blood count (4) Sepsis screen (if appropriate) Further management Myasthenic crisis—consider the following: (1) Plasma exchange—e.g. 50 ml/kg body weight per day for 4 or 5 days (2) Intravenous immunoglobulin—e.g. 0.4 g/kg body weight per day, for 5 days Myasthenia—consider the following for long-term treatment: (1) Immunosuppression—usually prednisolone (starting at a low dose of e.g. 10 mg on alternate days) and azathioprine (2.5 mg/kg body weight per day) (2) Anticholinesterase, e.g. pyridostigmine bromide 30–120 mg at suitable intervals throughout the day (total daily dose
0.3–1.2 g), together with antimuscarinic agent if needed (3) Thymectomy Acute Wernicke's encephalopathy See Chapter 24.21. Clinical features History (1) Alcoholism—usually, but also other

states of nutritional deficiency and protracted vomiting (e.g. hyperemesis gravidarum) (2) Motor—difficulty standing/walking (3) Diplopia (4) Higher cerebral function—lethargy, inattentiveness, confusion; the patient will almost certainly not be able to give a reliable history (corroborate as much information as possible from other sources, e.g. relatives, friends, general practitioner, etc.) Examination Related to Wernicke's encephalopathy, the classic triad of: (1) Ophthalmoplegia: • Horizontal and vertical nystagmus • Weakness/paralysis of lateral rectus muscles • Weakness/paralysis of conjugate gaze (2) Ataxia—predominantly affecting stance and gait, often without clear-cut intention tremor (3) Confusion, confabulation Related to clinical context: (1) Cardiovascular—look for evidence of intravascular volume depletion and/or dehydration (2) Consider other complications of alcoholism— peripheral neuropathy; acute alcohol withdrawal; acute liver failure; chronic liver disease and its complications (3) Consider other causes of an acute confusional state— see 'Acute confusional state' (4) Nutritional status Immediate management Thiamine—give parenteral thiamine immediately, usually in combination with other vitamins B and C, e.g. Pabrinex high-potency, 2–3 pairs of ampoules IV over 10 min every 8 h (each pair of ampoules contains ascorbic acid 500 mg, anhydrous glucose 1 g, nicotinamide 160 mg, pyridoxine hydrochloride 50 mg, riboflavin 4 mg, and thiamine hydrochloride 250 mg in a total of 10 ml) Notes (1) Anaphylaxis—facilities for treating anaphylaxis should be available when giving Pabrinex (2) Glucose—alcoholics with stupor or coma must be given high-dose thiamine before receiving IV glucose; without thiamine they cannot handle a glucose load, with risk of death Key investigations To establish the diagnosis: (1) Wernicke's encephalopathy is a clinical diagnosis (2) Red cell transketolase—a reduced level confirms thiamine deficiency To exclude other conditions: CT brain—should be done in all cases because of the high incidence of structural lesions, e.g. subdural haematoma, in this group of patients Other important tests: Depending on clinical context, consider as for acute confusional state—see 'Acute confusional state' Further management (1) After 3–5 days, switch from IV to oral vitamin replacement, e.g. thiamine 50 mg once daily + vitamin B tablets, Compound, Strong, 1–2 tablets three times daily + vitamin C 100 mg once daily (2) If alcohol withdrawal—see 'Drug overdosage' (3) Other aspects: as for acute confusional state—see 'Acute confusional state'—except avoid antipsychotics which lower seizure threshold (4) Long term—measures to help alcoholism Infectious disease Malaria See Chapter 8.8.2. Clinical features Falciparum malaria is the life-threatening form and the immediate concern in patients presenting to medical services in endemic areas, or who have travelled to such areas Transmitted to humans by the bite of an infected Anopheles mosquito. The interval between bite and first symptom is usually 7–14 days. Most patients with imported falciparum malaria present within 3 months of return from an endemic area, but a few present up to 1 year or more later History (1) Risk of exposure to malaria—anyone who has travelled to an endemic area and presents to medical attention with a febrile illness has malaria until proved otherwise Symptoms of malaria: (2) Early—malaise, headache, backache, myalgia, anorexia, fever (3) Later—dizziness, nausea, vomiting, abdominal discomfort, diarrhoea, rigors and drenching sweats (note that 'classical' tertian (48 h) or subtertian (36 h) periodicity of fever spikes are rarely seen in falciparum malaria) Symptoms of cerebral malaria: (4) Cerebral dysfunction—gradual decline in conscious level over several hours; generalized epileptic convulsion without postictal recovery of consciousness (present in 50% of adult cases of cerebral malaria) (continued)

 Examination (1) Vital signs—temperature, pulse rate, BP, respiratory rate. A high fever (rising to >39° C) is typical, which can be of any or no periodicity (2) General—anaemia, jaundice (3) Abdominal—look for moderate tender enlargement of liver

and/or spleen (4) Neurological—look for signs of cerebral malaria • Glasgow Coma Score—reduced (by definition in cerebral malaria) • Focal signs—note presence of dysconjugate gaze, brisk tendon reflexes, ankle clonus, extensor plantar responses and absent abdominal reflexes; and of decorticate or decerebrate posturing in severe cases • Fundi—retinal haemorrhages are common (exudates and papilloedema also occur) Notes (1) The following are not found in malaria: • Lymphadenopathy • Rash—excepting herpes simplex 'cold sores' in some cases • Focal signs (2) Signs of hypoglycaemia may be misinterpreted as being manifestations of cerebral malaria Immediate management If cardiorespiratory collapse—as described in 'Cardiorespiratory collapse: the patient in extremis' Oxygen—high flow, with reservoir bag if needed, to achieve oxygen saturations >92% If clinical evidence of intravascular volume depletion— establish IV access and resuscitate as described in 'Upper gastrointestinal haemorrhage', although caution should be exercised in fluid resuscitation for patients with malaria as they are prone to developing adult respiratory distress syndrome: consult your local tropical medicine centre at early opportunity Correct hypoglycaemia—if fingerprick blood glucose <3 mmol/litre, give 100 ml of 20% or 50 ml of 50% glucose (dextrose monohydrate) IV, followed by infusion of 10% glucose at sufficient rate to maintain blood glucose concentration >3 mmol/litre Antimalarial drugs for falciparum malaria (adult dosages) • Assume chloroquine resistance Patients with nonsevere malaria who can swallow and retain tablets Give one of the following regimen by mouth: (1) Artemether with lumefantrine [co-artemether] ('Riamet')—4 tablets (each containing 20 mg artemether and 120 mg lumefantrine) twice daily for 3 days (2) Proguanil with atovaquone ('Malarone')—4 tablets (each containing 100 mg proguanil and 250 mg atovaquone) once daily for 3 days (3) Quinine—the treatment of choice in many countries— 600 mg of quinine salt every 8 h for 7 days, followed by tetracycline 250 mg four times daily for 7 days or doxycycline 100 mg daily for 7 days Patients with severe malaria or who cannot swallow and retain tablets Give one of the following regimens: (1) Artesunate—by IV 'push': loading dose of 2.4 mg/kg followed by 1.2 mg/kg at 12 and 24 h, then 1.2 mg/kg daily for minimum of 3 days until patient can take oral therapy or another effective antimalarial (2) Artemether—by intramuscular injection: loading dose of 3.2 mg/kg on the first day (in one or two doses), followed by 1.6 mg/kg/day for minimum of 3 days until patient can take oral therapy or another effective antimalarial (3) Quinine—by IV infusion, which requires pretreatment ECG to assess QT interval and cardiac monitoring while receiving treatment: (a) loading dose of 20 mg/ kg dihydrochloride salt (maximum 1400 mg) diluted in 10 ml/kg isotonic fluid and given over 4 h, or (b) (in the intensive care unit) loading dose of 7 mg/kg dihydrochloride salt by infusion pump over 30 min, followed immediately by 10 mg/kg (maintenance dose) over 4 h; followed by (c) after 8 h give maintenance dose of 10 mg/kg (maximum 700 mg) over 4 h, repeated following further 8 h gaps until patient can swallow tablets to complete 7 day course; followed by (d) tetracycline 250 mg four times daily for 7 days or doxycycline 100 mg daily for 7 days Other measures (1) High fever—control by fanning, tepid sponging, cooling blankets, antipyretics (e.g. paracetamol 15 mg/kg in tablets, or powder washed down a nasogastric tube, or as suppositories or ibuprofen 400 mg by IV injection 6-hrly) (2) Anaemia—transfuse with whole blood or packed cells if haematocrit falls to <20% or if there is severe bleeding (3) Urine output—insert urinary catheter to monitor closely (4) Cerebral malaria—appropriate nursing care for the unconscious patient. Control convulsions (see 'Status epilepticus'). Consider elective intubation and ventilation if airway in danger of compromise (5) Hyperparasitaemia— exchange transfusions have always been controversial and are no longer recommended. Artesunate has the greatest mortality benefit in those with a high parasite count (6) Consider broad-spectrum antibiotics if evidence of shock or

