SEVENTH EDITION

SCULLY'S MEDICAL PROBLEMS IN DENTISTRY

CRISPIAN SCULLY



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Seventh Edition

Scully's Medical Problems in Dentistry

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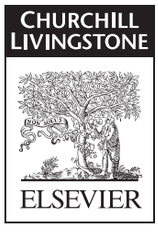
Seventh Edition

Scully's Medical Problems in Dentistry

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Preface

The aim of this book is to provide a basis for the understanding of how medical and surgical conditions influence oral health and oral health care, and to help dental health workers (DHWs) keep their patients informed of health risks and respect their choices.

Learning outcomes are for DHWs to be aware of systemic disorders and treatments that may cause complications in dental and oral health care. The reader should thus be able to understand relevant illness identified from the history, physical examination and investigations; be able to present a succinct and, where appropriate, unified list of all problems that could influence oral health care; and formulate a diagnosis/treatment plan for each problem (appropriate to the level of training). The reader should understand that the management of patients with diseases should take into consideration the severity of the condition; the type of operative procedure envisioned and, in particular, the amount of trauma, likely distress and time taken; other risk factors; and the health-care setting (skills/facilities) available. They should appreciate issues of access and informed consent, and the desirability of preventive oral health care and avoidance of harm. The reader should also be able to communicate appropriately and work with other health-care providers; to retrieve medical information using the recommended further reading sections and the Internet, in a manner that reflects an understanding of medical language, terminology, and the relationship between medical terms and concepts; to refine search strategies to improve the relevance and completeness of retrieved items; and to identify and acquire full-text electronic documents available from the Internet sites quoted.

Though dentistry remains largely a technical subject, there are a number of reasons why the education and training of dental professionals should have this basis. Dentistry is a profession and not a trade; medical problems can influence oral health and health care, whilst oral health and health care can influence general health and health care. DHWs need to understand patients and their attitudes to health care; they need to communicate at a reasonable level with other health professionals, with patients and sometimes with the media; they may need to act as advocates for patients; and, finally, they can find themselves in need of health care. It is incumbent upon DHWs to treat their patients in an appropriate way, taking into account both their dental needs and any special considerations related to their medical and drug history. To prevent any implication of negligence, a professional must administer appropriate care, and the patient should agree to it and receive adequate information about it. In general terms, DHWs need to develop strategies to identify patients at risk of medical problems, to assess the severity of those risks and, where necessary, to recognize the need for help and be able to seek advice from a colleague with special competence in the relevant fields.

Since the first edition of this book to this 7th edition, the importance of medicine in dentistry, interactions between medicine and dentistry, and the need for medical knowledge on the part of all members of the dental team have all increased radically – as has the whole of medicine. Increasing evidence supports, but does not prove, an association between oral infection and various systemic diseases. Thus there is interest in the possible associations of oral infection (periodontitis) with conditions such as atherosclerosis, Alzheimer disease, cancers (mouth, pancreas, renal), diabetes, erectile dysfunction, low-birth-weight babies, lung disease and rheumatoid arthritis, although space precludes all but a passing mention. Health-care needs are changing globally as people live longer and medical interventions advance. The populations in many countries are often surviving and ageing with the help of complex treatments. For example, in the UK the proportion of people aged over 65 is predicted to increase from 16% in 2006 to 22% in 2031. Advances in surgical and medical interventions and therapeutics are astounding, raising issues in relation to the understanding of these interventions and therapies, advantages and disadvantages, and the importance of informed consent. The US Federal Drug Administration recognizes this and may now approve new drugs with a Risk Evaluation and Mitigation Strategy (REMS), which consists of a Medication Guide advising patients of important safety information and a communication plan to inform health-care providers about the serious risks associated with their use. Advances in genetics have been equally impressive. During the life of this book, the human genome has been completely catalogued – revealing some 23 000 protein-coding genes. However, these genes were seen to occupy only 1.5% of the genome and, by 2012, the regulatory importance of the remaining DNA became evident. The genetic basis for many disorders has been or is being elucidated, and gene therapy is becoming a reality.

The knowledge base of medicine has thus been extended and effective new technologies, techniques and drugs have been developed, many of which have resulted in complications relevant to oral health care. Many patients who would, in earlier times, have succumbed are alive and live to much greater ages, thanks to advances in drugs, pacemakers and other cardiac devices, radiotherapy, public health and transplants – and they need good oral health and may well need oral health care. A wider range of medical problems has thus become relevant to oral health-care sciences. The world has changed further and the relevance of the book has grown even more, with a greater number of persons who require special care, and with increasing travel, not least by DHWs and trainees to developing countries. This text has become one of the most widely used sources of information for all DHWs who need to contend with the increasing variety of medical problems, particularly as they are aware that they face a growing risk of litigation if they do not keep themselves familiar with current knowledge, in line with the increasing acceptance of the need for continuing professional education and development. Sadly the evidence base in this area is not always strong and clinicians may need to resort to an heuristic approach. Nevertheless they should halt before making decisions when Hungry, Angry, Late or Tired!

In addition to the comments in previous prefaces, I thank Dr Andrew Narendran Robinson sincerely for his help with suggestions and literature searching, and Drs Paes de Almeida, Bagan, Carrozzo, Diz Dios, Malamos and Mosqueda for help with some new illustrations.

This edition has attempted to provide information about the most common diseases, though these, of course, vary depending on the area of the world concerned. The main killing conditions worldwide – trauma, cardiovascular disease, infectious and parasitic diseases, malignant disease, cerebrovascular disease, respiratory infections, AIDS and chronic obstructive pulmonary disease – receive considerable attention. There is detail on the other most common afflictions

in resource-rich countries, such as: anaemia, the common cold, diabetes, diarrhoea, hepatitis, lung cancer, sexually shared infections and streptococcal sore throat (http://www.livestrong.com/article/161780-10-most-common-health-diseases/#ixzz25tfVtfQu; accessed 12 June 2013). Less common or rare disorders do not receive so much attention.

Although previous editions have been extremely well received, the new edition has nevertheless been updated throughout and includes several added areas – such as a number of new medications, and comment about anticonvulsant hypersensitivity syndrome, anti-synthetase syndrome, antithrombotic therapy, biological therapies, Brugada syndrome, cosmetic and other implants, darkroom syndrome, dental materials hypersensitivity (chlorhexidine, nickel, titanium), drugs and dietary interactions, E numbers, elder maltreatment, food poisoning, hypnotherapy, implanted cardiac devices, imported infections, long QT syndrome (LQTS), mass gathering medicine, medication-overuse headache, *Mycobacterium abscessus* infections, neuropathic pain, new antiretrovirals, new aspects of alternative medicine, new autoinflammatory disorders (deficiency of the interleukin-1 receptor antagonist [DIRA]; and interleukin-36–receptor antagonist deficiency), new hospital-associated infections, new oral anticoagulants, new substance abuse, *N*-methyl-D-aspartate (NMDA) antagonists such as ketamine, parenteral nutrition, propofol infusion syndrome (PRIS), radiocontrast media, recreational water illnesses, relapsing polychondritis, self-harm, sexual minorities, titanium allergy, transfusion-related immunomodulation (TRIM), vagal nerve stimulation therapy, variably protease-sensitive prionopathy (VPSPr),various newly recognised immunodeficiencies, ventilator-associated pneumonia and vulnerable people. Space precludes more than brief discussion of the association between periodontal infection and various systemic diseases, and there is no examination of forensic issues.

Many data are available nowadays on the Internet, and the explosion in numbers of guidelines means that it is nigh on impossible to summarize all of these in a book, especially avoiding ambiguities and plagiarism at the same time. Increasingly, evidence-based medicine challenges current practice – including that in vital areas such as cardiopulmonary resuscitation. Practitioners should be aware of, and use, the best evidence-based medicine, current teaching and guidance from a responsible body of opinion, which also necessitates access to updated material such as that on the Internet: for example, http://pathways.nice.org.uk/ or http://www.sign.ac.uk/guidelines/published/index.html (accessed 12 June 2013). There is a growing desire in the health-care community for specific practice guidelines but, with advances in the field, guidelines can sometimes restrict diagnostic or therapeutic options; clinician and patient education and discussions are the key, with decisions individualized. Good communication between all health-care professionals (HCPs), and between HCPs and patients, is essential and this is true for DHWs. If contrary advice is received from another HCP, a discussion around the differing opinions is advised with this practitioner. It is important for the patient not to be compromised in any way. The discussion should be supported by evidence-based written information tailored to the person's needs. Treatment and care, and the information people are given about them, should be culturally appropriate and should take into account people's needs and preferences. It should also be accessible to those with additional needs such as physical, sensory or learning disabilities, and to people who do not speak or read English. Patients should have the opportunity to make informed decisions about their care and treatment, in partnership with their HCPs. If the person agrees, families and carers should be given the option of being involved in decisions about treatment and care. If people do not have the capacity to make decisions, HCPs should follow the UK Department of Health's advice on consent and the code of practice that accompanies the Mental Capacity Act in the UK.

The content of the book is for information and educational purposes only; in no way should it be considered as a substitute for medical consultation with a qualified professional. A physician should always be consulted for any health problem or medical condition. Clinicians are advised always to check the latest guidelines from bodies such as the National Institute for Health and Care Excellence (NICE), the Royal Colleges of Surgeons, the Royal Colleges of Physicians, the British Dental Association (BDA), the General Dental Council (GDC), the Resuscitation Council and the various specialist medical and dental societies or associations (e.g. http://www.sdcep.org.uk/). The spectre of litigation increasingly influences decisions and, although in some instances guidelines may not have led to clarity, clinicians may find their decisions difficult to defend if they fail to record a very good reason for not adhering to the guidelines. Readers should always check the most recent guidelines, drug doses, and potential reactions and interactions before use, discuss management issues with the patient, and never proceed with any intervention without the clear formal informed consent of the patient and consultation with their health-care advisers.

The comments and recommendations herein should be used as guidelines to care, not commandments. Unfortunately, there are very few randomized controlled trials available to provide evidence for the various practices, and so many of the recommendations have to be based on consensus. Any comments or criticisms from readers will, of course, be gratefully received, though I hope that the further significant improvements in this edition, together with the dearth of criticism of previous editions, means that I have fulfilled the aims as best I can. As my now-deceased co-author Professor Rod Cawson said in the preface to one of his other books: 'Some people will criticize this for being too brief, some for being too long but, sad as it may be, this is the best I can do.'

Crispian Scully
London
2014

A

General

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Medical emergencies 1

KEY POINTS

- Be prepared
- Ensure access to appropriate drugs and equipment
- Ensure training
- Know who to call
- Take a medical history

This chapter is focused on the main diagnostic and management issues in emergency management; fuller discussion of these conditions may be found in the relevant chapters and the controversies in this area are discussed in the references. The expanded knowledge base of medicine, and effective new technologies, techniques and drugs have allowed patients, who in earlier times would have succumbed, to remain alive and live to much greater ages; such patients in particular may be prone to medical emergencies. Collapse and other emergencies are a cause of concern for all involved (Box 1.1).

In general terms, health-care professionals (HCPs) should develop strategies to identify patients at risk of emergencies, assess the severity of those risks and, where necessary, recognize the need for help and be able to seek advice from a colleague with special competence in the relevant fields. All need to contend with the increasing variety of medical problems, particularly as they are aware that they face a growing risk of litigation if they do not keep themselves familiar with current knowledge, in line with the increasing acceptance of the need for continuing professional development (CPD).

There are few randomized controlled trials (RCTs) available to provide evidence for the various practices, and so many of the recommendations have to be based on consensus. The comments and recommendations herein should be used as guidelines to care, not commandments.

Annual theoretical and practical training of all clinical staff is required. Clinical staff have an obligation to be conversant with the current Resuscitation Council (UK) guidelines (2012) (see Further reading). The UK General Dental Council (GDC), in *Standards for the dental team* (2013), states that all dental professionals are responsible for putting patients' interests first and for acting to protect them. Central to this responsibility is the need to ensure that HCPs are able to deal with medical emergencies that may arise. All members of the dental team need to know their roles in the event of an emergency.

The GDC guidance, *Principles of dental team working* (2005), states that dental staff who employ, manage or lead a team should make sure that:

- there are arrangements for at least two people to be available to deal with medical emergencies when treatment is planned to take place
- all members of staff, not just the registered team members, know their role if a patient collapses or there is another kind of medical emergency
- all members of staff who might be involved in dealing with a medical emergency are trained and prepared to deal with such an emergency at any time, and regularly practise simulated emergencies together.

The GDC has stipulated that 10 hours of training and retraining in emergency management is a mandatory requirement of CPD in every 5-year period.

Emergencies are rare. A medical emergency occurring in dental practice is most likely to be the result of an acute deterioration of a known medical condition. It may pose an immediate threat to an individual's life and needs rapid intervention. It is best prevented! The most common medical emergency is the simple faint. Other common emergencies include fitting in an epileptic patient, angina pectoris (ischaemic chest pain), hypoglycaemia in a diabetic patient and haemorrhage. Myocardial infarction and cardiopulmonary arrest are more immediately dangerous (Box 1.2).

PREVENTING EMERGENCIES

Emergency management algorithms are of paramount importance and dental employers are ultimately responsible for the performance of their staff as regards delivery.

Confidence and satisfactory management of emergencies can be improved by the following measures:

- Repeatedly assessing the patient whilst undertaking treatment, noting any changes in appearance or behaviour.
- Never practising dentistry without another competent adult in the room.
- Always having accessible the telephone numbers of the emergency services and nearest hospital accident and emergency

Box 1.1 *Common emergencies*

- Collapse
- Fitting
- Chest pain
- Shortness of breath
- Mental disturbances
- Reactions to drugs or sedation
- Bleeding

Box 1.2 *Likely causes of sudden loss of consciousness and collapse*

- Simple faint
- Diabetic collapse secondary to hypoglycaemia
- Epileptic seizure
- Anaphylaxis
- Cardiac arrest
- Stroke
- Adrenal crisis

Table 1.1 *Suggested minimal equipment for emergency use in dentistry*[a]

Equipment	General comments	Detail
Oxygen (O_2) delivery	Portable apparatus for administering oxygen	Two portable oxygen cylinders ('D' size) with pressure reduction valves and flow meters. Cylinders should be of sufficient size to be easily portable but also to allow for adequate flow rates (e.g. 10 L/min), until the arrival of an ambulance or full recovery of the patient. A full 'D' size cylinder contains 340 L of oxygen and should allow a flow rate of 10 L/min for up to 30 min. Two such cylinders may be necessary to ensure the oxygen supply does not fail
	Oxygen face mask (non-rebreathe type) with tube	
	Basic set of oropharyngeal airways (sizes 1, 2, 3 and 4)	
	Pocket mask with oxygen port	
	Self-inflating bag valve mask (BVM; 1-L size bag), where staff have been appropriately trained	
	Variety of well-fitting adult and child face masks for attaching to self-inflating bag	
Portable suction	Portable suction with appropriate suction catheters and tubing (e.g. Yankauer sucker)	
Spacer device for inhalation of bronchodilators		
Automated external defibrillator (AED)	All clinical areas should have immediate access to an AED (collapse-to-shock time <3 min)	
Automated blood glucose measuring device		
Equipment for administering drugs intramuscularly	Single-use sterile syringes (2-mL and 10-mL sizes) and needles (19 and 21 sizes)	Drugs as in Table 1.2

[a]After Resuscitation Council (2012).

department. Details of the patient's general medical practitioner should be recorded in the notes.

- Training staff in emergency service contact protocols and emergency procedures. This should be repeated annually. All clinics should have a defined protocol for how the emergency services are to be alerted. The protocol should include clear directions to enable the emergency services to locate and access the clinic. In a large building, a member of the team should meet the emergency services at the main entrance.
- Having a readily accessible emergency drugs box and equipment that is checked on a weekly basis (Tables 1.1 and 1.2; Figs 1.1–1.3).
- Taking a careful medical history, assessing disease severity, scheduling and planning treatment carefully, and, in some cases, administering medication prior to treatment.
- Using the simple intervention of laying the patient supine prior to giving local analgesia/anaesthesia (LA). This will prevent virtually all simple faints.
- Ensuring that diabetic patients have had their normal meals, medication has been appropriately administered, and treatment is given early in the morning session or immediately after lunch. These measures are likely to prevent most hypoglycaemic collapses.

All this is even more important when conscious sedation (CS) is used, when invasive or painful procedures are planned, or when medically complex individuals are being treated. 'Forewarned is forearmed,' and dental professionals must ensure that medical and drug histories are updated at each visit prior to initiating treatment. It is suggested that disease severity should be assessed using a risk stratification system – for example, the American Society of Anesthesiologists (ASA) classification (Chs 2 and 3) – as this may help identify high-risk individuals.

Few emergencies can be treated definitively in the dental clinic. The role of the dental team is one of support and considered intervention using algorithms that can 'do no harm'. Previously, it has been suggested that 20 or more drugs should be available to the dental professional for the management of emergencies but this is impractical, may be a source of confusion and, if a drug is incorrectly administered, may be life-threatening.

Table 1.2 *Suggested minimal drugs for emergency use in dentistry*[a]

Emergency	Drugs required	Dosages for adults
Anaphylaxis	Adrenaline (epinephrine) injection 1:1000, 1 mg/mL	Intramuscular adrenaline (0.5 mL of 1 in 1000 solution)
		Repeat at 5 min if needed
Hypoglycaemia	Oral glucose solution/ tablets/gel/powder (e.g. GlucoGel®, formerly known as Hypostop® gel [40% dextrose])	Proprietary non-diet drink or 5 g glucose powder in water
	Glucagon injection 1 mg (e.g. GlucaGen HypoKit)	Intramuscular glucagon 1 mg
Acute exacerbation of asthma	(β_2 agonist)	Salbutamol aerosol
	Salbutamol aerosol inhaler 100 mcg/ activation	Activations directly or up to six into a spacer
Status epilepticus	Buccal or intranasal midazolam 10 mg/mL	Midazolam 10 mg
Angina	Glyceryl trinitrate[b] spray 400 mcg/metered activation	Glyceryl trinitrate, two sprays
Myocardial infarct	Dispersible aspirin 300 mg	Dispersible aspirin 300 mg (chewed)

[a]After Resuscitation Council (2012). No corticosteroid is included.
[b]Do not use nitrates to relieve an angina attack if the patient has recently taken sildenafil, as there may be a precipitous fall in blood pressure; analgesics should be used. Where possible, all emergency equipment should be single-use and latex-free. The kit does not include any intravenous injections.