secondary bacterial infection (7) All patients with severe or complicated malaria should be managed in a high dependency unit and discussed urgently with local tropical medicine unit Key investigations To establish the diagnosis: Depends on the detection of parasitaemia (stop antimalarial chemoprophylaxis): (1) Repeated examination of thick and thin blood films (8–12-hrly for 72 h) by an experienced microscopist (2) Antibody detection technique, e.g. dipstick antigen- capture assay Note If patient remains unwell and no other diagnosis can be made, consider therapeutic trial even if early smears are negative Other important tests: (1) Fingerprick stick test for blood glucose—?hypoglycaemia (2) Full blood count—anaemia with evidence of haemolysis is usual. Neutrophilia is common, but white cell count can be normal or low (3) Electrolytes, renal and liver function, glucose, coagulation screen—mild hyponatraemia is common (4) Arterial blood gases (5) Blood culture—to exclude secondary bacterial septicaemia in those with an obvious focus of such infection and in patients who are very unwell or have a raised blood white cell count (6) Depending on clinical context (mainly to exclude differential diagnoses)—CT brain, lumbar puncture, chest radiograph Further management Emphasize need for avoidance and prophylaxis with any future travel to malarious areas

30.1 Acute medical presentations 6631 Meningitis See Chapters 8.6.3, 8.6.5, 8.6.13, and 24.11.1. Clinical features Acute bacterial meningitis has a mortality of 70–100% if untreated and is the immediate concern in patients presenting to medical services History General symptoms: (1) Early—malaise, headache, fever, vomiting, diarrhoea (2) Later—increasingly severe headache, photophobia, drowsiness (3) Very late—coma, convulsions Localizing (if meningitis secondary to infection elsewhere): (4) Respiratory—pneumococcal disease (pneumonia) (5) Ear—H. influenzae (otitis media) Also: (6) Contact with a case of meningitis (7) Previous history of meningitis (8) History of immunodeficiency (9) Pregnancy—increased risk of listeria (10) Travel history—particularly meningococcal disease Examination (1) Vital signs—temperature, pulse rate, BP, respiratory rate (2) General: • Skin: petechiae/purpura—characteristic of meningococcal disease, but not specific • Conjunctivae/palate: petechiae—characteristic of meningococcal disease, but not specific • Posture—patients with severe meningism often lie with the back and neck in hyperextension (3) Neurological • Meningism—neck stiffness; Kernig’s sign (with the leg flexed at the hip, an attempt by the clinician to passively extend the knee is resisted by hamstring spasm) • Ocular fundi—papilloedema indicates raised intracranial pressure, but absence of papilloedema does not exclude this • Cranial nerve lesions—most commonly sixth (false localizing sign) (4) Other—in secondary meningitis there may be signs of primary focus, e.g. pneumonia, otitis media, cerebrospinal fluid shunts/reservoirs Immediate management (1) If cardiorespiratory collapse—as described in ‘Cardiorespiratory collapse: the patient in extremis’ (2) Oxygen—high flow, with reservoir bag if needed, to achieve oxygen saturations >92% (3) If clinical evidence of intravascular volume depletion, establish IV access and resuscitate as described in ‘Upper gastrointestinal haemorrhage’ Antimicrobial chemotherapy (empirical treatment, adult dosages) (1) Spontaneous (community acquired) or post-traumatic meningitis Drug Dose Route Frequency Duration Cefotaxime 2 g IV 4-hrly 1–2 weeks or Ceftriaxone 2 g IV 12-hrly 1–2 weeks If high prevalence of penicillin-resistant pneumococci, then add Vancomycin 1 g IV 12-hrly 2 weeks If underlying immunosuppression, pregnancy or age

50 years, then to cover Listeria add Ampicillin 2 g IV 4–6-hrly 3 weeks (2) Nosocomial meningitis If probability of pseudomonas is high, give vancomycin plus Ceftazidime 2 g IV 8-hrly 3 weeks or Meropenem 2 g IV 8-hrly 3 weeks If probability of pseudomonas is low, give vancomycin plus Cefotaxime 2 g IV 4-hrly 3 weeks or Ceftriaxone 2 g IV 12-hrly 3 weeks (3) Shunt-associated meningitis Treat as for nosocomial meningitis Notes (1) Antimicrobial therapy can be refined as soon as an organism is isolated, otherwise patients with suspected bacterial meningitis should receive treatment with the regimen indicated. (2) Doses of antimicrobials need to be adjusted in patients with chronic kidney disease or acute renal impairment (especially vancomycin) Corticosteroids Use remains controversial, but adjunctive dexamethasone has become routine therapy in most adults with suspected bacterial meningitis (see Chapter 24.11.1). Current NICE guidelines recommend dexamethasone 0.15 mg/kg to maximum dose of 10 mg four times daily for 4 days for suspected or confirmed bacterial meningitis. Key investigations To establish the diagnosis: (1) Epidemiological data (any current epidemics) (2) Lumbar puncture to obtain specimen of cerebrospinal fluid—looking in bacterial meningitis for: • General appearance—cloudy or purulent, but can be clear • Microscopy—(a) white cell count—usually raised (although can rarely be normal, i.e. <6 lymphocytes/ µl) with neutrophils accounting for >80% of cells, but can have a lymphocytic pleocytosis in early bacterial meningitis, partially treated disease, or with Listeria monocytogenes; (b) Gram stain—shows organisms in 50–80% of cases • Biochemical analysis—(a) glucose—usually reduced (<40% that of a parallel serum sample); (b) protein—usually elevated (>0.45 g/litre) Microbiological culture Other specific tests—antigen detection for common pathogens; polymerase chain reaction (PCR) for meningococcal disease Notes (1) In cases of suspected meningococcal meningitis/ septicaemia—give antibiotics immediately—before referral to hospital, and if in hospital before lumbar puncture (2) Lumbar puncture should not be performed if there are any of the following: • Symptoms or signs to suggest raised intracranial pressure, e.g. drowsiness/coma; focal neurological signs; loss of retinal vein pulsation/papilloedema; bradycardia/ hypertension • Local skin sepsis at the sight of puncture • Clinical suspicion of spinal cord compression • Bleeding diathesis (3) If symptoms or signs suggest raised intracranial pressure—arrange for CT brain to exclude space-occupying lesion or cerebral oedema (continued)

 Other important tests: For specific diagnosis (1) Blood culture (2) Throat swab—for viral and bacteriological culture (3) Skin lesion—disrupt with needle and make contact slide for Gram stain. (4) Blood sample—in EDTA (as full blood count) for bacterial-specific PCR Other: (1) Full blood count (2) Electrolytes, renal and liver function, glucose, clotting screen (3) HIV test (4) Immunoglobulins and splenic US (if proven pneumococcal disease) (5) Arterial blood gases (severe cases) (6) Chest radiography—?pneumonia (pneumococcal disease),?aspiration (if impaired conscious level) (7) CT/MRI brain—may demonstrate skull fractures or parameningeal

septic foci Further management (1) Meningitis is a notifiable disease (2) If meningococcal meningitis • Household and other intimate contacts—give prophylaxis (e.g. rifampicin 600 mg orally twice daily for 2 days, or ciprofloxacin 750 mg orally as single dose) and immunize if serogroup A,C,Y or W135 • Staff—prophylaxis is not required unless mouth to mouth resuscitation given (3) If proven pneumococcal disease • Pneumococcal vaccination Encephalitis See Chapters 8.5.2, 8.5.13, and 24.11.2. Clinical features Encephalitis is an acute inflammation of the brain
and/or spinal cord (encephalomyelitis) presenting as alteration of consciousness, convulsions and/or focal neurological signs. It is usually caused by an acute
viral infection of the central nervous system (typically herpes simplex, Japanese encephalitis, or an arthropod- borne virus), or it complicates a systemic viral infection such as measles (postinfectious encephalomyelitis)
or vaccination (postvaccinal encephalomyelitis). Case fatality is extremely variable but may exceed 40% when there is no antiviral therapy (e.g. Japanese encephalitis), and there is a high incidence of permanent neurological sequelae History General symptoms (after incubation period of a few days to 2 weeks) (1) Early—fever, headache, neck stiffness, vomiting (2) Later—psychiatric symptoms, altered consciousness, convulsions Localizing symptoms: (3) Altered behaviour, hallucinations, temporal lobe seizures—herpes simplex encephalitis (4) Rashes—preceding illness (e.g. measles, varicella, post- infectious encephalomyelitis); concurrent (e.g. West Nile virus encephalitis) Also: (5) Recent vaccination (vaccinia, nervous tissue rabies vaccine) (6) Current seasonal epidemic (arthropod-borne encephalitides) (7) Travel history—to endemic area (e.g. central Europe/ Scandinavia—tick-borne encephalitis) Examination (1) Vital signs—temperature, pulse rate, BP, respiratory rate, Glasgow Coma Scale (2) General • Skin: rashes—West Nile virus, enteroviruses, etc. • Mucous membranes: cold sores (herpes simplex encephalitis) (3) Neurological: • Meningism • Ocular fundi—papilloedema indicates raised intracranial pressure, but absence of papilloedema does not exclude this • Cranial nerve lesions—most commonly VI (false localizing sign) (4) Other—in postinfectious encephalomyelitis there may be signs of the preceding illness, e.g. measles, varicella, mumps, etc. Immediate management If cardiorespiratory collapse—as described in ‘Cardiorespiratory collapse: the patient in extremis’ If convulsing—as described in ‘Status epilepticus’ Oxygen—high flow, with reservoir bag if needed, to achieve oxygen saturations >92% (1) Antiviral treatment: • Aciclovir—where it is affordable, treatment with aciclovir should be started immediately in all undiagnosed cases in which viral encephalitis is included in the differential diagnosis. Specifically, aciclovir is recommended for herpes simplex, herpes simiae (B), herpes zoster, and Epstein–Barr virus encephalitides: dose 10 mg/kg every 8 h by IV infusion (reduced in renal impairment) • Ribavirin (tribavirin)—for the rare encephalitides associated with RNA virus infections (e.g. Lassa fever, Argentine haemorrhagic fever, Hanta virus, Crimean–Congo haemorrhagic fever and Rift Valley fever) ribavirin (tribavirin) has been recommended: 2 g loading dose by IV infusion, then 1 g every 6 h for 4 days, then 0.5 g 8-hrly for 6 days (2) Other measures: • Reduction of severe intracranial hypertension—IV mannitol or mechanical hyperventilation Key investigations To establish the diagnosis: (1) Epidemiological data (any current epidemics) (2) Lumbar puncture to obtain specimen of cerebrospinal fluid—looking in viral encephalitis for: • Microscopy—(a) white cell count—usually raised (but normal in 10–15% of patients with herpes simplex encephalitis at first examination), with lymphocytes and other mononuclear cells predominant except in early infections; (b) Gram stain—to exclude bacterial meningoencephalitis • Biochemical analysis—(a) glucose—usually normal, but low levels have been reported; (b) protein—usually elevated into range 0.5–1.5 g/litre • Virological testing—(a) PCR;

(b) specific viral IgM (microcapture technique); (c) viral isolation—e.g. mumps, enteroviruses, lymphocytic choriomeningitis virus (3) Other samples—(a) skin lesions—immunofluorescence (herpes zoster) and electron microscopy (herpesviruses); (b) nasopharyngeal aspirate—measles; (c) stool— enteroviruses; (d) serology (acute/convalescent titres)— mumps, Coxsackie viruses, arthropod-borne viruses Other important tests: (1) Full blood count (2) HIV test (3) Arterial blood gases (severe cases) (4) CT/MRI—may demonstrate focal lesions (e.g. herpes simplex encephalitis) or cerebral oedema Notes (1) The diagnosis of viral encephalitis should not be made too hastily as the differential diagnosis is broad and other treatable causes (e.g. cerebral malaria, bacterial or fungal meningoencephalitides) may be ignored (2) Lumbar puncture should not be performed if there are contraindications—see ‘Encephalitis’

30.1 Acute medical presentations 6633 Tetanus See Chapter 8.6.23. Clinical features Tetanus, caused by toxins of Clostridium tetani in contaminated wounds, remains common in some developing countries but is preventable by vaccination. It is now rare in developed countries but, because it is decreasingly familiar, is less likely to be diagnosed. The case fatality ranges from 20 to 60%, although in expert hands this may be reduced to 6%, even in severe cases History (1) Recent wound, especially penetrating, contaminated, or with necrosis, is identified in 75–85% of cases (2) Problems in head, neck, mouth—trismus due to a painful local condition is an important differential diagnosis (3) Drugs—a dystonic drug reaction is an important differential diagnosis Symptoms of tetanus: After an incubation period of usually 6–10 days (<15 days in 90% of cases): • Nonspecific—malaise, fever, sweating, and headache • Suggestive—muscle stiffness (especially of the jaws), spasms, and dysphagia Examination Features of tetanus: (1) Muscles—trismus, risus sardonicus, neck retraction; rigidity of erector spinae and abdominal muscles (board- like rigidity); opisthotonos; tonic contractions/spasms of the stiff muscles; spasms of respiratory muscles and larynx threaten to cause asphyxia; local tetanus may involve only muscles in the region of the wound, e.g. cephalic tetanus (2) Autonomic nervous system—fluctuating heart rate, BP, and temperature, with sweating and hypersalivation (3) Clinical grading—of prognostic significance: • I (mild)—trismus and generalized stiffness without respiratory embarrassment or spasms • II (moderate)—marked rigidity, brief spasms, mild respiratory embarrassment, and dysphagia • III and IV—frequent prolonged spasms, respiratory embarrassment with apnoeic spells, severe dysphagia. and cardiovascular abnormalities Also: • Look for features of alternative diagnosis, e.g. local cause of trismus • Do not forget the possibility of dystonic reactions, e.g. to metoclopramide Notes (1) Incubation period less than 4 days and period of onset (trismus to first spasm) less than 48 h are associated with high mortality (2) In developed countries, patients are often elderly (missed childhood vaccination) Immediate management • If cardiorespiratory collapse—as described in ‘Cardiorespiratory collapse: the patient in extremis’ • If convulsing—as described in ‘Status epilepticus’ • Oxygen—high flow, with reservoir bag if needed, to achieve oxygen saturations >92% (1) Airway/ventilation—if apnoeic/asphyxiating/ hypoxaemic—may require emergency tracheostomy, assisted ventilation with oxygen, neuromuscular blockade (pancuronium/vecuronium). See Chapter 30.2, ‘Management of the airway’. (2) Tetanus immune globulin—give in all cases before manipulating the wound, either (a) (preferably, if available) human tetanus immune globulin 100–300 U/kg intramuscularly, or (b) equine tetanus immune globulin 500–1000 U/kg intramuscularly (beware of anaphylaxis, see ‘Anaphylactic shock’) (3) Wound—give antibiotics to sterilize: metronidazole 500 mg, orally (if possible) or IV, three times a day for 10 days (4) Wound—surgical debridement after tetanus immune globulin has been given (5) Sedatives/muscle relaxants—give diazepam by continuous IV infusion (high doses may be required,