The Resuscitation Council recommendations for equipment and drugs are detailed in Tables 1.1 and 1.2. Other agents (e.g. the midazolam antagonist flumazenil) and equipment (e.g. a pulse oximeter) are needed if CS is administered.

General anaesthesia (GA) must be undertaken only by anaesthetists and where advanced life support (ALS) is available.



Fig. 1.1 Emergency kit.



Fig. 1.2 Automatic defibrillator.



Fig. 1.3 Automatic external defibrillator (AED).

RESUSCITATION AND EMERGENCIES

The GDC does not have any guidelines on resuscitation but would refer registrants to the Resuscitation Council, which does have relevant guidance. Full details are available at http://www.gdc-uk.org/Dentalprofessionals/Standards/Pages/home.aspx (accessed 30 September 2013).

The GDC's *Principles of dental team working* (2005) covers medical emergencies.

MANAGING EMERGENCIES

For all medical emergencies, a structured approach to assessment and reassessment prevents any symptoms and signs being missed and any incorrect diagnoses being made. The sequence is best remembered as 'ABCDE' (Box 1.3). 'Drs ABC' highlights the sequence:

- *d*anger (recognizing an emergency)
- *r*espiration (establishing an airway)
- *s*hout for help.
- ***A***; airway
- ***B***; breathing
- ***C***; circulation

People who collapse should be put in the 'recovery position' to maintain a clear airway UNLESS there could be a neck injury, such as after a fall or road traffic accident.

Box 1.3 *Assessment in emergencies*

Airway	Identify foreign body obstruction and stridor
Breathing	Document respiratory rate, use of accessory muscles, presence of wheeze or cyanosis
Circulation	Assess skin colour and temperature, estimate capillary refill time (normally, 2 s with hand above heart), assess rate of pulse (normal is 70 beats/min)
Disability	Assess conscious level using acronym AVPU: • *A*lert • responds to *V*oice • responds to *P*ainful stimulus • *U*nresponsive • Blood glucose
Exposure	Respecting the patient's dignity, try to elicit the cause of acute deterioration (e.g. rash, signs of recreational drug use)

CARDIOPULMONARY RESUSCITATION

Dental staff should be trained in basic cardiopulmonary resuscitation (CPR) so that, in the event of cardiac arrest, they should be able to:

- recognize cardiac arrest (the heart stops beating)
- summon immediate help (dial for the emergency services)
- initiate CPR according to current resuscitation guidelines (evidence suggests that chest compressions can be effectively performed in a dental chair)
- ventilate with high-concentration oxygen via a bag and mask
- apply an automated external defibrillator (AED) as soon as possible after collapse. Follow the machine prompts and administer a shock if indicated, with a maximum collapse-to-shock time of 3 minutes.

Hands-only CPR

- Call the emergency services
- Push hard and fast in the centre of the chest to double a person's chances of survival (the song 'Stayin' Alive' has the right beat for hands-only CPR)
- The method of delivering chest compressions remains the same, as does the rate (at least 100 per minute).

EMERGENCY PROCEDURE

- Call for local assistance
- Assess the patient – ABCDE (as Box 1.3) – and give oxygen if appropriate
- Use the acronym MOVE:
  *M*onitor – reassess ABCDE regularly, attach an AED if appropriate
  *O*xygen – 15 L/min through a non-rebreathe mask
  *V*erify – check that emergency services are coming
  *E*mergency action – correct positioning and drug administration.

Intramuscular (i.m.) injection is used nowadays for giving most emergency drugs. The most accessible site in a clothed patient sitting in a dental chair is the lateral aspect of the thigh. There the vastus lateralis is a large muscle with no large nerves or arteries running through it. In an emergency, the injection can be administered through clothing. The mid-point between the pelvis and the knee is the preferred site.

The Advanced Medical Priority Dispatch System (AMPDS) is a unified system that sends appropriate aid to medical emergencies, including systematized caller interrogation and pre-arrival instructions. AMPDS works on the following response categories:

- A (immediately life-threatening)
- B (urgent call)
- C (routine call).

This may well be linked to a performance targeting system where calls must be responded to within a given time period. For example, in the UK, calls rated as 'A' on AMPDS aim to have a responder on scene within 8 minutes.

The 'ABCDE' approach to the sick patient

The 'ABCDE' approach to the sick patient is outlined at http://www.resus.org.uk/pages/MEdental.pdf by the UK Resuscitation Council (2006, updated 2012; accessed 30 September 2013). Appendix (i), which cannot be bettered, and states:

Dental Practitioners, Dental Care Professionals and their staff should be familiar with standard resuscitation procedures as recommended by the Resuscitation Council (UK). In all circumstances it is advisable to call for medical assistance as soon as possible by dialling 999 and summoning an ambulance.

Early recognition of the 'sick' patient is to be encouraged. Pre-empting any medical emergency by recognising an abnormal breathing pattern, an abnormal patient colour or abnormal pulse rate, allows appropriate help to be summoned, e.g. ambulance, prior to any patient collapse occurring. A systematic approach to recognising the acutely ill patient based on the 'ABCDE' principles is recommended. Accurate documentation of the patient's medical history should further allow those 'at risk' of certain medical emergencies to be identified in advance of any proposed treatment. The elective nature of most dental practice allows time for discussion of medical problems with the patient's general medical practitioner where necessary. In certain circumstances this may lead to a postponement of the treatment indicated or a recommendation that such treatment be undertaken in hospital.

General principles

1. *Follow the Airway, Breathing, Circulation, Disability, and Exposure approach (ABCDE) to assess and treat the patient.*
2. *Treat life-threatening problems as they are identified before moving to the next part of the assessment.*
3. *Continually reassess, starting with Airway, if there is further deterioration.*
4. *Assess the effects of any treatment given.*
5. *Recognise when you need extra help and call for help early. This may mean dialling 999 for an ambulance.*
6. *Use all members of your dental team. This will allow you to do several things at once, e.g. collect emergency drugs and equipment, dial 999.*
7. *Organise your team and communicate effectively.*
8. *The aims of initial treatment are to keep the patient alive, achieve some clinical improvement and buy time for further treatment whilst waiting for help.*
9. *Remember – it can take a few minutes for treatment to work.*
10. *The ABCDE approach can be used irrespective of your training and experience in clinical assessment or treatment. Individual experience and training will determine which treatments you can give. Often only simple measures such as laying the patient down or giving oxygen are needed.*

First steps

- *In an emergency, stay calm. Ensure that you and your staff are safe.*
- *Look at the patient generally to see if they 'look unwell'.*
- *In an awake patient ask, 'How are you?' If the patient is unresponsive, shake him and ask, 'Are you all right?' If they respond normally, they have a clear airway, are breathing and have brain perfusion. If they speak only in short sentences, they may have breathing problems. Failure of the patient to respond suggests that they are unwell. If they are not breathing and have no pulse or signs of life, start CPR according to current resuscitation guidelines.*

Airway (A)

Airway obstruction is an emergency.

1. *Look for the signs of airway obstruction:*
   - *Airway obstruction causes 'paradoxical' chest and abdominal movements ('see-saw' respirations) and the use of the accessory muscles of respiration, e.g. neck muscles. Central cyanosis (blue lips and tongue) is a late sign of airway obstruction. In complete airway obstruction, there are no breath sounds at the mouth or nose.*
   - *In partial airway obstruction, air entry is diminished and usually noisy:*
     Inspiratory 'stridor' is caused by obstruction at the laryngeal level or above.
     Expiratory 'wheeze' suggests obstruction of the lower airways, which tend to collapse and obstruct during expiration. This is most commonly seen in patients with asthma or chronic obstructive pulmonary disease.
     Gurgling suggests there is liquid or semi-solid foreign material in the upper airway.
     Snoring arises when the pharynx is partially occluded by the tongue or palate.
2. *Airway obstruction is an emergency:*
   - *In most cases, only simple methods of airway clearance are needed:*
     Airway opening manœuvres – head tilt/chin lift or jaw thrust.
     Remove visible foreign bodies, debris or blood from the airway (use suction or forceps as necessary).
     Consider simple airway adjuncts, e.g. oropharyngeal airway.
3. *Give oxygen initially at a high inspired concentration:*
   - *Use a mask with an oxygen reservoir. Ensure that the oxygen flow is sufficient (15 litres per minute) to prevent collapse of the reservoir during inspiration.*
   - *If you have a pulse oximeter, titrate the oxygen delivery aiming for normal oxygen saturation levels (94–98%).*

In very sick patients this may not be possible and a lower oxygen saturation (more than 90%) is acceptable for a short period of time.

Breathing (B)

During the immediate assessment of breathing, it is vital to diagnose and treat immediately life-threatening breathing problems, e.g. acute severe asthma.

1. *Look, listen and feel for the general signs of respiratory distress: sweating, central cyanosis (blue lips and tongue), use of the accessory muscles of respiration (muscles of the neck) and abdominal breathing.*
2. *Count the respiratory rate. The normal adult rate is 12 to 20 breaths per minute and a child's rate is between 20 and 30 breaths per minute. A high, or increasing, respiratory rate is a marker of illness and a warning that the patient may deteriorate and further medical help is needed.*
3. *Assess the depth of each breath, the pattern (rhythm) of respiration and whether chest expansion is equal and normal on both sides.*
4. *Listen to the patient's breath sounds a short distance from their face. Gurgling airway noises indicate airway secretions, usually because the patient cannot cough or take a deep breath. Stridor or wheeze suggests partial, but important, airway obstruction.*
5. *If the patient's depth or rate of breathing is inadequate, or you cannot detect any breathing, use bag and mask (if trained) or pocket mask ventilation with supplemental oxygen while calling urgently for an ambulance.*
6. *Hyperventilation and panic attacks are relatively common in general dental practice. In most patients these will resolve with simple reassurance.*

Circulation (C)

Simple faints or vasovagal episodes are the most likely cause of circulation problems in general dental practice. These will usually respond to laying the patient flat and, if necessary, raising the legs (see Appendix (ii) Syncope). The systematic ABCDE approach to all patients will ensure that other causes are not missed.

1. *Look at the colour of the hands and fingers: are they blue, pink, pale or mottled?*
2. *Assess the limb temperature by feeling the patient's hands: are they cool or warm?*
3. *Measure the capillary refill time. Apply cutaneous pressure for five seconds on a fingertip held at heart level (or just above) with enough pressure to cause blanching. Time how long it takes for the skin to return to the colour of the surrounding skin after releasing the pressure. The normal refill time is less than two seconds. A prolonged time suggests poor peripheral perfusion. Other factors (e.g. cold surroundings, old age) can also prolong the capillary refill time.*
4. *Count the patient's pulse rate. It may be easier to feel a central pulse (i.e. carotid pulse) than the radial pulse.*
5. *Weak pulses in a patient with a decreased conscious level and slow capillary refill time suggest a low blood pressure. Laying the patient down and raising the legs may be helpful. In patients who do not respond to simple measures urgent help is needed and an ambulance should be summoned.*
6. *Cardiac chest pain typically presents as a heaviness, tightness or indigestion-like discomfort in the chest. The pain or discomfort often radiates into the neck or throat, into one or both arms (more commonly the left) and into the back or stomach area. Some patients experience the discomfort in one of these areas more than in the chest. Sometimes pain may be accompanied by belching, which can be misinterpreted as evidence of indigestion as the cause. The patient may have known stable angina and carry their own glyceryl trinitrate (GTN) spray or tablets. If they take these, the episode may resolve. If the patient has sustained chest pain, give GTN spray if the patient has not already taken some. The patient may feel better and should be encouraged to sit upright if possible. Give a single dose of aspirin and consider the use of oxygen.*

(See Appendix (ii) Cardiac Emergencies.)

Disability (D)

Common causes of unconsciousness include profound hypoxia, hypercapnia (raised carbon dioxide levels), cerebral hypoperfusion (low blood pressure), or the recent administration of sedatives or analgesic drugs.

1. *Review and treat the ABCs: exclude hypoxia and low blood pressure.*
2. *Check the patient's drug record for reversible drug-induced causes of depressed consciousness.*
3. *Examine the pupils (size, equality and reaction to light).*
4. *Make a rapid initial assessment of the patient's conscious level using the AVPU method:* Alert, *responds to* Vocal *stimuli, responds to* Painful *stimuli or* Unresponsive *to all stimuli.*
5. *Measure the blood glucose to exclude hypoglycaemia, using a glucose meter. If below 3.0 mmol per litre give the patient a glucose containing drink to raise the blood sugar (e.g.* Glucogel*;* Dextrogel*;* GSF-syrup *or* Rapilose *gel: see Appendix (ii)* Hypoglycaemia*) or glucose by other means.*
6. *Nurse unconscious patients in the recovery position if their airway is not protected.*

Exposure (E)

To assess and treat the patient properly loosening or removal of some of the patient's clothes may be necessary. Respect the patient's dignity and minimize heat loss. This will allow you to see any rashes (e.g. anaphylaxis) or perform procedures (e.g. defibrillation).

COMMON EMERGENCIES

See also Appendix 1.1 for the Resuscitation Council guidelines (2012) on dealing with common emergencies.

COLLAPSE (TABLE 1.3)

The cause of sudden loss of consciousness may be suggested by the medical history:

- Collapse at the sight of a needle or during an injection is likely to be a simple faint.
- Following some minutes after an injection of penicillin, collapse is more likely to be due to anaphylaxis.

Table 1.3 *Common emergencies*

		Actions; reassure patient and accompanying people, and			
Emergency	**Recognition**	**1. Call for assistance**	**2. Give oxygen 15 L/min**	**3. Other main actions**	**4. Alert emergency services**
Anaphylaxis	Acute Collapse Rash Angioedema Wheezing	Yes	Yes	Adrenaline (epinephrine) 500 mcg for adult i.m. (0.5 mL of 1 in 1000 adrenaline) Legs-up position	Yes
Angina	Severe chest pain, responding to glyceryl trinitrate	Yes	Yes	Glyceryl trinitrate 2 puffs sublingually	Only if no spontaneous recovery after action (3)
Asthma exacerbation	Breathless Wheeze Speechlessness Possible cyanosis	Yes	Yes	Sit patient up and forwards, salbutamol 2 × 100 mcg puffs for adult inhaled via spacer	If no spontaneous recovery after action (3)
Cardiac arrest	Severe chest pain, not responding to glyceryl trinitrate Collapse Pallor Breathlessness Sweating	Yes	Yes	Glyceryl trinitrate 2 puffs and aspirin 300 mg sublingually CPR	Yes
Choking	Inhaled foreign material Coughing Choking	Yes	Yes	Back slap five times, then abdominal thrust five times	Only if no spontaneous recovery after action (3)
Epileptic fit	Collapse Seizures Maybe incontinence	Yes	Yes	Protect patient from harm Consider midazolam 10 mg for adult in buccal mucosa (or i.m. or sublingually)	Only if no spontaneous or other recovery after 5 min, persistent altered conscious state or the fit characteristics are different to those previously described
Faint	Collapse, responding to laying flat Pallor Slow pulse Sweating No chest pain	Yes	No*	Lay patient flat Give glucose orally	Only if no spontaneous recovery after action (3)
Hypoglycaemia	Confusion or aggression, often known diabetes Shake or tremor Collapse	Yes	Yes	Blood glucose assay Give glucose drink, gel or tablets If unconscious, glucagon 1 mg for adult i.m.	Only if no spontaneous recovery after action (3)
Stroke	Face weakness Arm weakness Speech difficulties (Test all above)	Yes	Yes	–	Yes

*Not essential but oxygen may do no harm.

- Collapse of a diabetic at lunchtime, for example, is likely to be caused by hypoglycaemia.
- Collapse of a patient with angina or previous myocardial infarction may be caused by a new or further myocardial infarction.

The clinical features of the episode may also aid diagnosis; for example, severe chest pain suggests a cardiac cause. A structured and systematic assessment, regardless of perceived causative factors, is required to mitigate management errors.

For collapse of uncertain cause, see Table 1.3 and Figure 1.4.

The principles of the *chain of survival*, which applies to emergencies where the patient is not breathing and has no pulse, involve four stages:

- Early recognition and call for help
- Early CPR
- Early defibrillation
- Early ALS.

SIMPLE FAINT

Fainting (syncope) is the most common cause of sudden loss of consciousness. It is associated with a loss of postural tone, and there is spontaneous recovery. Up to 2% of patients may faint before or during dental treatment. Young, fit, adult males in particular are prone to faint, especially before, during and after injections.