up to 100 mg/h) Notes (1) Autonomic nervous system disturbances—(a) hypertension may require cautious use of low-dose short- acting β-blockers; (b) brady/tachyarrhythmias—treat only if causing significant haemodynamic disturbance: see ‘Tachycardia’; (c) IV magnesium sulphate (titrated to produce serum concentrations between 2 and 4 mmol/ litre) improves cardiovascular stability (2) Deep vein thrombosis prophylaxis—give low molecular weight heparin Key investigations Tetanus is a clinical diagnosis (1) Wound swab—but failure to culture Clostridium tetani from the wound does not exclude the diagnosis of tetanus (2) Lumbar puncture—the cerebrospinal fluid is normal Note The differential diagnosis includes the many local causes of trismus, dystonic reactions to drugs, tetany, strychnine poisoning, meningitis, and rabies (cephalic tetanus) Further management Infection does not confer immunity: give full course of active immunization (tetanus toxoid) after recovery Rabies See Chapter 8.5.10. Clinical features Rabies is a zoonotic viral infection of the central nervous system, endemic in domestic dogs and cats, wild carnivores, bats, etc., in most parts of the world. It is transmitted to humans by bites of rabid mammals, usually dogs. The case fatality of rabies encephalomyelitis is virtually 100%, but the disease is preventable by modern postexposure treatment started soon after the bite History (1) History of dog (or other mammal) bite (but may be distant or forgotten, especially with insectivorous bat bites in the USA) or a lick by a mammal on broken skin (2) Travel history to rabies endemic area (3) Postexposure treatment—see ‘Animal bites/stings’ Symptoms of rabies After an incubation period of usually 20–90 days (extreme range 4 days to 19 years): (1) Prodromal symptoms: • Nonspecific—fever, chills, malaise, weakness, tiredness, headache • Suggestive—itching, pain, or paraesthesiae at the site of the healed bite wound (2) A few days later: • Furious rabies—difficulty swallowing (especially water), causing spasms of breathing and great anxiety (with or without pain in the throat) • Extreme susceptibility to draughts, causing similar spasms • Bizarre behaviour • Periods of extreme excitement, hallucinations, terror, aggression with lucid intervals (3) After several more days: • Lapse into coma and convulsions • Sudden death during a hydrophobic spasm • Paralytic rabies—ascending weakness with sensory symptoms often starting in the bitten limb; sphincter problems; dysphagia, drooling, and respiratory weakness (continued)

 Examination (1) Wound: • Evidence of healed bite (2) Neurological: • Clinical examination may be normal • Excitable behaviour interspersed with lucid intervals • Furious rabies—violent, jerky spasms of inspiratory muscles associated with evident terror provoked by attempts to drink or exposure to a draught of air • Paralytic rabies—ascending flaccid paralysis with fasciculations, sensory loss, sphincter dysfunction • Weakness of muscles of deglutition and respiration • Excitable behaviour interspersed with lucid intervals (3) Autonomic nervous system: • Signs of overactivity—hypersalivation, sweating, labile pulse rate and BP Immediate management (1) Although life can be prolonged by invasive, intensive care (tracheostomy, paralysis, mechanical ventilation, cardiac monitoring, etc.), the chances of a successful outcome are so low that there is a strong case for palliative care to relieve pain and anxiety (2) There is currently no evidence to support use of the ‘Milwaukee Regimen’ (sedation, antiviral drugs, etc.) that was administered to an American girl who recovered from rabies Key investigations To establish the diagnosis during life: (1) Skin punch biopsy (hairy area, e.g. nape of neck)— detection of virus by direct fluorescent antibody in nerves surrounding hair follicles (2) Saliva—virus may be isolated (3) Blood—rabies-neutralizing antibody titre—elevated in unvaccinated patient (but may be negative for 7 days after clinical illness has begun) (4) Cerebrospinal fluid analysis—(a) may be normal, but protein usually elevated, and may have elevated white blood cell count; (b) rapid PCR (experimental); (c) virus may be isolated;

(d) rabies-neutralizing antibody titre—elevated in unvaccinated patient (but may be negative for 7 days after clinical illness has begun) (5) Exclusion of other diagnoses—given the appalling outcome of rabies it is important to pursue the possible differential diagnosis of a rapidly progressing encephalitis (see ‘Encephalitis’) if there is any doubt about the diagnosis Further management Attempt to identify/capture/examine (by veterinarian)/ test the animal responsible for the bite—if the biting animal is available (usually dog), it should be euthanized and its brain immediately examined to detect rabies virus by direct fluorescent antibody labelling of brain smear, or by viral isolation. When possible, this is preferred to previous practice of observing the animal for onset of rabid symptoms over a 10-day period Animal bites/stings See Chapter 10.4.2. Clinical features A very wide range of animals may inflict bites and stings. Serious consequences may result from trauma, envenoming, allergy, or infection History (1) Timing—the event is usually painful and memorable and so precisely timed by the victim Immediate symptoms: (2) Distress—associated with a terrifying event: (3) Trauma—pain, bleeding, dysfunction (depending on site and severity of injury) (4) Envenoming • Snake bite: • Local—pain, swelling, persistent bleeding, bruising, blistering, painful enlargement of draining lymph nodes • Systemic—syncope/collapse (may be early and transient), spontaneous systemic bleeding (gums, nose etc.), vomiting, progressive weakness starting with ptosis, blurred vision, inability to open mouth, swallow, speak etc., generalized muscle aches and tenderness, passage of black urine (rhabdomyolysis) • Scorpion sting: • Local—very severe pain, mild swelling • Systemic—vomiting, sweating, faintness, difficulty with breathing, muscle spasms • Spider bites: • Local—pain, sweating and gooseflesh (neurotoxic) or progressive skin changes (red, white, and blue sign; necrotic) • Systemic—vomiting, faintness, colic, and muscle spasms • Jellyfish stings: • Local—severe pain, blistering, contact rash • Systemic—collapse, vomiting • Fish stings: • Local—very severe pain • Systemic—rarely collapse (5) Allergy: • Hymenoptera stings (bees, wasps, hornets, yellowjackets, ants) • Local—pain, swelling (may be negligible) • Systemic—early syncope and collapse, raised, itchy rash, swelling of mouth, lips, tongue, and gums, chest tightness, wheezing, asthma attack, abdominal colic, vomiting, diarrhoea (all of these may develop within a few minutes of the sting) (6) Infection: • Symptoms attributable to infection are delayed, with earliest onset at about 12 h (Pasteurella multocida) • Local—pain, swelling, redness, heat, purulent discharge • Systemic—sometimes severe generalized symptoms (sepsis) Examination (1) Vital signs—temperature, pulse rate, BP, respiratory rate, Glasgow Coma Scale (2) Trauma—injuries to soft tissues, joints, tendons, bones (crush fractures), body cavities (e.g. haemothorax), evisceration, dead tissue, foreign material in the wound (broken teeth, claws, earth, etc.). May be severe/life- threatening. May be associated with envenoming and/or allergy and/or infection (e.g. marine coral cuts, sting ray, and sea urchin injuries) (3) Envenoming—see ‘History’ (4) Allergy—features of anaphylaxis (see ‘Anaphylactic shock’) (5) Infection—(a) local—pain, swelling, redness, heat, purulent discharge; (b) systemic—sepsis syndrome (see ‘Septic shock’) Notes (1) Human bites: • May be of medicolegal significance: document carefully, also any other evidence of injury (sketch and photograph) (see Chapter 27.1) • High risk of infection with group A, β-haemolytic streptococci, Staph. aureus (40% of wounds), haemophilus, klebsiella, Eikenella corrodens, and anaerobes • Consider risk of blood borne virus transmission and administer prophylaxis accordingly • May be self-inflicted—typically lips, buccal cavity, fingers, clenched-fist injuries of knuckles (2) Dog, cat/other mammal bites • Associated with high risk of infection with a wide range of pathogens, notably Pasteurella multocida, Capnoctyophaga canimorsus, Staph. aureus, Clostridium tetani, and other anaerobic bacteria, rabies virus, etc.

30.1 Acute medical presentations 6635 Immediate management First aid (1) Trauma: • Control pain and bleeding, contain wound with bandaging, give plasma expander if available, transport to medical care (2) Envenoming: Snake bite: • Immobilize the patient, especially the bitten limb • Avoid harmful remedies—tourniquets, incisions, suction, electric shock, cryotherapy, snake stones, etc. should never be used • Transport the patient to medical care • Neurotoxic bites only—pressure immobilization and splinting with a long elasticated bandage • Venom ophthalmia (spitting cobras and rinkhals)—irrigate affected eye with liberal quantities of bland fluid (e.g. water, milk) and apply 1% adrenaline (epinephrine) or local anaesthetic drops for pain (if available) Other bites and stings: • Fish stings—immerse stung part in uncomfortably hot but not scalding water (maximum 45° C) • Scorpion stings and other painful bites and stings—local 1% lidocaine (lignocaine) with digital block or strong systemic analgesia (if available) • Jellyfish stings—(a) box jellyfish (North Australia, Indo-Pacific)—wash area with dilute acetic acid/vinegar; (b) Atlantic jellyfish—apply a slurry of baking powder (c) hot water immersion for pain (see ‘Fish stings’ earlier in this list) • Bee stings—remove the sting as quickly as possible • Tick bites—apply surgical spirit to the animal and prise out the mouth parts with forceps Hospital management • If anaphylaxis—as described in ‘Anaphylactic shock’ • If cardiorespiratory collapse—as described in ‘Cardiorespiratory collapse: the patient in extremis’ • Oxygen—high flow, with reservoir bag if needed, to achieve oxygen saturations >92% • If clinical evidence of intravascular volume depletion— establish IV access and resuscitate as described in ‘Upper gastrointestinal haemorrhage’ (1) Trauma: • Explore wound under anaesthesia, debriding and removing foreign material. • Treat specific injuries to vital structures • Delayed primary suture (2) Envenoming: • Antivenom treatment—in cases of envenoming by snakes, fish, scorpions, spiders, box jellyfish, and ticks, administer antivenom IV (provided that an appropriate specific antivenom is available) if any of the following are present: paralysis (ptosis, etc.); spontaneous systemic bleeding (gums, gastrointestinal tract etc.); incoagulable blood; shock; ECG abnormalities; black urine (myoglobinuria, haemoglobinuria); severe/rapidly progressive local envenoming • Antivenom reactions (anaphylactic or serum)—beware of these and treat/prevent as follows—(a) Treatment: give adrenaline (1/1000, 0.3–0.5 ml intramuscularly = 0.3– 0.5 mg dose, repeated as necessary) plus anti-H1 (e.g. chlorpheniramine 10–20 mg IV) plus corticosteroid (e.g. hydrocortisone 5 mg/kg IV) at the first sign of a reaction; (b) Prevention: do not give routine prophylaxis except in atopic subjects with severe asthma and those who have suffered previous reactions to antivenom. See ‘Anaphylactic shock’ Key investigations (1) Trauma: • Appropriate radiological imaging to define extent of the injury (2) Snake bites: • Simple 20 min whole blood clotting test or rapid coagulation screen • Stick test urine for blood—positive may indicate lysed red blood cells (?disseminated intravascular coagulation) or myoglobin (rhabdomyolysis) • Australia only—rapid EIA venom detection kit, using swab from the bite wound • Tensely swollen limbs—measure intracompartmental pressure as guide to avoiding unnecessary fasciotomy Other important tests: • Depending on clinical context/severity—ECG, full blood count, electrolytes, renal and liver function tests, muscle enzymes (creatine kinase), arterial blood gases, chest radiograph Further management Trauma (bites by large animals) (1) Definitive wound closure with skin grafts, etc. (2) Infection risk: • Bacterial—prophylactic antibiotics for severe/multiple wounds or wounds of the fingers or in response to cultures: (a) amoxicillin/clavulanic acid—(expressed as) amoxicillin 250 mg three times daily by mouth (prophylaxis, mild case) to 1 g three times daily IV (treatment, severe case), or (b) second/third-generation cephalosporin, e.g. cefotaxime 1–2 g 6-hrly IV • Tetanus—give tetanus toxoid or, if unimmunized, consider tetanus immunoglobulin • Rabies—consider possibility of rabies exposure and (if appropriate) give rabies postexposure treatment: (a) thorough wound cleaning—scrub under

running tap with soap and water; irrigate with plain water; (b) apply viricidal agent such as 40–50% alcohol or 1% iodine; (c) avoid suturing; (d) vaccination—start active vaccination using tissue culture vaccine (dividing one dose of 0.5–1 ml between 8 sites intradermally produces the most rapid antibody response) plus start passive immunization with equine rabies immunoglobulin (40 units/kg body weight) or (preferably if available) human rabies immunoglobulin (20 units/kg body weight) infiltrated around the wound, with the residue given intramuscularly distant from the site of rabies vaccination. See https://www.gov.uk/government/ publications/rabies-the-green-book-chapter-27 (3) Envenoming • Nursing—avoid elevation of the bitten limb • Surgery—debridement of necrotic tissue with immediate split skin grafting; avoid hasty and unjustified fasciotomy (especially if the blood is still incoagulable) • Myoglobinuric renal failure—try to prevent by correcting hypovolaemia and acidosis and encouraging diuresis (see 'Rhabdomyolysis')
Septic shock See Chapters 8.2.1, 17.1, and 17.6. Clinical features Septic shock is a condition associated with the body's dysregulated response to severe infection in which there is hypotension (systolic BP <90 mmHg) unresponsive to fluids or requiring vasoactive drugs for its correction. The causative organisms may be Gram-positive or
Gram-negative bacteria, yeasts, viruses, or protozoa. Failure of one or more organ systems is common (continued)