Vasovagal (vasodepressor) attack (or pressure on the vagus) is the usual cause of a simple faint. The diagnosis rests on the history, upright posture, an emotional or painful stimulus, gradual not sudden

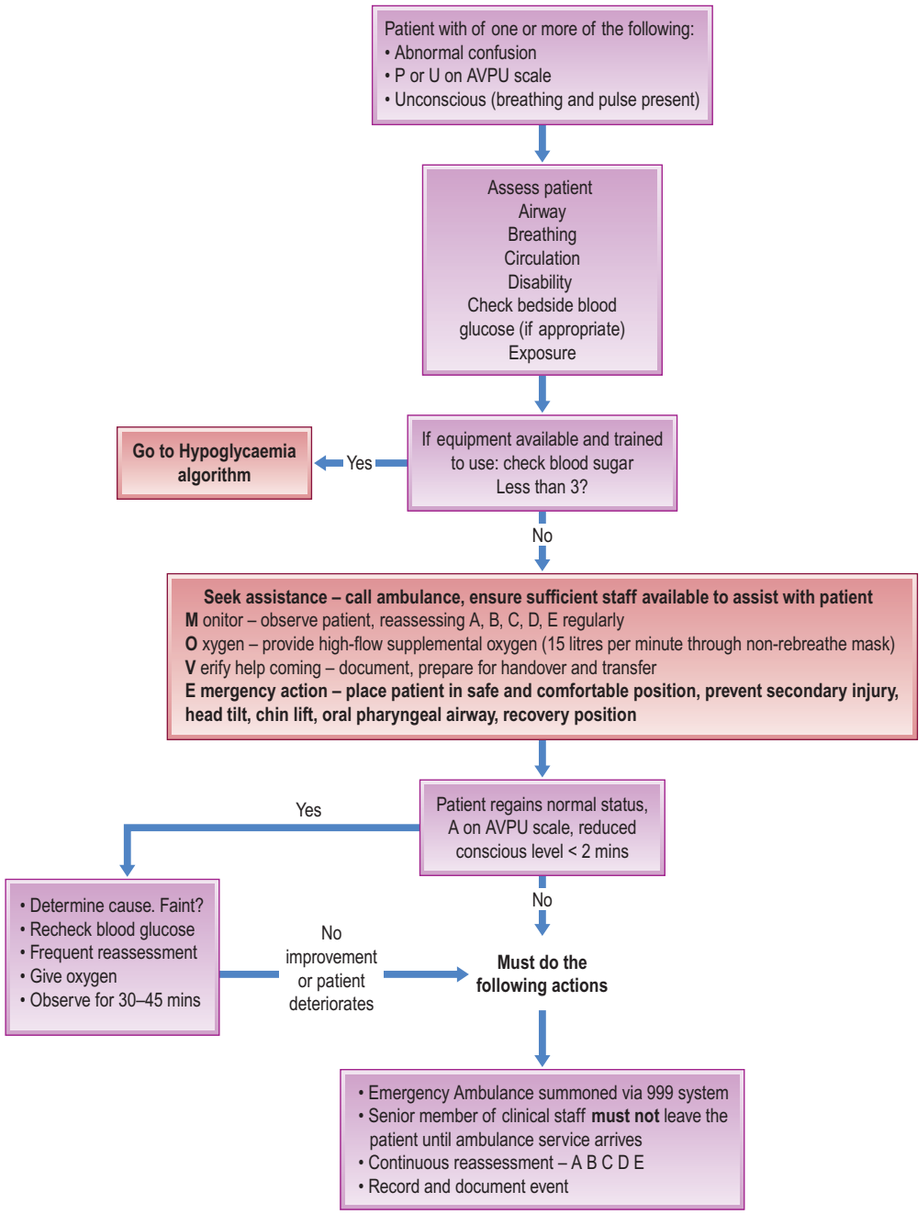


Fig. 1.4 Reduced consciousness algorithm.

fading of consciousness, sweating, nausea, pallor, other manifestations of autonomic activity, and rapid recovery on lying down. Simple faints tend to occur, and recur, in young people.

Other causes of sudden loss of consciousness include:

- situational syncope provoked by coughing, micturition (urination) or postural change
- sudden cardiac syncope due to arrhythmia or circulatory obstruction – typically in older people
- orthostatic hypotension
- neurological disorders.

These should be considered in the differential diagnosis.

Predisposing factors for vasovagal attack include:

- anxiety
- pain
- fatigue
- fasting (rarely)
- high temperature and relative humidity.

Signs and symptoms of a simple faint include:

- premonitory dizziness, weakness or nausea
- pallor
- cold, clammy skin
- dilated pupils
- pulse that is initially slow and weak, then rapid and full
- loss of consciousness.

The simple precaution of laying patients flat *before* giving injections will prevent fainting. Very rarely, patients can suffer *malignant vasovagal syncope* with recurrent, severe and otherwise unexplained syncope; their clinical history is intermediate between that of vasovagal and cardiac syncope, and diagnosis is confirmed by a tilt test.

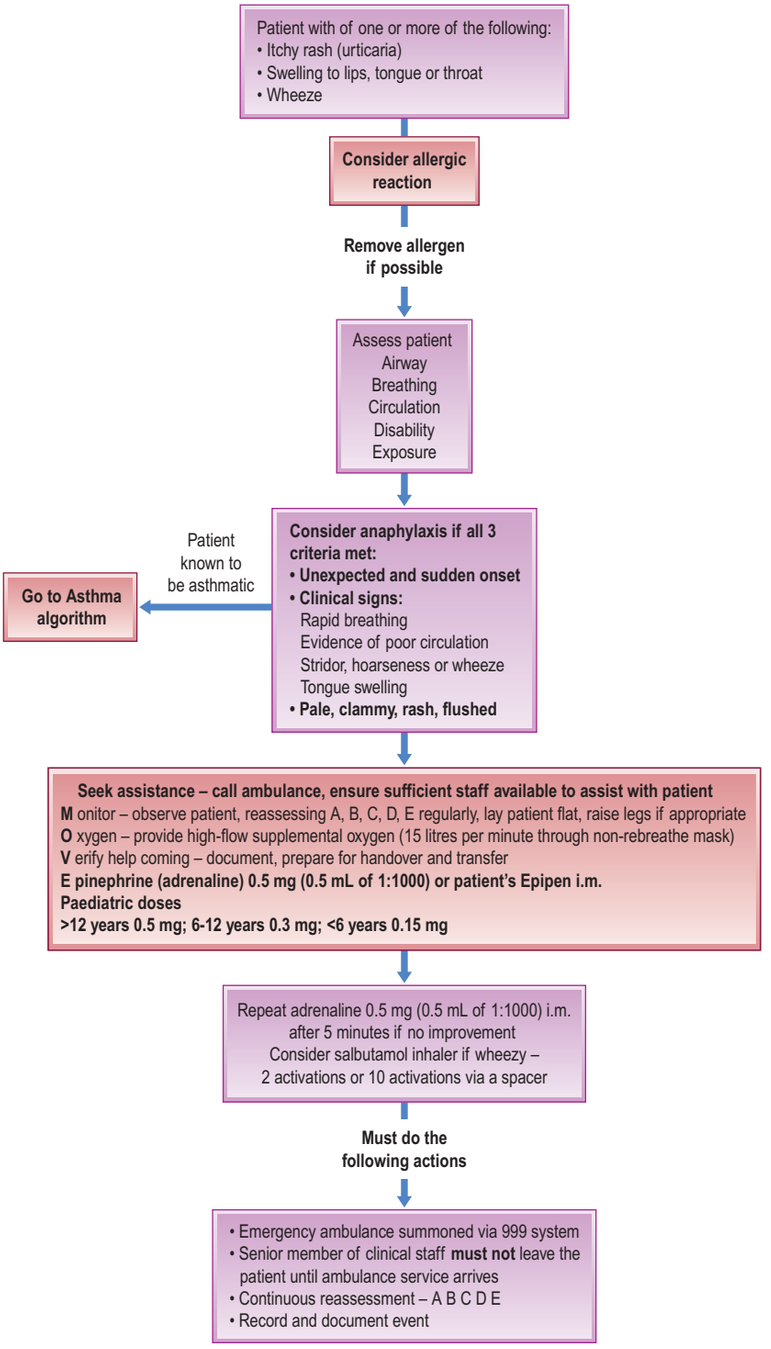


Fig. 1.5 Anaphylaxis algorithm.

ANAPHYLAXIS

- Always detail known allergies and the severity of any previous type 1 hypersensitivity reactions.
- Avoid possible allergens and, when this is not possible, refer the patient for specialist assessment.
- Life-threatening anaphylaxis may occur, despite no previous history of allergen exposure.
- Anaphylaxis is the most severe allergic response and manifests with acute hypotension, bronchospasm, urticaria rash and angioedema (Fig. 1.5).
- The causal agents include:
  penicillins – the most common cause, but also other antimicrobials (cephalosporins, sulphonamides, tetracyclines, vancomycin)
  latex
  muscle relaxants
  non-steroidal anti-inflammatory drugs (NSAIDs)
  opiates
  radiographic contrast media
  others – vaccines, immunoglobulins, various foods and insect bites.

- Strict avoidance of the causal agent is essential.
- Where there is a previous history of anaphylaxis, the patient should carry a self-administered i.m. injection device, e.g. EpiPen® (ALK-Abelló, Hungerford, Berkshire, UK) or Twinject® (Verus Pharmaceuticals, San Diego, California, USA) (or less commonly, an adrenaline (epinephrine) aerosol, such as MedihalerEpi). Patients should carry 2 EpiPens® with them because >35% of patients may require more than one adrenaline dose and up to 20% of patients will go on to develop a biphasic anaphylactic response sometimes hours later. The standard dosage of adrenaline supplied by an EpiPen for adults is 0.3 mL of 1 in 1000 (0.3 mg). Child-sized dosages (0.15 mg) are available as the EpiPen JR.
- Diagnosis is as follows:
  facial flushing, itching, paraesthesiae, oedema or sometimes urticaria, or peripheral cold clammy skin
  stridor or wheeze
  abdominal pain, nausea
  loss of consciousness
  pallor progressing to cyanosis
  rapid, weak or impalpable pulse.

Management

Treatment of an anaphylactic reaction should be based on general life-support principles:

- Use the ABCDE approach to recognize and treat problems.
- Call for help early.
- Treat the greatest threat to life first.
- Do not delay initial treatments because of the lack of a complete history or definite diagnosis.

Patients having an anaphylactic reaction in any setting should expect the following as a minimum:

- Recognition that they are seriously unwell
- An early call for help
- Initial assessment and treatments based on an ABCDE approach
- Adrenaline (epinephrine) therapy if indicated
- Investigation and follow-up by an allergy specialist.

CARDIAC ARREST

- Cardiac arrest can occur in a patient with no previous history of cardiac problems, but is more likely in those with a history of ischaemic heart disease, in diabetics and older people.
- Previous angina or myocardial infarction predispose to cardiac arrest.
- Ventricular fibrillation accounts for most sudden cardiac arrests. Causes include myocardial infarction, hypoxia, drug overdose, anaphylaxis, severe infection or severe hypotension.
- After airway and breathing assessment, basic life support (BLS) needs to be initiated immediately to maintain adequate cerebral perfusion until the underlying cause is reversed (Fig. 1.6).
- Basic life support comprises:
  initial assessment
  airway maintenance
  chest compression
  ventilation.

Management

See Figures 1.5 and 1.7.

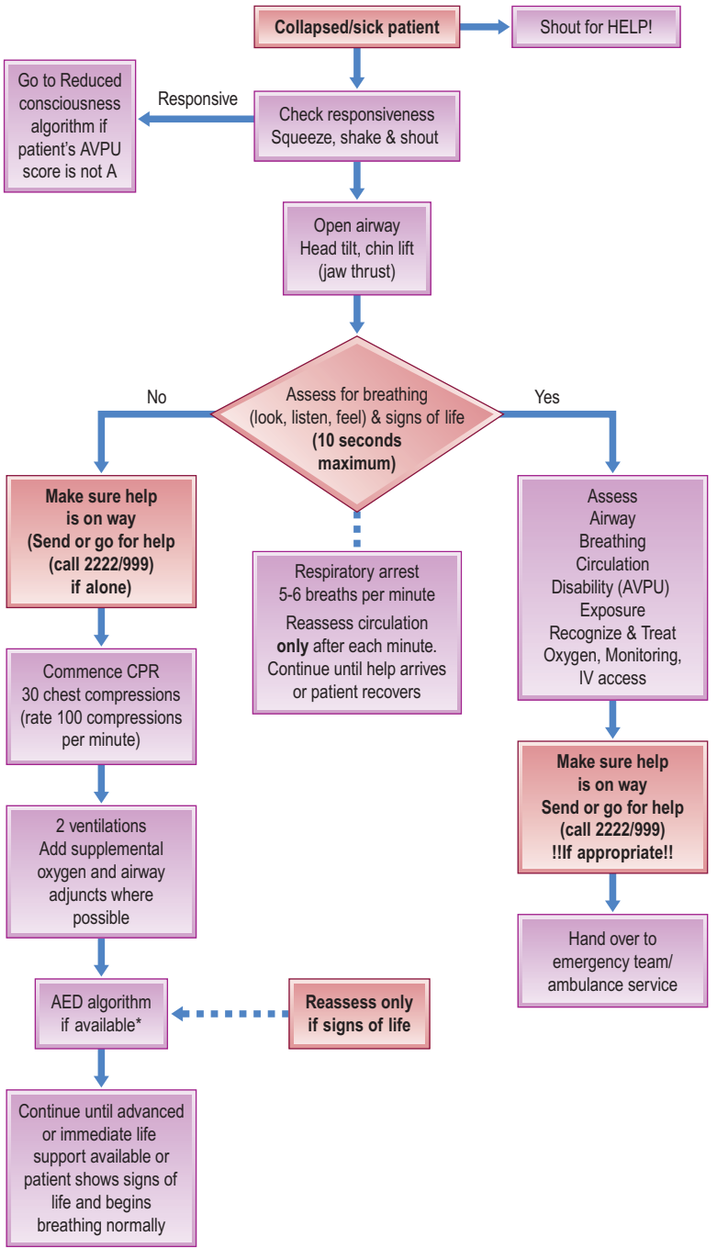


Fig. 1.6 Cardiac arrest – basic life support algorithm (*see Fig. 1.7).

DIABETIC COLLAPSE: HYPOGLYCAEMIA

- Hypoglycaemia is dangerous because the brain becomes starved of glucose.
- Diabetics treated with insulin, those with poor blood glucose control and those with poor awareness of their hypoglycaemic episodes have a greater chance of losing consciousness.
- Remember that a collapse in a diabetic may be caused by other emergencies, e.g. a faint or myocardial infarction. Ischaemic heart disease is common in long-standing diabetes.
- Hypoglycaemia may present as a deepening drowsiness, disorientation, excitability or aggressiveness, especially if it is known that a meal has been missed.
- A management algorithm is provided in Figure 1.8.

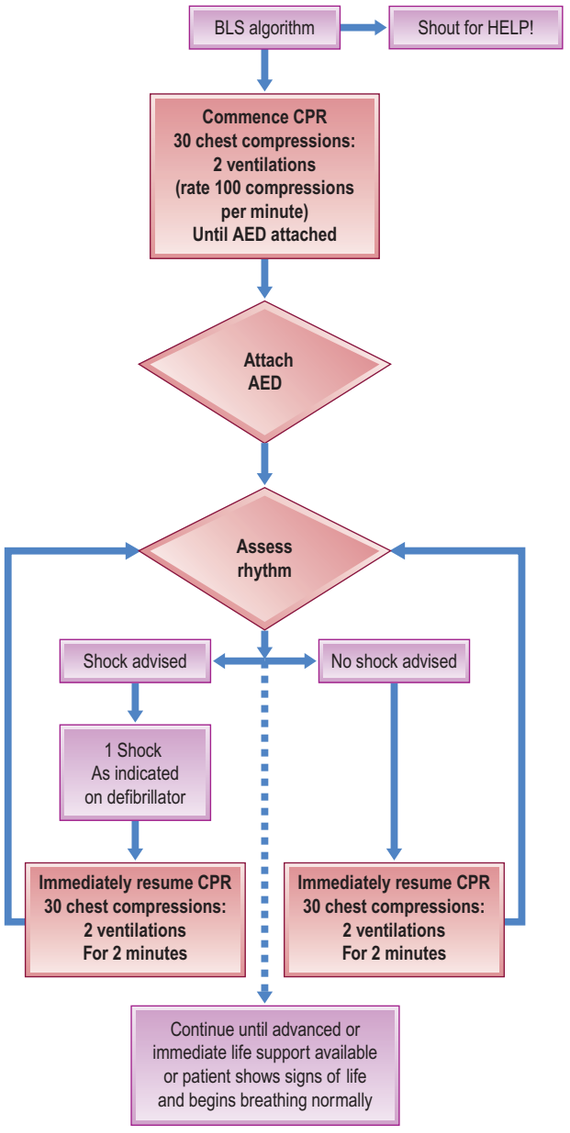


Fig. 1.7 Cardiac arrest – automated external defibrillator (AED) algorithm.

FITTING

- Fits are usually seen in known epileptics.
- Various factors may precipitate a fit, including not eating, cessation of anticonvulsant therapy, menstruation and some drugs, such as alcohol, flumazenil or tricyclic antidepressants.
- Fits may also affect people with no history of epilepsy, especially following hypoxia from loss of consciousness for other reasons or in hypoglycaemia.
- Diagnosis of a tonic–clonic (grand mal) seizure is as follows:
  loss of consciousness with rigid, extended body, which is sometimes preceded by a brief cry
  widespread jerking movements
  possible incontinence of urine and/or faeces
  slow recovery with the patient sometimes remaining dazed (post-ictal).
- A management algorithm for the fitting patient is shown in Figure 1.9.

Guidance from the Resuscitation Council is as follows:

If a patient continues to fit after an ambulance has been called then the emergency administration of buccal midazolam to assist in terminating the seizure is warranted. The dose is 10 mg for adults and an appropriately reduced dose for children. The evidence for using midazolam in this manner and for this indication is strong. It is recommended in the British National Formulary, by the Advanced Paediatric Life Support course, the National Epilepsy organisations and the Royal College of Paediatrics and Child Health. After many years of using midazolam for seizure control as an 'unlicensed' product, the drug has recently acquired a paediatric use marketing authorisation (PUMA) from the European Commission and as such is now classed as a 'licensed' product. 'Buccolam' is available as a 5 mg/ml solution for use in children up to 17 years old. Its use in adults will therefore remain 'off license' but the recommended dose is the same as that for the older child, i.e. 10 mg (2 ml). This 'off license' use is justified in the emergency situation described above. In both the 'licensed' and 'off licensed' setting, the drug does not need to have been prescribed to the patient when used in an emergency. It should, however, be administered by (or under the supervision of) a dental practitioner. There have been concerns regarding the reclassification of midazolam as a 'Schedule 3' Controlled Drug. Such reclassification requires certain legal processes. However, the law for this Schedule 3 drug does NOT require safe custody, i.e. locked cupboard, nor the need to keep a midazolam controlled drug register. Some institutions are encouraging such practices as part of their own Health and Safety protocols but there is no legal obligation to do so. Similarly, concerns have been raised about acquiring stocks of midazolam for use in the emergency setting of seizure control. A dentist can issue a requisition for any licensed product for use within their practice, as appropriate. The dentist will need to use the standardized requisition form, FP10CDF. Dental practitioners who do not use midazolam regularly are permitted to requisition this Schedule 3 Drug under the conditions laid out by the Royal Pharmaceutical Society of Great Britain in their guidance 'Medicines, Ethics and Practice: the professional guide for pharmacists'.