 History (1) Systemic features—may develop rapidly (minutes–hours), e.g. meningococcaemia, or gradually • Early—malaise, lethargy, nausea, vomiting, fever, sweating, shivering/rigors • Later—restless, anxious, confused, agitated (2) Localized features—related to causative
infection—e.g. pneumonia, urinary tract infection,
infected intravascular catheter, meningitis, after
large-bowel surgery, etc. (3) Risk factors—complication of surgery, instrumentation, burns, or other trauma; complication
of preceding illness, e.g. flu predisposing to staphylococcal pneumonia; travel history—could the patient have malaria? (see 'Malaria') Examination (1) Vital signs—temperature (fever or hypothermia), tachycardia, tachypnoea, hypotension, peripheral perfusion—warm (vasodilated) or cold/cyanosis (vasoconstricted), Glasgow Coma Score (2) Evidence of the causative infection—complete physical examination to look for focus of infection. Do not forget to examine the back and perineum/rectum (localized abscess) (3) Evidence of organ failure: • Respiratory—central cyanosis (check pulse
oximetry), crackles. Risk of adult respiratory distress syndrome • Renal—low urine output. Risk of prerenal renal failure or acute tubular necrosis • Liver—jaundice • Neurological—confusion • Haematological—abnormal bleeding/gangrene of extremities Notes (1) Look for evidence of predisposition to
infection—elderly, immunosuppressed, asplenic, malignant disease, artificial heart valve, prosthetic material, etc. (2) Streptococcal toxic shock syndrome—erythematous rash, local severe pain and swelling (necrotizing fasciitis/ myositis) (3) Staphylococcal toxic shock syndrome—diarrhoea, myalgia, rash (desquamating), often associated with menstruation/tampon use Immediate management If cardiorespiratory collapse—as described in 'Cardiorespiratory collapse: the patient in extremis' • Oxygen—high flow, with reservoir bag if needed, to achieve oxygen saturations >92% • If clinical evidence of intravascular volume depletion, establish IV access and resuscitate as described in 'Upper gastrointestinal haemorrhage' (1) Fluid/circulatory: • Targets for resuscitation are Svo2 >70% with a mean arterial pressure >60 mmHg. Other reasonable goals

include central venous pressure 8–12 mmHg and urine output >0.5 ml/kg per h • Fluid—give repeated IV fluid boluses (e.g. 250 ml 0.9% saline or physiological salt solution) until BP and tissue perfusion are acceptable, or there is pulmonary oedema,
or there is no further response • Vasopressor agents (e.g. dobutamine, norepinephrine, epinephrine, dopamine)—after giving fluid as
detailed earlier in this list, restore arterial and venous vasomotor tone using α-adrenergic sympathomimetic agents • Vasodilator agents (e.g. nitrates)—if there is impaired contractility then reduce afterload with vasodilators as tolerated, up to a decrease in mean arterial pressure to about 70 mmHg, targeting pulmonary artery occlusion ('wedge') pressure <18 mmHg and Svo2 >70%. In sepsis, Svo2 is usually elevated following fluid resuscitation, hence resuscitation targets usually focus on reaching elevated levels of oxygen delivery (e.g. >450 ml/min per m2) • Inotropes (e.g. dobutamine)—a trial of inotropic therapy is warranted if Svo2 remains <70% despite the earlier-mentioned interventions (2) Respiratory: • Consider early intubation and mechanical ventilation (3) Antibiotics • Give broad-spectrum, empirical treatment to cover the likely causative organisms Community-acquired septicaemia: • Aminoglycoside (e.g. gentamicin 5 mg/kg IV once daily, assuming normal renal function) + broad-spectrum penicillin (e.g. co-amoxiclav 1.2 g 6–8-hrly IV), or • Broad-spectrum cephalosporin (e.g. cefotaxime, 1 g 12- hrly to 2 g 6-hrly, IV) Hospital-acquired septicaemia: • Aminoglycoside (e.g. gentamicin 5 mg/kg IV once daily, assuming normal renal function) + broad-spectrum anti-pseudomonal penicillin (e.g. Tazocin 2.25–4.5 g (= piperacillin 2–4 g + tazobactam 250–500 mg) 6-hrly IV), or • Meropenem 1 g 8-hrly IV, or • Imipenem with cilastatin, 500 mg–1 g (of imipenem) 6 hourly IV Pseudomonas infection suspected: • Aminoglycoside (e.g. gentamicin 5 mg/kg IV once daily, assuming normal renal function) + broad-spectrum anti-pseudomonal penicillin (e.g. Tazocin 2.25–4.5 g (= Piperacillin 2–4 g + tazobactam 250–500 mg) 6-hrly IV) Gram-positive infection suspected: • Add flucloxacillin 1–2 g 6 hourly IV, or • Vancomycin 1 g 12-hrly IV (assuming normal renal function) Methicillin-resistant Staph. aureus (MRSA) suspected: • Vancomycin 1 g 12-hrly IV (dosing adjusted according to renal function) • Daptomycin 6 mg/kg once daily IV (every other day in patients with estimated GFR <30 ml/min) Anaerobic infection suspected: • Add metronidazole 500 mg 8-hrly IV Meningococcaemia: • Benzylpenicillin 2.4 g 4-hrly IV, or • Cefotaxime 2 g 6-hrly IV, or • Ceftriaxone 2 g 12-hrly IV Streptococcal toxic shock syndrome: • Benzylpenicillin 1.2–2.4 g 6-hrly IV, or cefotaxime 2 g 6- hrly IV; both plus clindamycin 600–1200 mg 6-hrly IV Notes (1) Aminoglycosides, vancomycin—dosage dependent on renal function; always monitor levels (2) Antibiotics—always refer to hospital protocols for antibiotic prescribing—these will take account of local epidemiology of infection and antimicrobial resistance patterns of pathogens (3) Other aspects: • Supportive treatment may be required for specific organ failure—mechanical ventilation, renal replacement therapy (haemofiltration, haemodialysis) • Surgical—e.g. urgent fasciotomy and débridement for streptococcal necrotizing fasciitis/myositis • Keep blood glucose in range 5.5–10 mmol/litre (100–180 mg/dl) using IV infusion of Actrapid insulin on sliding scale

30.1 Acute medical presentations 6637 Key investigations To establish the source of infection: (1) Blood culture (2) Other cultures as determined by clinical signs or imaging, e.g. needle aspiration of fluid collections (3) Consider cross-sectional imaging, e.g. CT chest/ abdomen/pelvis Other: (3) Full blood count—leucocytosis or leucopenia (4) Electrolytes, renal and liver function tests, glucose, clotting screen, muscle enzymes (creatine kinase,? rhabdomyolysis) (5) Arterial blood gases—pH, Po2, Pco2, base excess, lactate Psychiatry Acute alcohol withdrawal See Chapter 26.5.4. Clinical features History Related to alcohol withdrawal: (1) Autonomic hyperactivity, e.g. sweating,