CHEST PAIN

- Acute severe chest pain is usually caused by angina or, less commonly, myocardial infarction.
- Patients with 'unstable' angina and those with a recent history of hospital admission for ischaemic chest pain have the highest risk, and should not be considered for routine dental treatment in primary care.
- Diagnostic features include:
  severe crushing retrosternal pain radiating down the left arm
  breathlessness that may be described as 'heartburn'
  vomiting and loss of consciousness if there is an infarct
  weak or irregular pulse if there is an infarct.
- Management is detailed in Figure 1.10.

SHORTNESS OF BREATH

ACUTE SEVERE ASTHMA

- Anxiety, infection, or exposure to an allergen or drugs may precipitate asthma.
- High-risk asthmatics include those individuals who:
  take oral medication in addition to inhaled β_2 agonists and corticosteroids

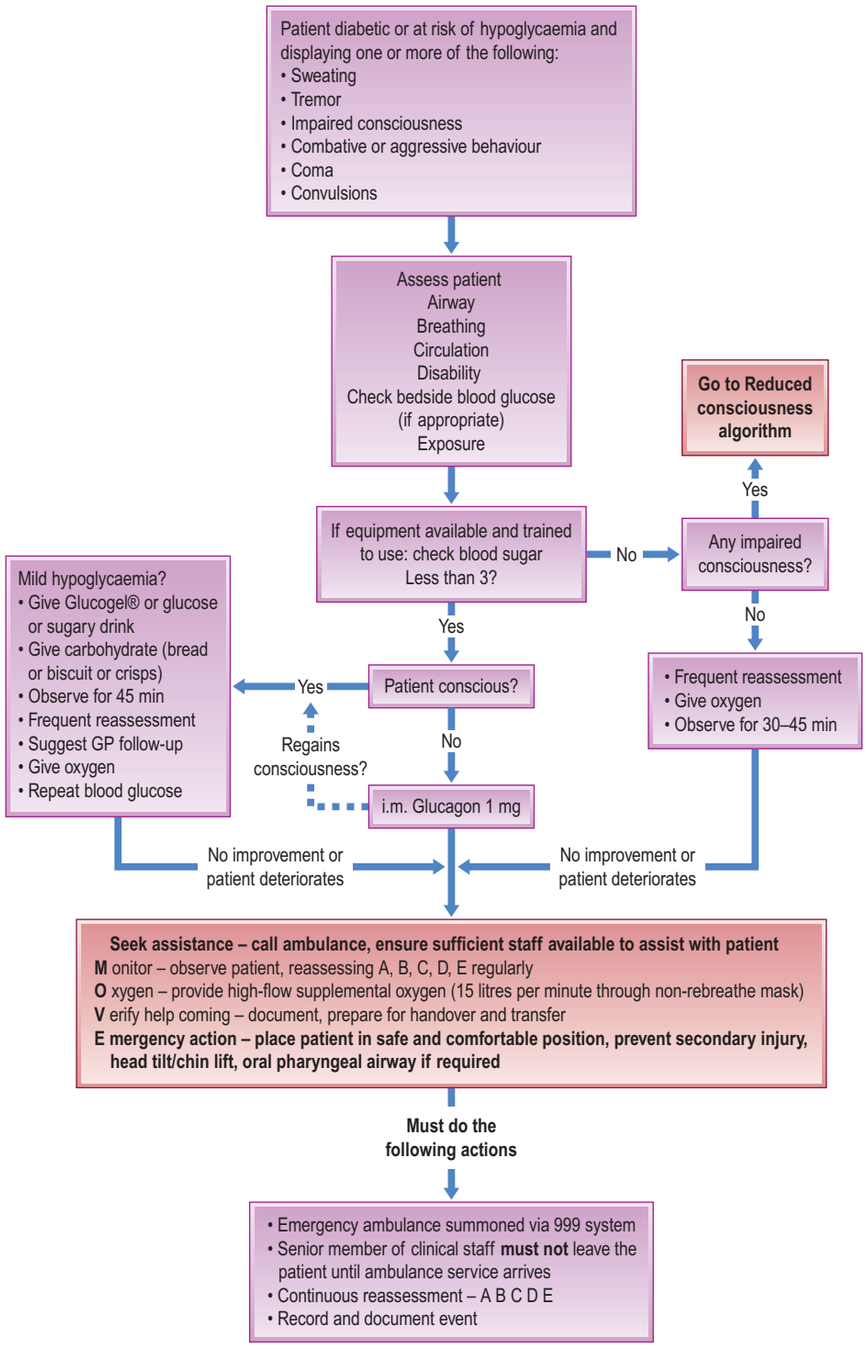


Fig. 1.8 Hypoglycaemia algorithm.

use a nebulizer regularly at home
have required oral steroids for their asthma within the last year
have been admitted to hospital with asthma within the last year.

- Diagnostic features are:
  breathlessness
  expiratory wheeze
  use of accessory muscles – shrugging the shoulders with each respiratory cycle with increased severity
  rapid pulse (usually over 110 beats/min) with increasing severity but this may slow in life-threatening exacerbation.
- Management is detailed in Figure 1.11.

FOREIGN BODY RESPIRATORY OBSTRUCTION

- Causes of respiratory obstruction include laryngeal spasm and foreign body. Although these may occur in any individual, the sedated patient poses a significant risk.
- Prevention of inhalation of foreign bodies, including teeth, crowns, filling materials or endodontic instruments, is far better than the event occurring. At the least, such an event causes great embarrassment, at worst respiratory obstruction, lung abscess or death.
- Use a rubber dam.

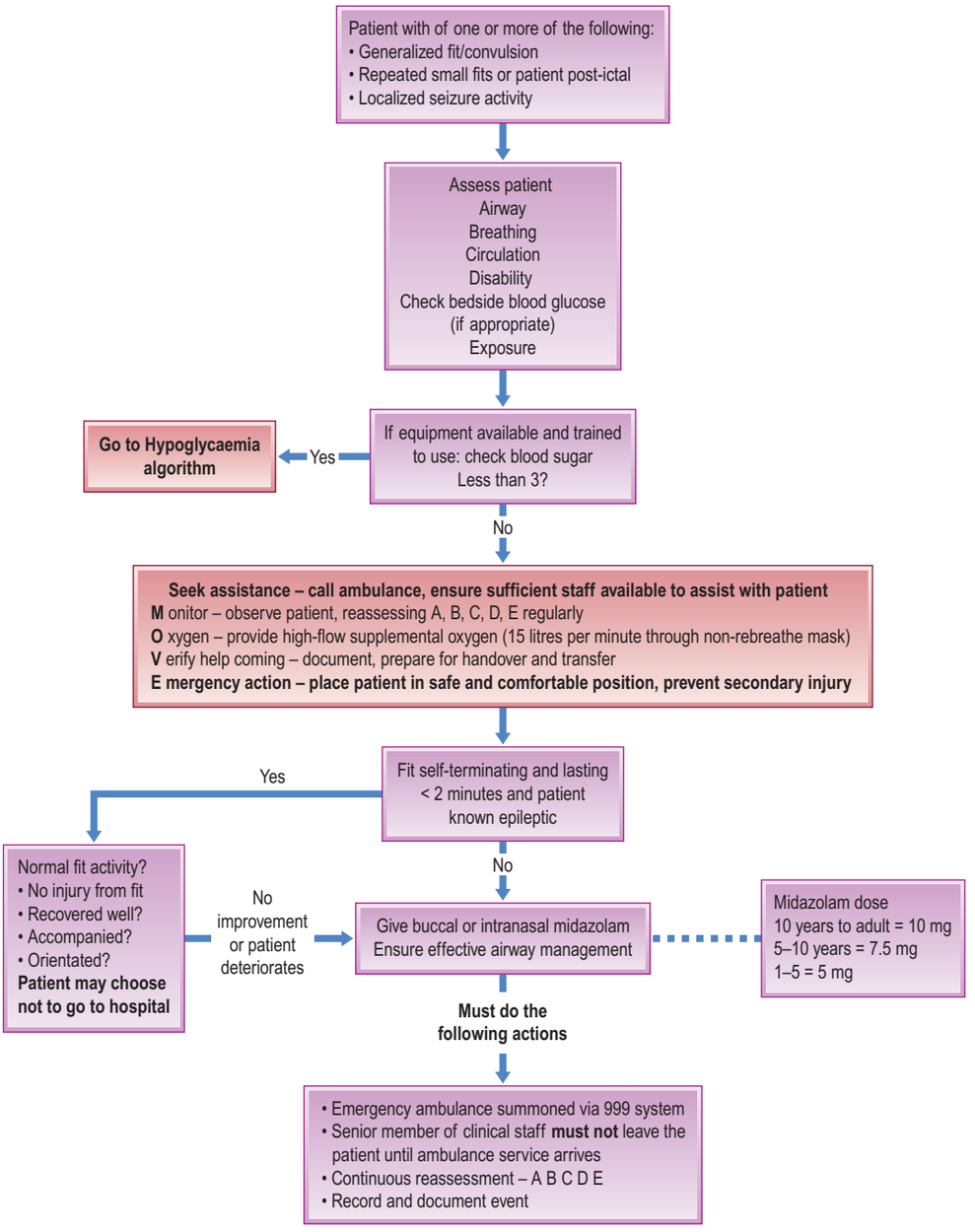


Fig. 1.9 Fitting/convulsions algorithm.

- Diagnosis is as follows:
  irregular breathing with crowing or croaking on inspiration
  violent respiratory efforts using accessory muscles
  deepening cyanosis.
- Management is shown in Figures 1.12 and 1.13.

LESS COMMON EMERGENCIES

STROKE

- Stroke may rarely occur in apparently healthy patients, but is more common in older and hypertensive individuals. A history of stroke predisposes to a further event.
- Diagnosis varies with the size and site of brain damage but typically includes:
  loss of consciousness
  unilateral weakness of the arm and leg
  facial palsy.
- Management details are shown in Box 1.4.

ADRENAL CRISIS: COLLAPSE OF A PATIENT WITH A HISTORY OF CORTICOSTEROID THERAPY

- Collapse in a patient with Addison disease or a history of systemic corticosteroid therapy may be caused by adrenal insufficiency, triggered by general anaesthesia, trauma, infections or other stress, but has never been recorded in primary dental care.

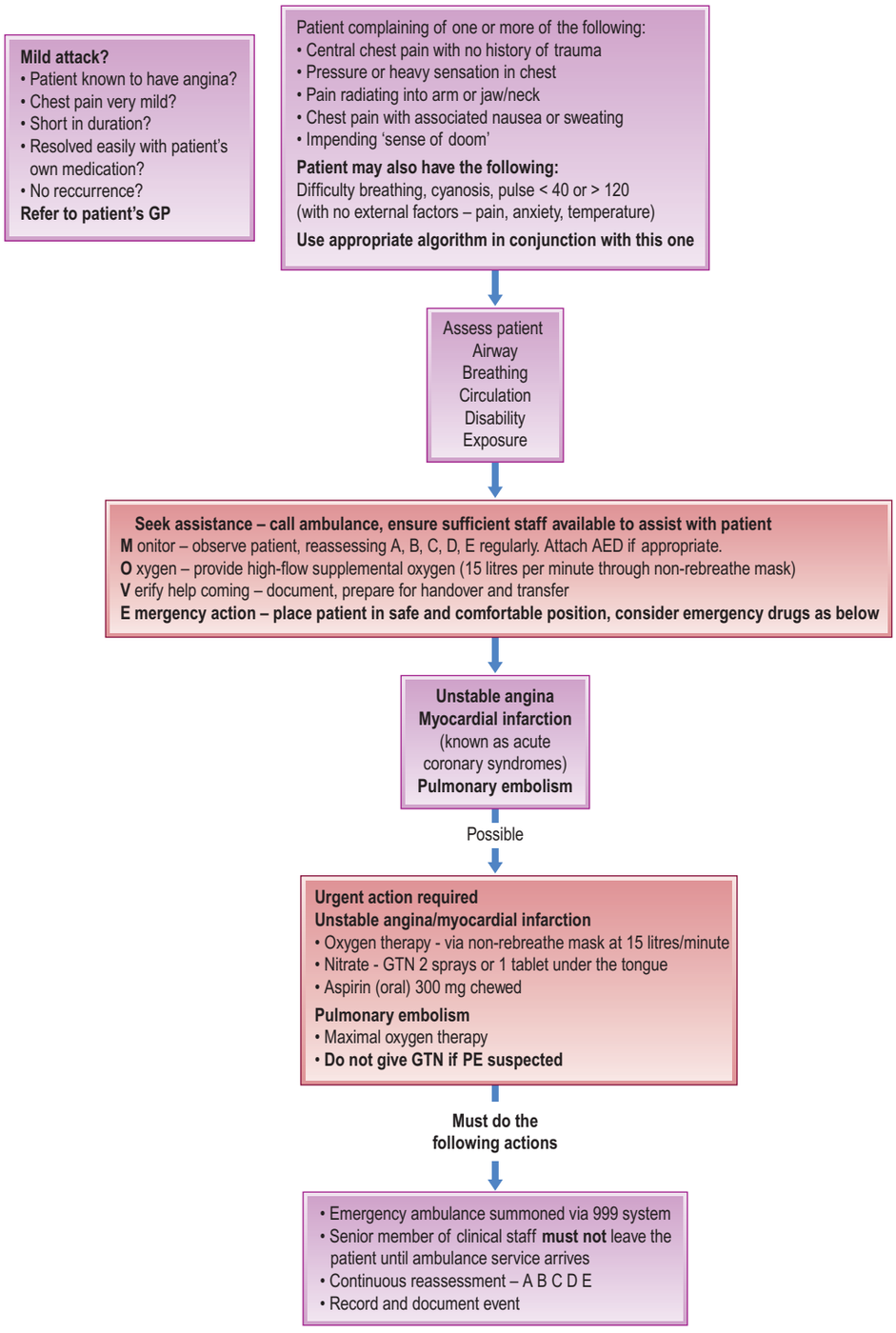


Fig. 1.10 Chest pain algorithm.

- Prevention of this emergency is contentious and will be dealt with in Chapter 6.
- Diagnosis is as follows:
  pallor
  pulse – rapid, weak or impalpable
  loss of consciousness
  rapidly falling blood pressure.
- Management is detailed in Figure 1.14.

REACTIONS TO DRUGS OR SEDATION

Intravascular injection of local anaesthetic agent

- Diagnostic features may include:
  agitation
  confusion
  drowsiness
  fitting
  eventually, loss of consciousness.
- Management is detailed in Box 1.5.

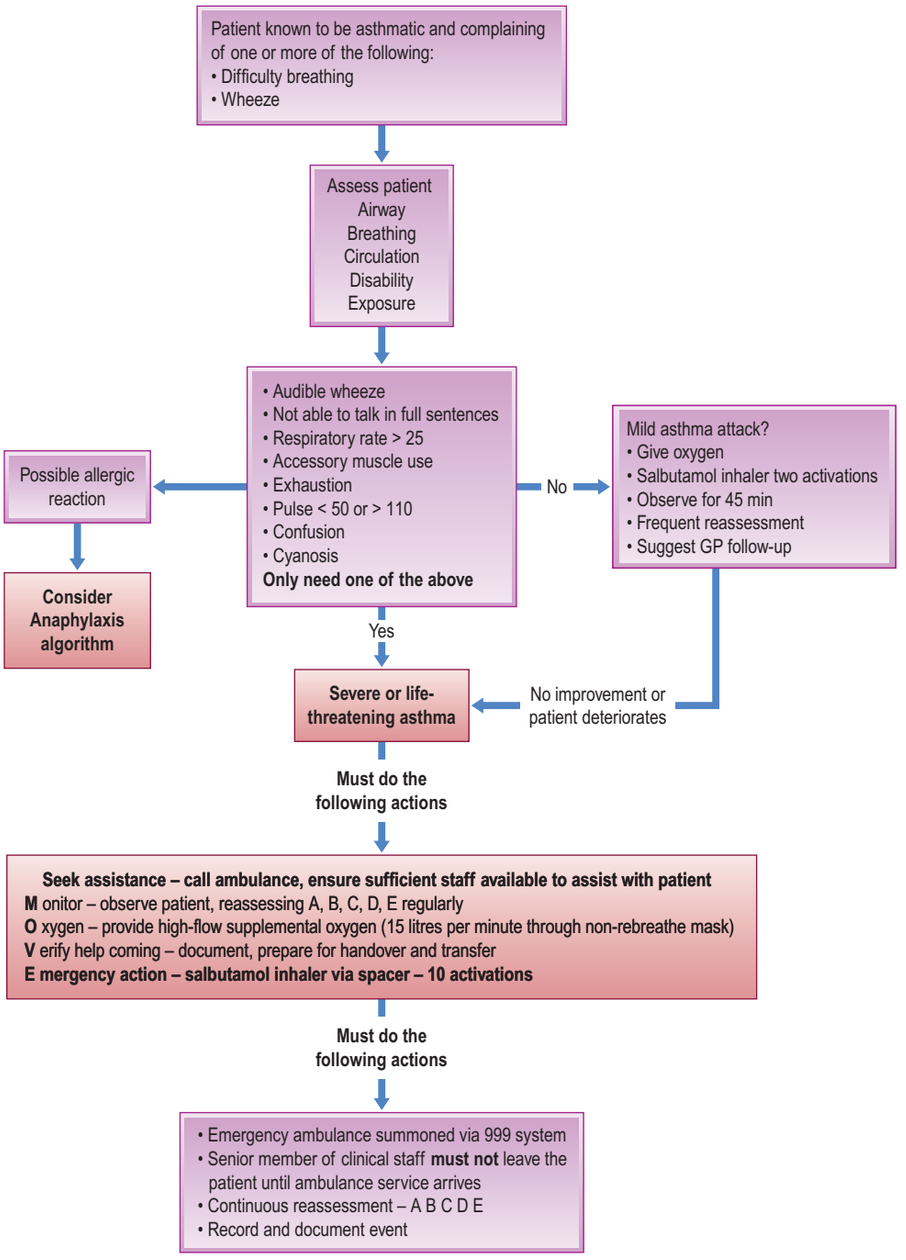


Fig. 1.11 Asthma algorithm.

Temporary facial palsy, diplopia or localized facial pallor

- These occur rarely as a result of action of the anaesthetic agent on the facial nerve or orbital contents; the transient effects resolve.
- If the individual is unable to blink, the eyelids should be taped closed until the anaesthetic abates.

Local anaesthetic allergy

- Allergy to LA is managed as for anaphylaxis, but is very rare.

Cardiovascular reactions to local anaesthetic

- Usually, only palpitations are experienced.
- Identify the likely cause and reassure the patient.
- Await natural subsidence of symptoms.
- If chest pain occurs, treat as above.
- Where possible, defer further immediate dental treatment.

Hypotension resulting from interaction with antihypertensive drugs

- Assess and clear the airway.
- Assess breathing and administer oxygen.
- Assess circulation.
- Lay the patient flat.
- Reassure.
- Summon assistance.
- Where possible, defer further immediate dental treatment.

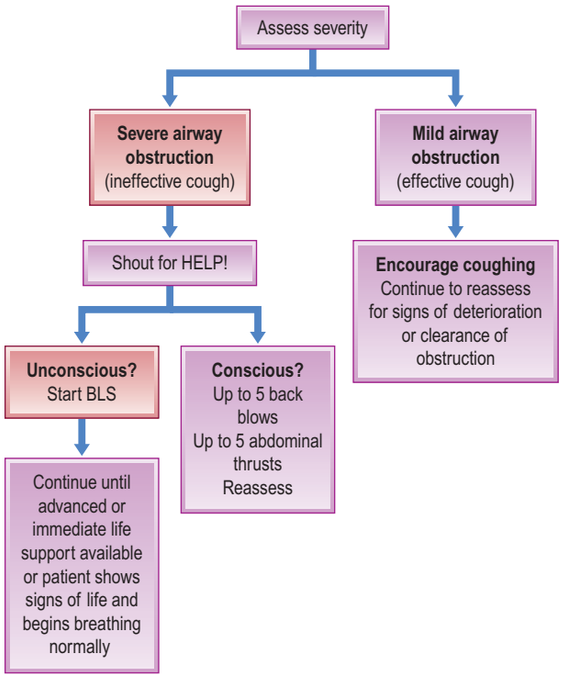


Fig. 1.12 Choking algorithm.

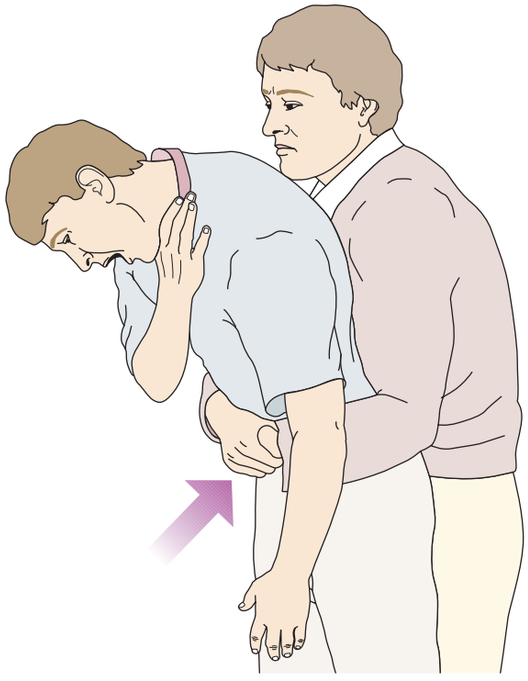


Fig. 1.13 Abdominal thrust (formerly the Heimlich manœuvre).

Box 1.4 *Management of stroke*

- Assess (FAST: *f*ace, *a*rm, *s*peech, *t*ime), clear the airway and check breathing
- Check pulse and capillary refill
- Reassure the patient
- Give high-flow oxygen
- Call an ambulance
- Defer dental treatment

SEDATION EMERGENCIES

Respiratory failure

- Causes include drug overdose or hypoxia.
- Diagnosis is as follows:
  Respiratory rate slows and then stops.
  There is ashen cyanosis.
  Pulse is initially rapid and weak, later irregular or impalpable.
  Cardiac arrest may follow.
- Management is as follows:
  Assess the patient using ABCDE.
  Call an ambulance.
  Administer no further sedation.
  Lay patient flat.
  Commence ventilation with bag and mask containing high oxygen concentration.
  Consider flumazenil administration.
  Defer dental treatment.

Sedative drug overdose or drug interaction

- Accidental overdose or the combination of the sedative agent with another drug used by the patient may be responsible.
- Diagnosis is as follows:
  pallor
  decreased pulse rate
  hypotension
  respiratory depression.
- Management is as follows:
  Stop the drug.
  Give oxygen and ventilate artificially if required.
  For midazolam overdose, give flumazenil.
  If the patient progresses to cardiac arrest, commence CPR.
  Call the emergency services.
  Defer dental treatment.

MENTAL DISTURBANCES

HYPERVENTILATION SYNDROME

- Causes of hyperventilation include:
  anxiety or neurosis
  pain
  cardiovascular disease
  nervous system disease
  acidosis (either metabolic or drug-associated)
  poor respiratory exchange (but in this case it is a compensatory physiological response).
- The clinical features vary widely, but neurological and psychological features may include:
  anxiety
  weakness
  light-headedness
  dizziness
  disturbed consciousness
  perioral and peripheral paraesthesiae
  tetany
  muscle pain or stiffness.
- The most common underlying diagnosis is psychological and is typically seen in a young woman overbreathing secondary to anxiety until carbon dioxide washout results in paraesthesia.

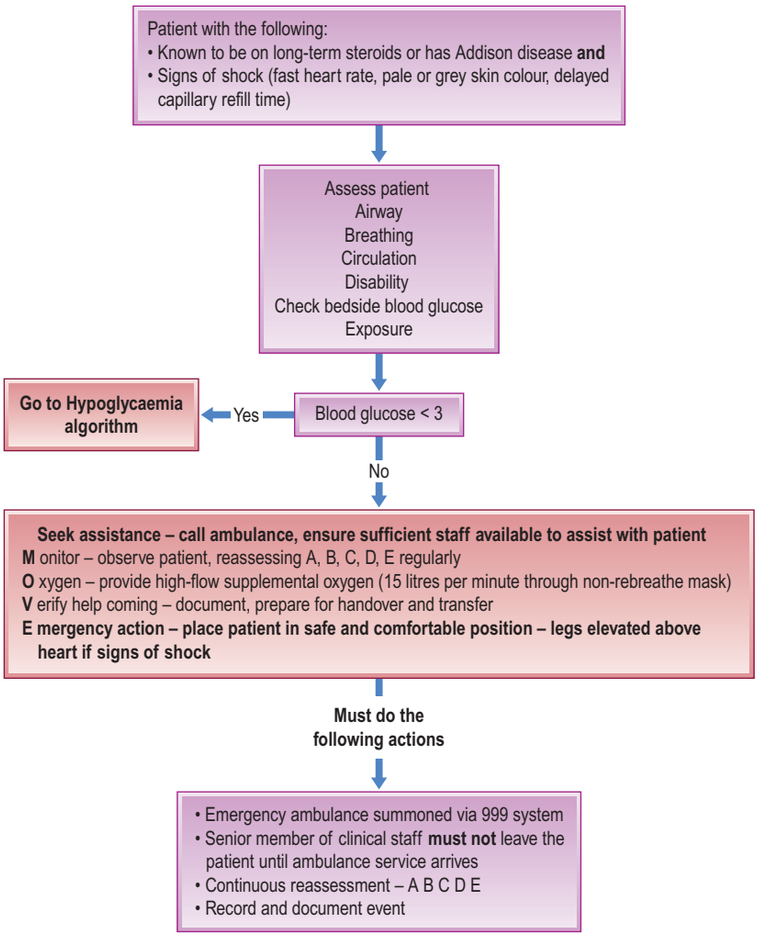


Fig. 1.14 Adrenal insufficiency algorithm.

Box 1.5 *Management of intravascular injection of local anaesthetic*

- Stop the local anaesthetic administration
- Lay the patient flat
- Reassure the patient
- Assess and maintain the airway
- Check breathing and circulation
- Remember that most patients recover spontaneously within half an hour
- Stabilize and defer further dental treatment until another day

Box 1.6 *Management of hyperventilating patients*

- Assess airway, breathing and circulation; identify any disability
- Reassure the patient
- Encourage the patient to decrease the respiratory rate slowly
- If there is obvious sympathetic overactivity, as shown particularly by tachycardia or arrhythmias, a cardiologist's opinion should be obtained, as treatment with a beta-blocker may be necessary
- Defer dental treatment until medical assessment has taken place

- Cardiovascular and respiratory features may include:
  palpitations
  chest pain
  breathlessness.
- Management is detailed in Box 1.6.

DISTURBED OR AGGRESSIVE BEHAVIOUR

- Disturbed or aggressive behaviour may be the result of:
  an annoyed patient or underlying psychiatric disorder
  drugs, especially barbiturates, alcohol or other drugs of addiction or drug withdrawal, or corticosteroids
  pain or discomfort
  infections, particularly in the elderly
  hypoglycaemia or other endocrine disorders
  temporal lobe epilepsy
  cerebral tumours.
- Management is detailed in Box 1.7.

BLEEDING

- Post-extraction bleeding causes are usually secondary to local trauma.
- Haemorrhagic disease, though uncommon, must always be considered (see Box 1.8 and Ch. 8).

Management is detailed in Box 1.8.

Box 1.7 *Management of disturbed or aggressive behaviour*

- Reassure and try to calm the patient, and not to restrain
- Do not sedate, as this may confuse the diagnosis and may occasionally be fatal
- Remember that midazolam or diazepam is likely to worsen the excitement of a psychotic patient
- Call an ambulance
- If the patient is violent and uncontrollable, call the police
- Defer dental treatment

Box 1.8 *Management of the bleeding patient*

- Assess airway, breathing, circulation, disability and exposure
- Reassure the patient. Post-extraction bleeding often worries the patient excessively because a little blood dissolved in saliva gives the impression of a major bleed
- Ask partners or relatives to remain in the waiting room, as their anxiety can prevent early resolution
- Gently clean the mouth
- Locate the source of the bleeding
- Suture the socket under local analgesia
- Enquire into the patient's history, especially family history of abnormal bleeding
- If the bleeding is persistent or severe and there has been an estimated loss of more than about 500 mL, or if the patient is already compromised secondary to severe anaemia, arrange for the patient to be admitted to hospital
- Use tranexamic acid mouthwash 5%, which may help to stabilize the clot in the interim
- If the bleeding is uncontrollable, call an ambulance

KEY WEBSITES

(Accessed 23 May 2013)
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Advanced Life Support Group. <http://www.alsg.org>.
European Resuscitation Council. <http://www.erc.edu>.
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APPENDIX 1.1 MANAGEMENT OF COMMON EMERGENCIES

The Resuscitation Council guidelines (2012), Appendix ii, deal with common emergencies.

ASTHMA

Patients with asthma (both adults and children) may have an attack while at the dental surgery. Most attacks will respond to a few 'activations' of the patient's own short-acting beta2-adrenoceptor stimulant inhaler such as salbutamol (100 micrograms/actuation). Repeat doses may be necessary. If the patient does not respond rapidly, or any features of severe asthma are present, an ambulance should be summoned. Patients requiring additional doses of bronchodilator should be referred for medical assessment after emergency treatment. If the patient is unable to use the inhaler effectively, additional doses should be given through a large-volume spacer device. If the response remains unsatisfactory or if the patient develops tachycardia, becomes distressed or cyanosed (blueness around the lips or extremities), arrangements must be made to transfer them urgently to hospital.

Symptoms and signs

*Clinical features of **acute severe asthma** in adults include:*

- *Inability to complete sentences in one breath*
- *Respiratory rate > 25 per minute*
- *Tachycardia (heart rate > 110 per minute).*

*Clinical features of **life-threatening asthma** in adults include:*

- *Cyanosis or respiratory rate < 8 per minute*
- *Bradycardia (heart rate < 50 per minute)*
- *Exhaustion, confusion, decreased conscious level.*

Treatment

- *Whilst awaiting ambulance transfer, oxygen (15 litres per minute) should be given.*
- *Assuming the patient's nebuliser is unavailable, up to 10 activations from the salbutamol inhaler should be given using a large-volume spacer device and repeated every 10 minutes if necessary until an ambulance arrives. All emergency ambulances in the UK carry nebulisers, oxygen and appropriate drugs.*
- *If bronchospasm is part of a more generalized anaphylactic reaction and there are 'life-threatening' signs, an intramuscular injection of adrenaline should be given (see Anaphylaxis).*
- *The perceived risk of giving patients with chronic obstructive pulmonary disease too much oxygen is often quoted but this should not distract from the reality that ALL sick, cyanosed patients with respiratory difficulty should be given high-flow oxygen until the arrival of the ambulance. This short-term measure is far more likely to be of benefit to the patient than any risks of causing respiratory depression.*
- *If any patient becomes unresponsive always check for 'signs of life' (breathing and circulation) and start CPR in the absence of signs of life or normal breathing (ignore occasional 'gasps'). For further information about the management of the patient with asthma see http://www.brit-thoracic.org.uk/guidelines/asthma-guidelines.aspx (accessed 30 September 2013).*

ANAPHYLAXIS

Anaphylaxis is a severe, life-threatening, generalized or systemic hypersensitivity reaction. It is characterised by rapidly developing life-threatening airway and/or breathing and/or circulation problems usually associated with skin and mucosal changes.

Anaphylactic reactions in general dental practice may follow the administration of a drug or contact with substances such as latex in surgical gloves. In general, the more rapid the onset of the reaction, the more serious it will be. Symptoms can develop within minutes and early, effective treatment may be life-saving. Anaphylactic reactions may also be associated with additives and excipients in medicines. It is wise therefore to check the full formulation of preparations which may contain allergenic fats or oils (including those for topical application, particularly if they are intended for use in the mouth).

Symptoms and signs

The lack of any consistent clinical manifestation and a wide range of possible presentations can cause diagnostic difficulty. Clinical assessment helps make the diagnosis.

Signs and symptoms may include:

- *urticaria, erythema, rhinitis, conjunctivitis*
- *abdominal pain, vomiting, diarrhoea and a sense of impending doom*
- *flushing is common, but pallor may also occur*
- *marked upper airway (laryngeal) oedema and bronchospasm may develop, causing stridor, wheezing and/or a hoarse voice*
- *vasodilation causes relative hypovolaemia leading to low blood pressure and collapse. This can cause cardiac arrest*
- *respiratory arrest leading to cardiac arrest.*

Treatment

- *Use an ABCDE approach to recognize and treat any suspected anaphylactic reaction. First-line treatment includes managing the airway and breathing and restoration of blood pressure (laying the patient flat, raising the feet) and the administration of oxygen (15 litres per minute).*
- *For severe reactions where there are life-threatening airway and/or breathing and/or circulation problems, i.e. hoarseness, stridor, severe wheeze, cyanosis, pale, clammy, drowsy, confusion or coma … adrenaline should be given intramuscularly (anterolateral aspect of the middle third of the thigh) in a dose of 500 micrograms (0.5 mL adrenaline injection of 1:1000); an autoinjector preparation delivering a dose of 300 micrograms (0.3 mL adrenaline injection 1:1000) is available for immediate self-administration by those patients known to have severe reactions. This is an acceptable alternative if immediately available. The dose is repeated if necessary at 5-minute intervals according to blood pressure, pulse and respiratory function. The paediatric dose for adrenaline is based on the child's approximate age or weight. …*
- *In any unconscious patient always check for 'signs of life' (breathing and circulation) and start CPR in the absence of signs of life or normal breathing (ignore occasional 'gasps').*
- *In less severe cases any wheeze or difficulty breathing can be treated with a salbutamol inhaler as detailed above in the section on* Asthma.
- *All patients treated for an anaphylactic reaction should be sent to hospital by ambulance for further assessment, irrespective of any initial recovery.*

Antihistamine drugs and steroids, whilst useful in the treatment of anaphylaxis, are not first-line drugs and they will be administered by the ambulance personnel if necessary.

For further information about the management of the patient with an emergency anaphylactic reaction see http://www.resus.org.uk/pages/reaction.pdf (accessed 30 September 2013).

CARDIAC EMERGENCIES

The signs and symptoms of cardiac emergencies include chest pain, shortness of breath, fast and slow heart rates, increased respiratory rate, low blood pressure, poor peripheral perfusion (indicated by prolonged capillary refill time) and altered mental state.

If there is a history of angina the patient will probably carry glyceryl trinitrate spray or tablets (or isosorbide dinitrate tablets) and they should be allowed to use them. Where symptoms are mild and

resolve rapidly with the patient's own medication, hospital admission is not normally necessary. Dental treatment may or may not be continued at the discretion of the Dental Practitioner. More severe attacks of chest pain always warrant postponement of treatment and an ambulance should be summoned.

Sudden alterations in the patient's heart rate (very fast or very slow) may lead to a sudden reduction in cardiac output with loss of consciousness. Medical assistance should be summoned by dialling 999.

Myocardial infarction

The pain of myocardial infarction is similar to that of angina but generally more severe and prolonged. There may only be a partial response to GTN.

Symptoms and signs of myocardial infarction

- *Progressive onset of severe, crushing pain in the centre and across the front of chest. The pain may radiate to the shoulders and down the arms (more commonly the left), into the neck and jaw or through to the back.*
- *Skin becomes pale and clammy.*
- *Nausea and vomiting are common.*
- *Pulse may be weak and blood pressure may fall.*
- *Shortness of breath.*

Initial management of myocardial infarction

- *Call 999 immediately for an ambulance.*
- *Allow the patient to rest in the position that feels most comfortable; in the presence of breathlessness this is likely to be the sitting position. Patients who faint or feel faint should be laid flat; often an intermediate position (dictated by the patient) will be most appropriate.*
- *Give sublingual GTN spray if this has not already been given.*
- *Reassure the patient as far as possible to relieve further anxiety.*
- *Give aspirin in a single dose of 300 mg orally, crushed or chewed. Ambulance staff should be made aware that aspirin has already been given, as should the hospital. Many ambulance services in the UK will administer thrombolytic therapy before hospital admission. Any dental treatment carried out that might contraindicate this must be brought to the attention of the ambulance crew.*
- *High-flow oxygen may be administered (15 litres per minute) if the patient is cyanosed (blue lips) or conscious level deteriorates.*
- *If the patient becomes unresponsive always check for 'signs of life' (breathing and circulation) and start CPR in the absence of signs of life or normal breathing (ignore occasional 'gasps').*

EPILEPTIC SEIZURES

Patients with epilepsy must continue their normal dosage of anticonvulsant drugs before attending for dental treatment. Epileptic patients may not volunteer the information that they are epileptic, but there should be little difficulty in recognising a tonic–clonic (grand mal) seizure.