tachycardia, anxiety (2) Hand tremors (3) Headache (4) Insomnia (5) Nausea and vomiting (6) Hallucinations—tactile, visual, auditory (7) Psychomotor agitation (8) Grand mal seizures Also: (9) Drinking history—how much alcohol does the patient usually drink? Have they recently been drinking particularly heavily, or have they stopped? Examination Related to alcohol withdrawal: (1) Agitation and anxiety (2) Confusion (3) Tremor (4) Sweating (5) Tachycardia and hypertension Related to clinical context: (6) Cardiovascular—look for evidence of intravascular volume depletion and/or dehydration (7) Consider other complications of alcoholism: • Wernicke's encephalopathy—see 'Acute Wernicke's encephalopathy' • Acute liver failure • Chronic liver disease and its complications (8) Consider other causes of an acute confusional state— see 'Acute confusional state' (9) Nutritional status Immediate management (1) Sedation • Patient can take oral medication: • Reducing schedule of chlordiazepoxide, e.g. 30 mg four times daily (day 1); 25 mg four times daily (day 2); 20 mg four times daily (day 3); 15 mg four times daily (day 4); 10 mg four times daily (day 5); 10 mg three times daily
(day 6), 10 mg twice daily (day 7); 5 mg twice daily (day 8), 5 mg at night (day 9) • Patient cannot take oral medication: • Clomethiazole (chlormethiazole), 0.8% solution, initially 2.5–7.5 ml/min (20–60 mg/min) until light sleep is induced from which the patient can easily be roused, with the rate of infusion then reduced to the lowest possible to maintain this state. Note—careful monitoring for respiratory depression is required: resuscitation facilities must be available. Switch to oral sedation when possible (2) Thiamine • Give parenteral thiamine immediately, usually in combination with other vitamins B and C as Pabrinex I/V high potency, 2–3 pairs of ampoules IV over 10 min every 8 h (each pair of ampoules contains ascorbic acid 500 mg, anhydrous glucose 1 g, nicotinamide 160 mg, pyridoxine hydrochloride 50 mg, riboflavin 4 mg and thiamine hydrochloride 250 mg in a total of 10 ml). Note—facilities for treating anaphylaxis should be available • Then (3) Glucose—treat/prevent hypoglycaemia • Do not give glucose before thiamine—danger of precipitating Wernicke's encephalopathy • If blood glucose <3 mmol/litre, give 100 ml of 10% glucose (dextrose monohydrate) IV • If not hypoglycaemic—start 5% dextrose infusion at 50 ml/h to prevent hypoglycaemia (if hyponatraemic used reduced volume of more concentrated dextrose solution) Key investigations To establish the diagnosis: Acute alcohol withdrawal is a clinical diagnosis Other important tests: Depending of clinical context, consider as for acute confusional state—see 'Acute confusional state' Further management (1) After 2 days, switch from IV to oral vitamin replacement, e.g. thiamine 50 mg once daily + vitamin B tablets, Compound, Strong, 1–2 tablets three times daily + vitamin C 100 mg once daily (2) Other aspects: as for acute confusional state—see 'Acute confusional state'—except avoid antipsychotics which lower seizure threshold (3) Long term—measures to help alcoholism Drug overdosage See Chapter 10.4.1. Clinical features History The overdose: (1) Nature, time, and quantity of drug ingested (2) Circumstantial evidence (3) Concurrent alcohol consumption Also: (4) Assessment of intent (5) Past medical history, medications, and allergies (6) Past psychiatric history Notes (1) Be cautious in accepting the patient's account at face value (2) Assume that overdoses of multiple drugs are likely Examination Initial survey: (1) Airway, breathing, circulation (2) Fingerprick stick test for blood glucose (?hypoglycaemia) (3) Check for small pupils and slow respiratory rate (?opioid overdose) (4) Check temperature (?hypothermia) (5) Check Glasgow Coma Score (see Table 30.1.18) Further examination: (6) Look for features indicated in Table 30.1.22 Immediate management If cardiorespiratory collapse, as described in 'Cardiorespiratory collapse: the patient in extremis' • Nurse in recovery position if Glasgow Coma Score impaired • Oxygen—high flow, with reservoir bag if needed, to achieve oxygen saturations >92% • Airway—consider oropharyngeal airway or cuffed endotracheal tube depending on level of consciousness (continued)

 (1) Cardiac rhythm—place patient on ECG monitor, but do not treat arrhythmias unless these are associated with profound hypotension (2) Establish IV access: • If fingerprick blood glucose <3 mmol/litre, give 100 ml of 20% or 50 ml of 50% glucose (dextrose monohydrate) IV • If possibility of opioid overdose—give naloxone 0.4–2 mg IV, repeated at intervals of 2–3 min to a maximum of 10 mg. Treat if in doubt. (3) Consider hypothermia—start rewarming (4) Prevention of drug absorption—see Table 30.1.23 (5) Specific antidote (if available)—see Table 30.1.24 If in doubt—discuss management with a Poisons Centre: the following single number for the UK National Poisons Information Service directs the caller to the relevant local centre: 0344 892 0111 Key investigations To establish the diagnosis: (1) Serum drug levels, e.g. paracetamol, salicylates, iron, theophylline, lithium, digoxin (2) Save serum sample for measurement of other toxins after discussion with clinical chemist, e.g. paraquat (3) Urine for toxicology screen (including amphetamine, barbiturate, benzodiazepine, tricyclics, cocaine, marijuana, methamphetamine, morphine, methadone, MDMA, opiates and phencyclidine) Note Record time of blood sampling accurately on specimen tube and in notes Other important tests: (1) Electrolytes; glucose; renal, liver, and bone function tests; full blood count; clotting screen (2) ECG Consider: (3) Arterial blood gases (4) Carboxyhaemoglobin level (5) Chest radiograph—look for evidence of aspiration or pulmonary oedema (6) Abdominal radiograph See Table 30.1.25 Further management (1) Dependent on the nature of overdose taken (2) As dictated by psychiatric condition (if any) Table 30.1.22 Clinical features of drug overdose Clinical feature Drug to consider Vital signs Hypothermia Alcohol Phenothiazines Hyperthermia Amphetamines Sympathomimetics, including cocaine Monoamine oxidase inhibitors Salicylates Ecstasy General appearance Sweating Salicylates Venepuncture marks Drug abuse Cardiovascular Cardiac arrhythmia Tricyclics Amphetamines Potassium Theophylline Digoxin β-Blockers Hypertension and tachycardia Amphetamines Sympathomimetics Hypotension Sedatives Narcotics Hypnotics Iron Tricyclics Alcohol Respiratory Hyperventilation Salicylates Hypoventilation Opioids Sedatives Hypnotics Gastrointestinal Oral ulceration Strong acids or alkalis Haematemesis Iron Salicylates Eyes Pinpoint pupils Opioids Dilated pupils Anticholinergics Tricyclics Cocaine Neurological Drowsiness (depressed GCS) Alcohol Sedatives Opioids Hypnotics Salicylates Tricyclics Confusion Alcohol Ataxia Tricyclics Excitability Antihistamines Salbutamol Solvents Dystonia Metoclopramide Haloperidol Phenothiazines

 Table 30.1.23 Prevention of absorption of drugs taken in overdose Indications Contraindications Notes Gastric lavage Within 2 h of ingestion of life-threatening amount of toxic substance May be extended up to 6 h after drugs that delay gastric emptying (e.g. salicylates, opioid analgesics, anticholinergic drugs) Inability to maintain the airway (unless intubated with cuffed endotracheal tube) Ingestion of corrosives or organic solvents Save lavage sample for analysis Ipecacuanha No indication (for use in adults) No evidence of reduced drug absorption in poisoned patients Activated charcoal Within 2 h of ingestion of life-threatening amount of toxic substance Consider repeat doses for some toxins, e.g. slow-release preparations, carbamazepine, dapsone, digoxin, paraquat, phenobarbitone, quinine, Amanita phalloides (death cap mushroom) Drugs that are not bound to charcoal, e.g. iron salts, lithium, ethanol, methanol, ethylene glycol, cyanide salts, acids/alkalis, organic solvents, mercury, lead, fluorides, potassium salts Standard adult dose is 50 g Can be given after gastric lavage Table 30.1.24 Antidotes used in drug overdose Overdose Antidote β-Adrenoceptor blockers
(if severe hypotension) Atropine 0.6–3.0 mg IV If no response to atropine then give glucagon 50–150 µg/kg IV in 1 min, then 1–5 mg/h by IV infusion Digoxin Digoxin-specific Fab antibodies, IV