Symptoms and signs

- *There may be a brief warning or 'aura'.*
- *There will be a sudden loss of consciousness, the patient becomes rigid, falls, may give a cry, and becomes cyanosed (tonic phase).*
- *After a few seconds, there are jerking movements of the limbs; the tongue may be bitten (clonic phase).*
- *There may be frothing from the mouth and urinary incontinence.*
- *The seizure typically lasts a few minutes; the patient may then become floppy but remain unconscious.*
- *After a variable time the patient regains consciousness but may remain confused.*
- *Fitting may be a presenting sign of hypoglycaemia and should be considered in all patients, especially known diabetics and children. An early blood glucose measurement is essential in all actively fitting patients (including known epileptics).*
- *Check for the presence of a very slow heart rate (<40 per minute) which may drop the blood pressure. This is usually caused by a vasovagal episode (see Syncope section below). The drop in blood pressure may cause transient cerebral hypoxia and give rise to a brief seizure.*

Treatment

- *During a seizure try to ensure that the patient is not at risk of injury but make no attempt to put anything in the mouth or between the teeth (in the mistaken belief that this will protect the tongue).*
- *Do not attempt to insert an oropharyngeal airway or other airway adjunct while the patient is actively fitting.*
- *Give high-flow oxygen (15 litres per minute).*
- *Do not attempt to restrain convulsive movements.*
- *After convulsive movements have subsided place the patient in the recovery position and reassess.*
- *If the patient remains unresponsive always check for 'signs of life' (breathing and circulation) and start CPR in the absence of signs of life or normal breathing (ignore occasional 'gasps').*
- *Check blood glucose level to exclude hypoglycaemia. If blood glucose <3.0 mmol per litre or hypoglycaemia is clinically suspected, give oral/buccal glucose (e.g.* Glucogel*;* Dextrogel*;* GSF-syrup *or* Rapilose *gel), or glucagon (see above and* Hypoglycaemia *section below).*

After the seizure the patient may be confused ('post-ictal confusion') and may need reassurance and sympathy. The patient should not be sent home until fully recovered and they should be accompanied. It may not always be necessary to seek medical attention or transfer to hospital unless the convulsion was atypical, prolonged (or repeated), or if injury occurred. The National Institute for Care and Health Excellence (NICE; formerly the National Institute for Clinical Excellence) guidelines suggest the indications for sending to hospital are:

- *status epilepticus*
- *high risk of recurrence*
- *first episode*
- *difficulty monitoring the individual's condition.*

Medication should only be given if seizures are prolonged (convulsive movements lasting 5 minutes or longer) or recur in quick

succession. In this situation an ambulance should be summoned urgently.

With prolonged or recurrent seizures, ambulance personnel will often administer IV diazepam, which is usually rapidly effective in stopping any seizure. An alternative, although less effective treatment, is midazolam given via the buccal route in a single dose of 10 mg for adults. For children the dose can be simplified as follows: child 1–5 years 5 mg, child 5–10 years 7.5 mg, above 10 years 10 mg. This might usefully be administered while waiting for ambulance treatment, but the decision to do this will depend on individual circumstances.

(See Appendix (viii) Emergency use of buccal midazolam*).*

HYPOGLYCAEMIA

Patients with diabetes should eat normally and take their usual dose of insulin or oral hypoglycaemic agent before any planned dental treatment. If food is omitted after having insulin, the blood glucose will fall to a low level (hypoglycaemia). This is usually defined as a blood glucose <3.0 mmol per litre, but some patients may show symptoms at higher blood sugar levels. Patients may recognize the symptoms themselves and will usually respond quickly to glucose. Children may not have such obvious features but may appear lethargic.

Symptoms and signs

- *Shaking and trembling*
- *Sweating*
- *Headache*
- *Difficulty in concentration/vagueness*
- *Slurring of speech*
- *Aggression and confusion*
- *Fitting/seizures*
- *Unconsciousness.*

Treatment

The following staged treatment protocol is suggested depending on the status of the patient. If any difficulty is experienced or the patient does not respond, the ambulance service should be summoned immediately; ambulance personnel will also follow this protocol. Confirm the diagnosis by measuring the blood glucose.

Early stages *– where the patient is co-operative and conscious with an intact gag reflex, give oral glucose (sugar [sucrose], milk with added sugar, glucose tablets or gel [e.g. Glucogel; Dextrogel; GSF-syrup or Rapilose gel]). If necessary this may be repeated in 10–15 minutes.*

In more severe cases *– where the patient has impaired consciousness, is uncooperative or is unable to swallow safely, buccal glucose gel and/or glucagon should be given.*

- *Glucagon should be given via the IM route (1 mg in adults and children > 8 years old or >25 kg, 0.5 mg if <8 years old or <25 kg). Remember it may take 5–10 minutes for glucagon to work and it requires the patient to have adequate glucose stores. Thus, it may be ineffective in anorexic patients, alcoholics or some non-diabetic patients.*
- *Recheck blood glucose after 10 minutes to ensure that it has risen to a level of 5.0 mmol per litre or more, in conjunction with an improvement in the patient's mental status.*
- *If any patient becomes unconscious, always check for 'signs of life' (breathing and circulation) and start CPR in the absence of signs of life or normal breathing (ignore occasional 'gasps').*
- *It is important, especially in patients who have been given glucagon, that once they are alert and able to swallow, they are given a drink containing glucose and if possible some food high in carbohydrate. The patient may go home if fully recovered and they are accompanied. Their General Practitioner should be informed and they should not drive.*

SYNCOPE

Inadequate cerebral perfusion (and oxygenation) results in loss of consciousness. This most commonly occurs with low blood pressure caused by vagal overactivity (a vasovagal attack, simple faint, or syncope). This in turn may follow emotional stress or pain. Some patients are more prone to this and have a history of repeated faints.

Symptoms and signs

- *Patient feels faint/dizzy/light-headed*
- *Slow pulse rate*
- *Low blood pressure*
- *Pallor and sweating*
- *Nausea and vomiting*
- *Loss of consciousness.*

Treatment

- *Lay the patient flat* **as soon as possible** *and raise the legs to improve venous return.*
- *Loosen any tight clothing, especially around the neck and give oxygen (15 litres per minute).*
- *If any patient becomes unresponsive, always check for 'signs of life' (breathing, circulation) and start CPR in the absence of signs of life or normal breathing (ignore occasional 'gasps').*

Other possible causes

- **Postural hypotension** *can be a consequence of rising abruptly or of standing upright for too long. Several medical conditions predispose patients to hypotension with the risk of syncope. The most common culprits are drugs used in the treatment of high blood pressure, especially the ACE inhibitors and angiotensin antagonists. When rising, patients should take their time. Treatment is the same as for a vasovagal attack.*
- *Under stressful circumstances, many anxious patients* **hyperventilate***. This may give rise to feelings of light-headedness or faintness but does not usually result in syncope. It may result in spasm of muscles around the face and of the hands. In most cases reassurance is all that is necessary.*

CHOKING AND ASPIRATION

Dental patients are susceptible to choking with the potential risk of aspiration. They may have blood and secretions in their mouths

for prolonged periods. Local anaesthesia may diminish the normal protective pharyngeal reflexes and 'impression material' or dental equipment is often within their oral cavity and poses additional risks. Good teamwork and careful attention to detail should prevent aspiration episodes and any risk of choking.

Symptoms and signs

- *The patient may cough and splutter.*
- *They may complain of difficulty breathing.*
- *Breathing may become noisy with wheeze (usually aspiration) or stridor (usually upper airway obstruction).*
- *They may develop 'paradoxical' chest or abdominal movements.*
- *They may become cyanosed and lose consciousness.*

Treatment

- *In cases of aspiration, allow the patient to cough vigorously.*
- *Symptomatic treatment of wheeze with a salbutamol inhaler may help (as for asthma).*
- *If any large pieces of foreign material have been aspirated, e.g. teeth or dental amalgam, the patient should be referred to hospital for a chest X-ray and possible removal.*
- *Where the patient is symptomatic following aspiration they should be referred to hospital as an emergency.*
- *The treatment of the choking patient involves removing any visible foreign bodies from the mouth and pharynx.*
- *Encourage the patient to cough if conscious. If they are unable to cough but remain conscious then sharp back blows should be delivered. These can be followed by abdominal thrusts (Heimlich manœuvre) if the foreign body has not been dislodged. If the patient becomes unconscious, CPR should be started. This will not only provide circulatory support but the pressure generated within the chest by performing chest compressions may help to dislodge the foreign body.*

See Appendix (iv) for the Resuscitation Council (UK) Adult and Child Choking Algorithm.

ADRENAL INSUFFICIENCY

Adrenal insufficiency may follow long-term administration of oral corticosteroids and can persist for years after stopping therapy. A patient with adrenal insufficiency may become hypotensive when under physiological stress. The nature of dental treatment makes this a rare possibility, however, and if a patient collapses during dental treatment other causes should be considered first and managed before diagnosing adrenal insufficiency. Routine enquiry about the current or recent use of corticosteroids as part of the medical history prior to dental treatment should alert the Dental Practitioner to the patient at risk of this condition. Some patients carry a steroid warning card. Acute adrenal insufficiency can often be prevented by administration of an increased dose of corticosteroid prior to treatment.

Dental treatment that requires an increased steroid dose is that which may cause significant physiological stress. Usually, simple dental extractions and restorative procedures, including endodontics, are not a cause for concern, but surgical extractions or implant placement should be considered as a risk. Patients who are systemically unwell from a dentally related infection are also recommended to have a prophylactic increase in steroid dose in addition to any surgical and antimicrobial treatment indicated.

Guidance on the management of those patients with known Addison's disease is available from the Addison's Clinical Advisory Panel (http://www.addisons.org.uk/; accessed 30 September 2013), who recommend doubling the patient's steroid dose before significant dental treatment under local anaesthesia and continuing this for 24 hours.

2 Medical history, examination, investigations and risk assessment

KEY POINTS

- Crucial history-taking includes (A–E):
  1. allergies
  2. bleeding tendency
  3. cardiac history
  4. drug history
  5. endocrine disease (e.g. diabetes)
- Patients may be unclear about, or unaware of or not disclose their medical history or drug history
- Confidentiality is essential

PROTECTING PATIENTS

Health care aims to improve the health of patients but can itself carry risks. The first principle should be to do no harm (*primum non nocere*). Nevertheless, a UK report estimated that up to 18% of the population believe that they have suffered from a 'medical error', 10% of hospital admissions may result in something going wrong and 5% have had adverse effects from medical care. In a survey of Dutch oral surgeons who had had, on average, 21 years of work experience, 40% of respondents confirmed that they had experienced the death of a patient after oral surgery. Most of these patients had died after a dental extraction, the most important causes of death being postoperative spread of an infection, failure to survive cancer treatment, or heart and/or lung failure.

Operations are now associated with far less morbidity and mortality than formerly but there remains room for improvement. Morbidity and mortality in the dental surgery providing local anaesthesia (LA) and conscious sedation (CS) are rare but greater in patients with medical and/or dental problems; for example, extractions attributed to dental infections were significant predictors for risk factors for myocardial infarction compared with tooth extraction for trauma and other reasons in an Oslo study. Deaths as a result of the use of general anaesthesia (GA) in the dental surgery in the past were few but nevertheless provoked widespread public concern, and it is no longer permissible for a dentist in the UK to act as anaesthetist (this had been the case for some time in some other countries). *GA must only be given in a hospital with critical care facilities – because of the need to have resuscitation equipment available – and must be carried out by a qualified anaesthetist.*

If working in hospital, however, dentists may be required to assess patients for GA and to ensure that essential prerequisites are met before GA, and may need to manage GA patients postoperatively. They must therefore have an understanding of risk assessment and perioperative care.

RISK ASSESSMENT

At the start of a patient's visit, it is essential to:

1. obtain a careful medical, dental, family, social (and sometimes developmental) history, and make a risk assessment
2. assess the patient's needs and agree them with the patient
3. obtain the patient's valid consent to any investigations required
4. obtain the patient's consent to an agreed treatment plan.

Adequate risk assessment is essential and endeavours to anticipate and prevent trouble. The criteria of 'fitness' for a procedure are not absolute but depend on a number of factors, as shown in Box 2.1. Dentistry should be very safe, especially if the procedure is not dramatically invasive and the patient is healthy.

Surgical procedures are generally the most hazardous. The World Health Organization (WHO) recognizes this and grades risks on the basis of severity of the procedure (Table 2.1). WHO also identifies three phases of an operation at each of which, for patient safety, a checklist coordinator must confirm that the surgery team has completed the listed tasks before it proceeds:

- Before anaesthesia induction ('sign in')
- Before skin incision ('time out')
- Before the patient leaves the operating room ('sign out').

Drug use is also potentially dangerous; all agents should be carefully administered, particularly those acting on the neurological system and affecting consciousness and cardiac or respiratory functioning (e.g. sedatives and anaesthetic agents). Most oral care is given under LA and then morbidity is minimal. CS is not as safe as LA, though considerably safer than GA. Even so, CS must be carried out in appropriate facilities, by adequately trained personnel and with due consideration of the possible risks. By contrast, GA with intravenous or inhalational agents is only occasionally required for dental treatment and then only in a hospital setting; control of vital functions is impaired or lost to the anaesthetist. As stated above, GA is only permitted in a hospital with appropriate resuscitation facilities.

A patient attending for dental treatment who is apparently 'fit' may actually have serious systemic disease(s) and be taking drugs (including recreational drugs), either or both of which might influence the health care required. Many patients with life-threatening diseases now survive as a result of advances in surgical and medical care, and either or both can significantly affect the dental management or even the fate of the patient. Though this is most likely when treating hospital patients and other risk groups such as older people, one study showed that 30% of dental patients have a relevant medical condition. The risk is greatest when surgery is needed, and when GA or CS are

Box 2.1 *Factors influencing outcomes of health-care procedures*

- Health of the patient
- Type of procedure
- Duration of the procedure
- Degree of trauma and stress
- Degree of urgency of the procedure
- Skill and experience of the operator
- Skill and experience of the anaesthetist/sedationist
- Facilities and equipment

Table 2.1 *WHO grades of surgery*

Grade	Termed	Includes
1	Minor	Excision of skin lesion; drainage of breast abscess[a]
2	Intermediate	Primary repair of inguinal hernia; excision of varicose vein(s) of leg; tonsillectomy/adenotonsillectomy; knee arthroscopy
3	Major	Total abdominal hysterectomy; endoscopic resection of prostate; lumbar discectomy; thyroidectomy
4	Major+	Total joint replacement; lung operations; colonic resection; radical neck dissection; neurosurgery; cardiac surgery

[a] Includes dentoalveolar surgery.

Table 2.2 *Risk assessment and management*

Risks increased by	Risks reduced by
Increasing age	Planned treatment
Medical treatments	Non-invasive procedures
Surgical treatments	Monitoring
Lengthy dental procedures	Reassurance
Drug use – medication or recreational	Competent operator

Table 2.3 *American Society of Anesthesiologists (ASA) classification*

ASA class	Definition
I	Normal, healthy patient
II	A patient with mild systemic disease (e.g. well-controlled diabetes, asthma, hypertension or epilepsy), pregnancy, anxiety
III	A patient with severe systemic disease limiting activity but not incapacitating (e.g. epilepsy with frequent seizures, uncontrolled hypertension, recent myocardial infarct, uncontrolled diabetes, severe asthma, stroke)
IV	A patient with incapacitating disease that is a constant threat to life (e.g. cancer, unstable angina or recent myocardial infarct, arrhythmia or recent cerebrovascular accident)
V	Moribund patient not expected to live more than 24 h with or without treatment

Table 2.4 *American Society of Anesthesiologists (ASA) grades II and III*

	ASA II	ASA III
Chronic obstructive pulmonary disease (COPD)	Cough or wheeze; well controlled	Breathless on minimal exertion
Angina	Occasional use of glyceryl trinitrate (GTN)	Regular use of GTN or unstable angina
Hypertension	Well controlled on single agent	Poorly controlled; multiple drugs
Asthma	Well controlled with inhalers	Poorly controlled; limiting lifestyle
Diabetes	Well controlled; no complications	Poorly controlled or complications

given – and these problems may be compounded if close medical support is lacking.

Although every care must be taken to identify the medically compromised patient, it must be appreciated that the means to do so in conventional dental settings are limited and by no means always successful. It is impossible to legislate for all possibilities and there have been many cases where apparently fit people have died suddenly within a short time of being declared healthy on medical examination.

The main aims are to ensure that procedures are carried out:

- promptly but safely
- on the correct patient and at the correct site
- with minimal complications and the best possible outcome.

However, although risks arise mainly when the procedure is invasive (tissues are disrupted) and/or the patient is not healthy, they may also be a factor if health-care professionals (HCPs) are overambitious in terms of their skill or knowledge. Clinicians should work only within their field of competence. No interventional procedure is entirely free from risk but care can be improved by making an adequate assessment based on history, clinical signs and, where appropriate, investigations, and by minimizing trauma and stress to the patient (Table 2.2).

Assessment of the risks involved must include the health of the patient, which may be evaluated using a risk-stratification scoring system such as the Physical Status Classification of the American Society of Anesthesiologists (ASA) (Table 2.3). ASA I and II patients can generally be treated in general dental practice or community services. ASA III patients are often best treated in a hospital-based clinic where expert medical support is available. ASA IV and V patients are usually hospitalized or bedridden, and generally are only seeking emergency dental treatment.

Dental treatment must be significantly modified if the patient has an ASA score of III or IV, which is true of a relatively high percentage of patients aged 65–74 years (23.9%) and 75 years or over (34.9%). Controversies can arise in relation to the management of patients with ASA scores of II and III. Table 2.4 summarizes these scores for some of the more common disorders.

The Prognosis and Assessment of Risk Scale (PARS) is another assessment tool, which is virtually identical to the ASA scale but can be modified by factors such as those shown in Table 2.5; it categorizes patients into groups I–V. Other factors considered in PARS are shown in Table 2.6. The Karnofsky scale, which has been adapted for use in many areas including hospices, cancer clinics and so on, is a quick and easy way to indicate how a patient is feeling on a given day, without going through several multiple choice questions or symptom surveys (Table 2.7). The Medical Complexity classification is another available tool (Table 2.8).

Good communication is essential with both patient and other health professionals. Often, dental treatment in medically compromised patients may have to be delayed until expert advice has been sought and this is always the case for patients undergoing procedures under GA, who must be pre-assessed by the anaesthetist.

INFORMED CONSENT (OTHERWISE KNOWN AS VALID CONSENT)

The patient's autonomy must be respected at all times. Patients can determine what investigations and treatment they are or are not willing to receive. Before they are asked to make a decision, they must be given sufficient information about their condition, suggested treatment(s) (including alternative management if available), any associated risks involved in the proposed treatment, and possible outcomes if nothing is done. They have the right to refuse treatment, even if this could

Table 2.5 *Dental care modifications and the American Society of Anesthesiologists (ASA) scale and Prognosis and Assessment of Risk Scale (PARS)*

ASA	Definition	PARS	Dental care modifications
I	Normal, healthy patient	I	None
II	A patient with mild systemic disease (e.g. well-controlled diabetes, asthma, hypertension or epilepsy), pregnancy, anxiety	II	Dental care should focus on elimination of acute infection before medical/surgical procedure (e.g. prosthetic cardiac valve)
III	A patient with severe systemic disease limiting activity but not incapacitating (e.g. epilepsy with frequent seizures, uncontrolled hypertension, recent myocardial infarct, uncontrolled diabetes, severe asthma, stroke)	III	Dental care should focus on elimination of acute infection and chronic disease before medical/surgical procedure (e.g. organ transplant patients)
IV	A patient with incapacitating disease that is a constant threat to life (e.g. cancer, unstable angina or recent myocardial infarct, arrhythmia or recent cerebrovascular accident)	IV	All potential dental problems should be corrected before medical/surgical procedure (e.g. prior to radiotherapy to head and neck)
V	Moribund patient not expected to live more than 24 h with or without treatment	V	Control of acute dental pain and infection only

Table 2.6 *Prognosis and Assessment Risk Scale*

Factor	Comment
Medical status	Any complicating medical factors
Physical status	
Oral hygiene	
Psychological needs	
Functional ability	
Mental status	Level of understanding
Social environment	Support or significant events planned shortly after treatment
Family environment	
Access issues	Access to dental building, etc.
Financial issues	
Communication needs	Is an interpreter required?
Behaviour	Is behaviour management needed?
Consent	Is patient competent to give consent?

Table 2.7 *Karnofsky scale*

Score	Definition
100	Able to work. Normal, no complaints, no evidence of disease
90	Able to work. Able to carry out normal activity, minor symptoms
80	Able to work. Normal activity with effort, some symptoms
70	Independent, not able to work. Cares for self, unable to carry out normal activity
60	Disabled, dependent. Requires occasional assistance, cares for most needs
50	Moderately disabled, dependent. Requires considerable assistance and frequent care
40	Severely disabled, dependent. Requires special care and assistance
30	Severely disabled. Hospitalized, death not imminent
20	Very sick. Active supportive treatment needed
10	Moribund. Fatal processes are rapidly progressing

Table 2.8 *Medical Complexity classification*

Class	Medical condition	Status	Complications
MC-0	No significant medical problems	MC-0	No complications anticipated
MC-1	Controlled and stable condition/disease	MC-1A	No complications anticipated
		MC-1B	Minor complications anticipated
		MC-1C	Major complications anticipated
MC-2	Poorly controlled and/or unstable condition/disease	MC-2A	No complications anticipated
		MC-2B	Minor complications anticipated
		MC-2C	Major complications anticipated
MC-3	Cardiac or other conditions needing continuous monitoring		

adversely affect the outcome or result in their death. Depending on the situation, time should be allowed for the patient to think about and discuss the proposed treatment with people close to them. Consent is the expressed or implied agreement of the patient to undergo an examination, investigation or treatment. Consent is not an isolated event, but involves a continuing dialogue between clinician and patient (and occasionally their relatives or partner). In order to give informed (valid) consent, the individual concerned must have adequate reasoning faculties and be in possession of all relevant facts at the time consent is given. *Patients who undergo procedures performed without their valid consent may be entitled to claim damages in the civil courts by making a claim of negligence. The clinician is also vulnerable in the criminal courts to a charge of assault and battery following a complaint to the police by the person who received the treatment.*

Information about what the proposed investigations or treatment will involve, the benefits and risks (including adverse effects and complications), and the alternatives available is crucial for patients when they are making up their minds. The courts have stated that patients should be told about 'significant risks which would affect the judgment of a reasonable patient'.

'Significant' has not been legally defined but the General Medical Council (GMC) requires doctors to tell patients about 'serious or frequently occurring' risks. In addition, if patients make it clear that they have particular concerns about certain kinds of risk, the clinician must ensure that they are informed about these risks, even if they are very small or rare. Sometimes, patients may make it clear that they do not want any information about the options, but want the health professional to decide on their behalf. In such circumstances, ensure that the patient receives at least some very basic information about what is proposed. Where information is refused, this should be documented in the patient's notes and/or on a consent form. The important thing is for the clinician to record sufficient details of the consent process in order to be able to reconstruct the discussions and the thinking that led to a particular course of treatment in the event of a challenge at a later stage – possibly years later.

The patient's open agreement to proceed with the investigation or treatment proposed after full discussion and the patient's receipt of sufficient information is sometimes called 'informed consent'.

When obtaining consent, patients should be informed of:

- details of the diagnosis and prognosis with and without treatment
- uncertainties about the diagnosis
- options available for treatment
- the purpose of all aspects of a proposed investigation or treatment
- the likely benefits and probability of success
- any possible adverse effects and the risks of the procedure proposed
- the likelihood of one or more of the risks coming to pass
- likely outcomes if a procedure is not carried out
- the need for drains, catheters, tracheostomy, etc.
- their right to change their mind at any stage
- their right to a second opinion.

Other issues that should be discussed at this stage include:

- time of appointment or admission
- eating/starving instructions
- management of usual daily medications
- specific preoperative preparation that may be required
- transport to where the procedure will be performed
- specific anaesthetic issues
- anticipated duration of procedure
- likely recovery period
- likely discharge date
- specific postoperative care
- follow-up requirements
- anticipated date of return to full activity.

'Informed' consent means that the patient must be fully aware of the procedure, its intended benefits and its possible risks, and the level of these benefits and risks. In particular, patients must be warned about:

- preoperative preparation
- possible adverse effects
- postoperative sequelae (e.g. pain)
- where they will be during their recovery
- the possibility of intravenous infusions, catheters, nasogastric tubes, any deformity, swelling, bruising, pain, etc.

All questions should be answered honestly. Information should not be withheld that might influence the decision-making process. Patients should never be coerced. Finally, for consent to be valid, the person who obtains it must have sufficient knowledge of the proposed treatment and its risks, and should be the person who is undertaking the procedure.

At any time, the information on the form can be augmented by an additional record made in the patient's notes covering conversations, discussions or warnings.

Consent may be:

- implied (a patient lying in the dental chair with an open mouth is consenting to a dental examination).
- expressed in writing.

Although rarely a legal requirement (but frequently a contractual obligation), it is good practice to seek written consent on most occasions and this is essential where the treatment is complex or involves significant risks or adverse effects. Written consent must always be obtained from all patients having an operation. The possible benefits of the treatment must be weighed against the risks and always discussed by the person carrying out the procedure; if, for some reason, this is not possible, it must be done by a delegated person with the appropriate expertise to do so (i.e. a person who is competent to carry out the proposed surgery themselves as an independent practitioner in their own right). Written consent is also essential when provision of clinical care is not the primary purpose, the treatment is part of a project or research, or there are significant consequences for personal or social life. Your organization may have a policy setting out when you need to obtain written consent. A signature on a consent form does not itself prove the consent is valid; the point of the form is to record the patient's decision and also, increasingly, the content of the discussions that have taken place. A signed consent form is not a legal waiver; if, for example, patients do not receive enough information on which to base their decision, then the consent may not be valid, even though the form has been signed. A signed consent form will not protect the clinician if there is doubt as to whether consent was actually 'informed'. Ideally, the form should be designed to serve as an *aide-mémoire* to health professionals and patients, by providing a checklist of the kind of information patients should be offered, and by enabling the patient to have a written record of the main points discussed. However, the written information provided for the patient in no way should be regarded as a substitute for face-to-face discussions with the individual. Patients are also entitled to change their mind after signing the consent form, if they retain capacity to do so.

Although the law in relation to consent continues to evolve (as does most legislation) and there are significant variations between countries, the principles are as follows:

- Before examining, treating or caring for competent adults, consent must be obtained.
- Adults are assumed to be competent unless demonstrated otherwise.
- Patients may be competent to make some health-care decisions, even if they are not competent to make others.
- Giving and obtaining consent is usually a process, not a one-off event. *Patients can change their minds and withdraw consent at any time*.

For consent to be valid, patients must receive sufficient information about their condition and proposed treatment. It is the HCP's responsibility to explain all the relevant facts to the patient and to ascertain that they are understood. If there are doubts about their competence, the question to ask is: 'Can this patient understand, retain and then weigh up the information needed to make this decision?' If patients are not offered as much information as they reasonably need to make their decision, and in a form they can understand, their consent may not be valid. For example, information for those with visual impairment should be provided in the form of audio tapes, Braille or large print.

Patients whose first language is not English may need the help of an interpreter. Most organizations have access to experienced interpreters. It is preferable to rely on a neutral interpreter (i.e. *not* a family member) when examining and seeking consent from a patient for surgery or treatment.

Ensure the patient, staff and, where appropriate and in accordance with the patient's wishes, the patient's relatives and/or partner are kept fully informed. Maintain good, clear, contemporaneous records of the nature of all discussions that take place, including the names of those involved. Good communication and documentation can prevent future dispute and litigation. If there is any reason to believe

that consent may be disputed later, or if there are concerns about an individual's attitude or behaviour, meticulous documentation in the case notes is essential. The UK Department of Health's *Reference guide to consent for examination or treatment* (available at www.gov.uk/government/publications; accessed 30 September 2013) offers a comprehensive summary of the law on consent.

SPECIFIC CONSENT ISSUES

- No one else can make a decision on behalf of a competent adult.
- In an emergency, a life-saving procedure can be performed without consent.
- All actions must, however, be justifiable to one's peers.
- No one can give or withhold consent on behalf of a mentally incapacitated patient; decisions lie primarily with the clinicians, who should act in the patient's best interest. Where there is doubt, ultimately a court will decide on the best course of action, having taken expert advice. The Mental Capacity Act 2005 provides guidance for HCPs in England and Wales (see also The Adults with Incapacity (Scotland) Act 2000) who treat this group of patients. Guidance has been published by the UK Department of Health (Mental Capacity Act 2005 Code of Practice) and is available at http://www.dca.gov.uk/legal-policy/mental-capacity/mca-cp.pdf (accessed 30 September 2013).

Essentially, everyone aged 16 or more is presumed to be competent to give consent for themselves, unless the opposite is demonstrated.

Competent adults – namely, persons aged 16 and over who have the capacity to make their own decisions about treatment – can consent to dental treatment and they are also entitled to refuse treatment, even where it would clearly benefit their health. If a patient is mentally competent to give consent but is physically unable to sign a form, you should complete this form as usual and ask an independent witness to confirm that the patient has given consent orally or non-verbally.

If the patient is 18 or over and is not legally competent to give consent, you should use a form for adults who are unable to consent to investigation or treatment. Patients will not be legally competent to give consent if:

- they are unable to comprehend and retain information material to the decision; and/or
- they are unable to weigh and use this information in coming to a decision.

You should always take all reasonable steps (e.g. involving more specialist colleagues) to support patients in making their own decision before concluding that they are unable to do so.

Relatives *cannot* be asked to sign this form on behalf of an adult who is not legally competent to consent for him or herself, unless the patient has appointed a friend or relative to act for them, creating a lasting power of attorney (LPA). This LPA must have been created when the patient was competent and the LPA must be lodged with the Court of Protection. An LPA may allow the relative or friend to take decisions about the health of the patient, should the patient be found to be lacking capacity.

Children under the age of 16 years may also have capacity to consent if they have the ability to understand the nature, purpose and possible consequences of the proposed investigation or treatment, as well as the consequences of non-treatment. Children below 16 who have *Gillick* competence (i.e. they understand fully what is involved in the proposed procedure) may therefore consent to treatment without their parents' authority or knowledge, although their parents will ideally be involved. 'Gillick competence' is a term used in medical law to decide whether a child (16 years or younger) is able to consent to medical treatment, without the need for parental permission or knowledge:

> *As a matter of Law the parental right to determine whether or not their minor child below the age of sixteen will have medical treatment terminates if and when the child achieves sufficient understanding and intelligence to understand fully what is proposed.*

The standard is based on a House of Lords' decision in the case *Gillick v West Norfolk and Wisbech Area Health Authority* [1985] 3 All ER 402 (HL). The case is binding in England, and has been approved in Australia, Canada and New Zealand. Similar provision is made in Scotland by the Age of Legal Capacity (Scotland) Act 1991. In Northern Ireland, although separate legislation applies, the then Department of Health and Social Services Northern Ireland stated that there was no reason to suppose that the House of Lords' decision would not be followed by the Northern Ireland Courts.

Where a child under 16 years old is not deemed competent to consent, a person with parental responsibility (e.g. their legal parent or guardian, or a person appointed by the courts) has authority to consent for investigations or treatment that are in the child's best interests.

There are several legal tests that have been described in relation to consent. The *Bolam* test states that a doctor who:

> *acted in accordance with a practice accepted as proper by a responsible body of medical men skilled in that particular art is not negligent if he is acting in accordance with such a practice, merely because there is a body of opinion which takes a contrary view.*

However, a judge may, on certain rare occasions, choose between two bodies of expert medical opinion, if one is to be regarded as 'logically indefensible' (*Bolitho* principle). The main alternative to the Bolam test is the *'prudent-patient test'* widely used in North America. According to this test, doctors should provide the amount of information that a 'prudent patient' would want.

Obtaining consent from adult patients without capacity

The more elective the procedure, the more care should be taken in ensuring that the patient, parent, guardian or carer has been consulted. In true emergency situations, a dentist may rely on the best-intent principle in relation to the overall well-being of the patient, although, where there is any doubt, advice should be taken. Involve the patient as far as possible; some incapacitated patients may be quite capable of giving partial consent. Decide who else should be involved in any decision to proceed with the patient's treatment. The current position (in the UK) is that no adult can consent to the treatment of another adult (with the exception of cases that fall under the Mental Capacity Act 2005). Before anyone can give valid consent to treatment, she or he must possess the requisite capacity. The law presumes that, in the absence of evidence to the contrary, patients over the age of 16 years are capable of giving (or withholding) consent to treatment. The broad test of capacity is that the person concerned should be able

to understand the nature and purpose of the treatment and must be able to weigh the risks and benefits. They should be able to retain and weigh this information, as well as communicate their decision.

Where there is doubt, a decision has to be made as to the capacity of the patient. This presents a problem for dentists providing care for patients with learning impairment. Where the patient lacks the capacity to consent, then the dentist would normally act in the patient's best interests and treatment should not be withheld simply because consent has not been obtained, or a charge of failure in duty of care could be made. If a person is incapable of giving or refusing consent, and has not validly refused such care in advance, treatment may still be given lawfully if it is deemed to be in the patient's best interests. However, this should happen only after full consideration of its potential benefits and unwanted effects, and in consultation with the carer(s), relatives and other people close to the patient. Where treatment involves taking irreversible decisions or carrying greater risks, then the agreement of another dentist or doctor is appropriate. For those with learning difficulties, it is important to have a discussion with the parent, carer or, in their absence, two professionals who should sign their approval in the best interests of the patient. The discussions and agreement should be documented in the patient's record and, whilst this does not constitute consent, it represents good practice.

The Mental Health Act 1983 is primarily concerned with the care and treatment of people who are diagnosed as having a mental health problem which requires that they be detained or treated in the interests of their own health and safety or with a view to protecting other people.

The Mental Capacity Act 2005 applies to everyone involved in the care, treatment or support of people aged 16 years and over in England and Wales who lack capacity to make all or some decisions for themselves. This Act also applies to situations where a person may lack capacity to make a decision at a particular time due to illness, drugs or alcohol. Assessments of capacity should be time- and decision-specific. The Act clarifies the terms 'mental capacity' and 'lack of mental capacity', and says that a person is unable to make a particular decision if they cannot do one or more of the following:

- Understand information given to them
- Retain that information long enough to be able to make the decision
- Weigh up the information available to make the decision
- Communicate their decision; this could be done, for example, by talking, using sign language, or even making simple muscle movements such as blinking an eye or squeezing a hand.

A new criminal offence of ill-treatment or wilful neglect of people who lack capacity also came into force in 2007. Within the law, 'helping with personal hygiene' (that would include tooth-brushing) attracts protection from liability, as long as the individual has complied with the Act by assessing a person's capacity and acting in their best interests. 'Best-interest' decisions made on behalf of people who lack capacity should be the least restrictive of their basic rights and freedoms.

Further changes within the Act include the introduction of LPAs that extend to health and welfare decisions. When a health professional has a significant concern relating to decisions taken under the authority of an LPA that relate to serious medical treatment, the case can be referred for adjudication to the *Court of Protection*, which is ultimately responsible for the proper functioning of the legislation. The Act also created a new *Public Guardian* with responsibility for the registration and supervision of both LPAs and court-appointed deputies. Furthermore, *Independent Mental Capacity Advocates* (IMCAs) have been introduced to support particularly vulnerable incapacitated adults – most often those who lack any other forms of external support – in making certain decisions.