over 30 min Dose determined in relation to patient’s body weight and serum digoxin concentration (or 380–760 mg if potentially life- threatening toxicity and serum digoxin concentration not known) Iron salts Desferrioxamine mesilate 15 mg/kg per h IV (maximum 80 mg/kg over 24 h) Opioids Naloxone 0.4–2.0 mg IV/IM, repeated at intervals of 2–3 min to maximum 10 mg. If drowsiness recurs after arousal, consider IV infusion (2 mg in 500 ml 0.9% saline, rate adjusted according to response) Paracetamol Methionine 2.5 g orally, followed by 2.5 g 4 hourly (×3 further doses), or N-acetylcysteine 150 mg/kg IV over 1 h, then 50 mg/kg over 4 h, then 100 mg/kg over 16 h (in 5% dextrose) Phenothiazines (dystonia) Benzatropine mesilate 1–2 mg IV/IM or procyclidine 5–10 mg IV/IM Warfarin Vitamin K1 (phytomenadione) 5 mg slow IV Benzodiazepines Flumazenil is a benzodiazepine antagonist but should not be given to patients when the identity of ingested drugs is not known: it can provoke withdrawal seizures in patients with benzodiazepine dependence and arrhythmias in patients who have also taken tricyclic antidepressants. If used then dosage is 0.2 mg IV over 15 s, then 0.1 mg at 60-s intervals (maximum total dose 1 mg), and if drowsiness recurs after arousal, consider IV infusion at 0.1–0.4 mg/h Note: (1) All dosages are for adults.
Table 30.1.25 Laboratory data in drug overdose Abnormality Drug to consider Hypokalaemia Sympathomimetic drugs Diuretics Hyperkalaemia Cardiac glycosides (e.g. digoxin) β-Blockers Potassium salts Hypoglycaemia Insulin Oral hypoglycaemic agents Ethanol Salicylates Metabolic acidosis Methanol Ethylene glycol Salicylates Tricyclics Carbon monoxide Cyanide Carboxyhaemoglobin Carbon monoxide Smoke Chest radiograph— pulmonary oedema Opioids Salicylates Inhalation of toxins (ammonia, chlorine, oxides of nitrogen) Abdominal radiograph— radio-opacities Button batteries Iron Sustained-release potassium tablets

 Other conditions Disseminated intravascular coagulation See Chapters 22.7.2 and 22.7.5. Clinical features Disseminated intravascular coagulation (DIC) is a systemic disorder in which haemorrhage (main problem in 90% of cases) and thrombosis can occur at the same time. It involves the generation of intravascular fibrin and the consumption of procoagulants and platelets. May be acute or chronic (only acute discussed here) History Presence of DIC: (1) Bleeding • Skin—extensive superficial bruising; oozing from venepuncture/intramuscular injection sites, around indwelling catheters/tubes • Mucosa—mouth, nose, gastrointestinal tract, (lungs), (renal tract) • Internal—brain, other organs (2) Thrombosis: • Microthrombotic lesions • Skin—often on fingers/toes • Internal organs—dysfunction of kidneys, liver, lungs, brain Related to cause of DIC: (1) Sepsis—bacterial, viral, fungal, parasitic (malaria) (2) Major trauma—including burns, surgery (3) Toxins—e.g. venoms (see ‘Animal bites/stings’) (4) Obstetric—placental abruption, eclampsia, amniotic fluid embolism (5) Cancer—metastatic carcinoma of stomach, colon, pancreas, breast, lung; mucin-secreting adenocarcinomas; leukaemia (especially acute promyelocytic leukaemia) (6) Blood transfusion—incompatible, massive (7) Liver disease—acute hepatic failure (8) Others—heatstroke (see ‘Heat stroke’), prosthetic devices (e.g. shunts, ventricular assist devices) (9) Idiopathic—purpura fulminans Examination (1) Vital signs (2) Evidence of bleeding or thrombosis (3) Related to possible cause (see list earlier in this table) Immediate management If cardiorespiratory collapse—as described in ‘Cardiorespiratory collapse: the patient in extremis’ (1) Underlying cause—DIC will not improve unless the underlying cause is treated effectively. Give broad- spectrum antimicrobials to cover sepsis if diagnosis not clear (see ‘Septic shock’) (2) DIC—treatment is justified in patients with serious bleeding, high risk of bleeding (e.g. postoperative), or who require invasive procedures • Fresh frozen plasma—to keep prothrombin time and activated partial thromboplastin time below a value 1.5 times the upper limit of control values • Cryoprecipitate/fibrinogen concentrates—to keep fibrinogen levels >1 g/litre • Platelets—to keep platelets >50 × 109/litre • Blood (packed red blood cells)—to keep

haematocrit >0.30 Notes (1) Heparin—if the main clinical problem is thrombotic, e.g. migratory thrombophlebitis or acral ischaemia, then consider giving heparin. On theoretical ground this would only be expected to be effective if patient's antithrombin III level is near normal, hence: • If low antithrombin III—give antithrombin III in dose calculated according to manufacturer's instructions, aiming to maintain levels >80% of normal (unlicensed indication) • Heparin, 500 units/h by continuous IV infusion, titrated to achieve activated partial thromboplastin time (APTT) of about 45 seconds (2) Protein C concentrate—consider in protein C deficiency (congenital or acquired, e.g. meningococcal septicaemia) associated with purpura fulminans (3) Adrenal infarction (Waterhouse–Friederichson)— give steroid (e.g. hydrocortisone 50–100 mg 6-hrly IV) if circulatory compromise Key investigations To establish the diagnosis: There is no single diagnostic test for DIC: the condition should be suspected in any patient with: (1) Appropriate clinical context (2) Platelet count—decreased (3) Blood film—microangiopathic changes The diagnosis is confirmed by laboratory demonstration of increased thrombin generation and increased fibrinolysis: (1) Thrombin generation increased—fibrinogen decreased (2) Fibrinolysis increased—elevated fibrinogen/fibrin degradation products; elevated D-dimer (3) Prothrombin time— increased (4) APTT—increased (5) Other haematological features that may be present include—reduced antithrombin III level; increased thrombin time; increased soluble fibrin monomers Other important tests: Dependent on clinical context Further management Dependent on clinical context Sickle cell crises See Chapter 22.6.7. Clinical features History There are several clinical conditions: (1) Pain crisis—severe pain in limbs, hips, back, chest, or abdomen; the pain is genuine, excruciating, and varies in character and location (2) Chest/lung syndrome—breathlessness, pleuritic chest pain (3) Brain/neurological syndrome—epileptic fits, transient ischaemic attacks, strokes And less commonly in adults: (4) Aplastic crisis—presents with breathlessness and fatigue. Usually seen in children. Associated with parvovirus infection (5) Sequestration crisis—presents with profound anaemia. Usually seen in babies and young children when the spleen and/or liver enlarge rapidly due to trapping of red blood cells. Hepatic sequestration can occur in adults (6) Priapism Also: (7) Previous sickle cell crises (8) Precipitating factors—extremes of heat and cold, infections/fever (often upper respiratory tract, flu), heavy exercise, emotional stress, any situation producing hypoxia (9) Family history—patterns of crises may follow through generations Note Patients or their relatives/friends generally know that they have sickle cell disease and are often knowledgeable about the condition Examination (1) Airway, breathing, circulation (2) Glasgow Coma Scale (3) Vital signs—pulse rate, BP, respiratory rate, temperature

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