In Scotland, the position is complicated by the fact that the dentist has to comply with the Adults with Incapacity Act 2000. This requires the patient's doctor to issue a certificate before treatment. The document is procedure-specific and a new one is required for each treatment plan or in the event of a change to the plan. Episodes requiring GA or sedation not included in the original treatment plan will need further certification. The interesting nuance is that the dentist can assess capacity but it is the doctor who has to assess incapacity. This has created significant practical difficulties for many health-care providers.

Obtaining consent for child patients

Changing social patterns have meant that the position relating to who is able to consent to treatment for a child is no longer the same. Parental responsibility lies with the natural mother, natural father (if married to the mother at birth), adoptive parents or those who have temporary residence orders (where the child lives with them). The local authority may acquire responsibility. The natural father not married to the natural mother does *not* have parental responsibility. Parental responsibility can be granted by court order, by agreement with the mother or on her death, if stated in her will. Step-parents can be granted parental responsibility by court order.

It is important to remember that the legal situation with regard to consent varies around the world and is subject to continued debate and development.

THE USE OF RESTRAINT

Occasionally, patients may need some assistance in order to be able to undergo or cooperate with investigations or treatment. The dividing line between assistance and trespass to the person can be fine. Three forms of trespass to the person exist:

- Assault – the fear or threat of impending harm
- Battery – the unlawful application of force or unwanted touching
- False imprisonment – the infliction of restraint.

These issues must be considered carefully when the patient lacks the necessary capacity to understand the procedure being carried out. Any physical intervention is subject to the rule of 'reasonableness'. Sometimes it is necessary to control movements during operative procedures or to support an arm, for example, for the injection of intravenous drugs in order to prevent patients injuring themselves. It is wise to seek the assistance of a carer or relative at such times and to ensure that this is documented. Learning disabilities teams may be able to assist and are likely to have developed protocols and procedures to deal with such problems.

MEDICAL HISTORY

The history (or anamnesis) is the information gained by an HCP with the aim of formulating a diagnosis, providing medical care and identifying medical problems relevant to health care. The history is obtained from either the patient or people who know the patient and can provide the necessary information. History-taking also allows the HCP to develop rapport with the patient, place the diagnosis in the context of the patient's life, identify relevant physical signs, and assess mental state and attitude towards health care. Age and cultural factors may also be important (Appendices 2.1 and 2.2). Due cognisance must be taken of a person's "protected characteristics", of which there are nine (Table 2.9).

Table 2.9 *Protected characteristics*

Age	Where this is referred to, it refers to a person belonging to a particular age (e.g. 32 year olds) or range of ages (e.g. 18–30 year olds).
Disability	A person has a disability if s/he has a physical or mental impairment which has a substantial and long-term adverse effect on that person's ability to carry out normal day-to-day activities.
Gender reassignment	The process of transitioning from one gender to another.
Marriage and civil partnership	Marriage is defined as a 'union between a man and a woman'. Same-sex couples can have their relationships legally recognised as 'civil partnerships'. Civil partners must be treated the same as married couples on a wide range of legal matters.
Pregnancy and maternity	Pregnancy is the condition of being pregnant or expecting a baby. Maternity refers to the period after the birth, and is linked to maternity leave in the employment context. In the non-work context, protection against maternity discrimination is for 26 weeks after giving birth, and this includes treating a woman unfavourably because she is breastfeeding.
Race	Refers to the protected characteristic of Race. It refers to a group of people defined by their race, colour, and nationality (including citizenship), ethnic or national origins.
Religion and belief	Religion has the meaning usually given to it but belief includes religious and philosophical beliefs including lack of belief (e.g. Atheism). Generally, a belief should affect your life choices or the way you live for it to be included in the definition.
Sex	A man or a woman.
Sexual orientation	Whether a person's sexual attraction is towards their own sex, the opposite sex or to both sexes. http://www.equalityhumanrights.com/advice-and-guidance/new-equality-act-guidance/protected-characteristics-definitions/

Box 2.2 *Corah dental anxiety scale*

If you had to go to the dentist tomorrow, how would you feel about it?

- I would look forward to it as a reasonably enjoyable experience
- I wouldn't care one way or the other
- I would be a little uneasy about it
- I would be afraid that it would be unpleasant and painful
- I would be so anxious that I might break out in a sweat or almost feel physically sick

When you are waiting in the dental surgery for your turn in the chair, how do you feel?

- Relaxed
- A little uneasy
- Tense
- Anxious
- So anxious that I sometimes break out in a sweat or almost feel physically sick

When you are in the dentist's chair waiting while the drill is prepared to begin work on your teeth, how do you feel?

- Relaxed
- A little uneasy
- Tense
- Anxious
- So anxious that I sometimes break out in a sweat or almost feel physically sick

You are in the dentist's chair to have your teeth cleaned. While you are waiting and the dentist is getting out the instruments for scraping your teeth around the gums, how do you feel?

- Relaxed
- A little uneasy
- Tense
- Anxious
- So anxious that I sometimes break out in a sweat or almost feel physically sick

It may occasionally be helpful to carry out a formal assessment of the patient's feelings about health care, and tools such as the Corah anxiety scale are available for this (Box 2.2; Ch. 10).

When taking a history, a structured guide such as that shown in Box 2.3 should be followed. Patients should also be given a form on which to supply all the information they can about their health and any medication they are receiving. Medical and drug history should be regularly updated at subsequent dental visits. *Remember that all such information is confidential.*

Box 2.3 *Essentials of history-taking*

- Personal details
- Presenting complaint (PC)
- History of presenting complaint (HPC)
- Relevant medical history (RMH)
- Drug history
- Social history
- Family history

PERSONAL DETAILS

The patient's personal details include age, sex, educational status, religion or faith, occupation, relationship status, address and contact details. This information is necessary for administrative purposes and, since the questions are largely non-threatening, this stage provides a gentle introduction into the meeting of patient and clinician, in a format that can be individualized to suit a particular culture.

PRESENTING COMPLAINT

This should be recorded in the patient's own words (e.g. 'pain in my face').

HISTORY OF PRESENTING COMPLAINT

The timing of the complaint and its evolution should be elicited. If the patient has pain, a useful mnemonic is 'SOCRATES': S – site, O – onset (gradual/sudden), C – character, R – radiation, A – associations (other symptoms), T – timing/duration, E – exacerbating and alleviating factors, S – severity (pain rated on a visual analogue scale of 1 [minimal] to 10 [unbearable]).

RELEVANT MEDICAL HISTORY

This includes any past medical and surgical problems. Patients should be asked if they carry a medical warning card or device and careful note should be taken of it, particularly in respect of allergies, a bleeding disorder, cardiac disease or diabetes (see, for example, Medic-Alert and Talisman; Figs 2.1–2.3). Patients increasingly wear wristbands and bracelets that show the major medical issues they face. These may be seen clearly in writing; available electronically with bar codes or QR codes; supplied on a USB stick; or provided on a chip that is available for electronic scanning with a sensor (Fig. 2.4).



Fig. 2.1 Medic-Alert bracelet. The patient's main diagnosis or drug treatment is engraved on the reverse, together with the telephone number of the company that holds details of the medical history.



Fig. 2.2 Diabetes alert necklace.



Fig. 2.3 Talisman warning emblem.



Fig. 2.4 Electronic reading of medical data. (Courtesy of Google).

Box 2.4 *Review of systems (see Table 2.10)*

- Allergies
- Bleeding disorders
- Cardiorespiratory disorders
- Drug treatment
- Endocrine disorders
- Fits or faints
- Gastrointestinal disorders
- Hospital admissions and attendances
- Infections
- Jaundice and liver disease
- Kidney and genitourinary disorders
- Likelihood of pregnancy
- Mental state
- Neurological problems

The completion of a medical history form provides a useful basis for the dental professional to enquire further, and the following chapters describe in more detail the nature and relevance of any diseases that are mentioned. The completion of such a form and appropriate response to its contents also constitute useful evidence when the clinician is faced with any medico-legal claims. The medical history is crucial but has limitations, not least because patients may be confused or ill informed. *The history may also change radically with time, so it is essential for it to be updated before each new course of treatment and every sedation session, and especially before surgery or GA.* For example, patients not pregnant at one course of treatment could well be by the next. One study followed a small group of middle-aged and older dental patients, and found that nearly 20% developed significant medical disorders (mostly cardiovascular) over a period of 5 years.

Functional enquiry or review of systems (ROS) helps disclose undeclared medical problems. Patients should be asked specifically about their conditions; Box 2.4 offers an alphabetical list that is easy to recall.

The relevance of the main points from the history is shown in Table 2.10. It may also be necessary to enquire about constitutional symptoms (e.g. fever, weight loss, night sweats, fatigue/malaise/lethargy, sleeping pattern, appetite, fever), musculoskeletal conditions (pain, stiffness, swelling of the joints), and rash, blistering or lumps (Figs 2.5–2.8).

DRUG (MEDICATION) HISTORY

Enquire whether the patient has any allergies, and ask for a description of any reactions that have occurred.

Often, a medical problem is revealed only after a drug history has been elicited, but some patients may be unaware of the name of, or reason for taking, their medication. Multiple drug use is common in older people with complex medical histories (Figs 2.9–2.11). Sometimes, the nature of the drug used may be suggested by the name (Table 2.11). Ask the patient if they are taking any prescription-only medication (POM; this may be tablets, injections, patches or inhalers) and also any over-the-counter (OTC) medications, including herbal preparations. Some of these can influence health care.

SOCIAL HISTORY

Enquire tactfully about occupation, marital status, partner's job and health, housing, dependants, mobility, lifestyle habits (alcohol,

Table 2.10 *Relevance of medical history to dentistry*

Condition	Main features	Other comments	Relevance in dentistry
Allergies	Range from urticaria to anaphylaxis	Rashes? Racial origins may be important, especially in the case of drug reactions. Carbamazepine-induced Stevens–Johnson syndrome is strongly associated with HLA-B1502 in Han Chinese, Hong Kong Chinese, Thais and Indians, and HLA-A3101 in Northern Europeans	Common allergies relate to latex, iodine, Elastoplast® and drugs (hence acronym 'LIED'). Anaesthetics, analgesics (e.g. aspirin or codeine) and antibiotics (e.g. penicillin) are main offending drugs
Bleeding disorders	Bleeding and/or bruising	Haematological/lymphatic: lymph node swelling? Bleeding or bruising? History of involvement of other family members or of admission to hospital for control of bleeding is particularly important	Significant hazard to surgery
Cardiorespiratory disorders	Wheezing, cough, dyspnoea, chest pain, swelling of ankles, palpitations, hypertension	Chest pain? Shortness of breath? Exercise tolerance? Orthopnoea? Oedema? Palpitations? Cough? Sputum? Wheeze? Haemoptysis? Patient's ability to climb 15–20 stairs without pain, dyspnoea or tiredness may indicate degree of fitness of cardiorespiratory system	Often a contraindication to GA or CS
Drug treatment	Obtaining useful answers about drug treatment, including over-the-counter medications, will necessitate asking: 'Do you ever have any injections or take drugs, pills, tablets, medicines or herbal preparations of *any* kind?'	Drug use may be only indication of serious underlying disease. Corticosteroids, antihypertensives, anticonvulsants, anticoagulants, antibiotics, insulin and oral hypoglycaemics are all important in this respect	Most serious drug interactions are with GA agents (intravenous or inhalational), monoamine oxidase inhibitors and antihypertensive drugs. Aspirin and other non-steroidal anti-inflammatory drugs (NSAIDs) may be a hazard in anticoagulated, asthmatic, diabetic or pregnant patients, those with peptic ulcer, or children under 16 y. If patient does not know name of medicines, defer treatment until drug is identified by patient's doctor, Drugs Information Unit or pharmacy, or by checking *Monthly Index of Medical Specialties* (MIMS), *Physicians' Desk Reference* (PDR) or *British National Formulary* (BNF)
Endocrine disorders	Diabetes mellitus may lead to collapse	Diabetes: irritability, aggression, lassitude, anorexia, weight loss Hyperthyroidism: heat intolerance, emotional lability, sweating, diarrhoea, oligomenorrhoea, weight loss despite increased appetite, tremor, palpitations, visual disturbances Hypothyroidism: dislike of cold weather, lethargy, tiredness, depression, dry skin and hair, hoarseness, menorrhagia, constipation Hyperadrenocorticism: weight gain and redistribution, moon face, hirsutism, skin striae, purpura Hypoadrenalism: weakness, weight loss, hypotension, pigmentation	Hypoglycaemia is main problem
Fits or faints	History of fits or faints	Type? Frequency? Precipitating factors? Awareness may allow preventive measures to be instituted	Fainting, epilepsy and other causes of loss of consciousness can disrupt dental treatment and may result in injury to patient
Gastrointestinal disorders	Abdominal pain, frequency and type of stool, bleeding and weight loss	Difficulty swallowing? Indigestion? Nausea/vomiting/haematemesis? Bowel habit? Faecal colour, consistency, blood (or melaena), smell, difficulty flushing away, tenesmus (feeling of incomplete evacuation) or urgency?	Crohn disease or coeliac disease may lead to oral complications, and gastric disorders may increase risk of vomiting during GA
Hospital admissions and attendances	Hospital admissions may also indicate underlying disease, and past operations may suggest possibility of future complications that can influence dental treatment		A history of operations may provide knowledge of possible reactions to GA and surgery. A patient who has had a tonsillectomy, for example, without complications is most unlikely to have a congenital bleeding disorder. Retinal operations, since they may use intraocular gases, may be a contraindication to GA or relative analgesia, which may cause rapid expansion of ocular gas and lead to blindness

(*Continued*)

Table 2.10 (Continued)

Condition	Main features	Other comments	Relevance in dentistry
Infections	Various, possibly rashes and/or fever	Ever attended a clinic for sexually shared infections (SSIs), or been admitted to hospital for an infection, or been accepted or refused for blood donation? Men who have sex with men, abusers of intravenous drugs and patients who have attended SSI clinics are more likely to have a history of infection with human immunodeficiency virus (HIV), hepatitis viruses, herpes simplex, syphilis, gonorrhoea and many other infections (Ch. 21)	The possibility of transmission of infections and their sequelae must be considered. Carriers of meticillin-resistant *Staphylococcus aureus* (MRSA) may be a hazard to others; carriers of *Neisseria meningitides* may be sources of meningitis outbreaks
Jaundice and liver disorders	A history of jaundice may imply carriage of hepatitis viruses, although jaundice is a clinical sign of other underlying liver diseases		Liver disease can lead to prolonged bleeding and impaired drug metabolism can result (Ch. 9). Jaundice after an operation may have resulted from halothane hepatitis and, if this is suspected, a different general anaesthetic, such as isoflurane, desflurane or sevoflurane, should be given
Kidney and genitourinary disorders	Manifestations of chronic kidney disease may include hypertension, pallor and bruising	Incontinence (stress or urge), dysuria (pain), haematuria, nocturia, frequency, polyuria, hesitancy, terminal dribbling? Vaginal discharge?	Can affect dental management, as excretion of some drugs is impaired. Tetracyclines should be given in lower doses. Complications of renal failure or transplants can produce oral signs
Likelihood of pregnancy		Menses (periods) – frequency, regularity, heaviness, duration, painfulness? First day of last menstrual period (LMP)? Number of pregnancies and births? Menarche? Menopause? Any chance of pregnancy now? Which trimester?	Any essential procedures involving drugs (even aspirin), radiography or GA should be arranged during middle trimester
Mental state	Behavioural changes	Appearance and behaviour; thought (speech) form, rate, quantity, pattern, flight of ideas, loosening of associations; mood (subjective); affect (observed); thought content, preoccupations, obsessions, overvalued ideas, ideas of reference, delusions; suicidality; abnormal experiences, hallucinations, passivity, thought interference; cognition; consciousness; attention/concentration; memory; orientation; intelligence; executive function; insight. It may sometimes be useful to assess degree of patients' anxiety in a relatively objective way by using Corah dental anxiety scale (see Box 2.2)	Anxiety is inexorably associated with attending for dental treatment. Anxious patients may sometimes react aggressively and anxiety may limit extent of dental treatment that can be provided under LA
Neurological problems		Special senses – any changes in sight, smell, hearing and/or taste? Seizures, faints, fits, funny turns? Headache? Pins and needles (paraesthesiae) or numbness? Limb weakness, poor balance? Speech problems? Sphincter disturbance?	Movement disorders can significantly disrupt operative procedures. Access can be a barrier to care



Fig. 2.5 'Boxer's ear', showing distortion.



Fig. 2.6 Cyst in submental region.



Fig. 2.7 Facial bruising.



Fig. 2.8 Lipoma.

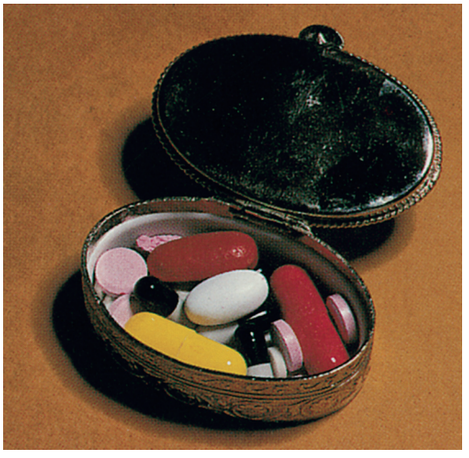


Fig. 2.9 Pill box presented by an outpatient who proved to be taking eight different medications daily, including a corticosteroid.

tobacco, betel, etc., and recreational drugs), culture and faith. Any social or religious engagements that are dependent on the patient being unimpeded following an elective treatment (wedding, examination, job interview) need discussion and possibly the treatment should be rescheduled; see also Chapters 25, 28 and 30.

FAMILY HISTORY

The medical history of blood relatives may be very informative.



Fig. 2.10 Manual organizer for multi-drug therapy.



Fig. 2.11 Digital organizer for multi-drug therapy. (Courtesy of Google).

CLINICAL EXAMINATION

It is important for dental professionals not merely to inspect and examine the mouth and neck, but also to inspect the exposed areas of the patient (the face, neck, arms and hands). The patient's appearance, behaviour, speech and body language can reveal many significant conditions (Fig. 2.12). However, it must be stressed that even very ill patients can look remarkably well. A search should be made for such readily visible signs as anxiety, movements, tremors, dyspnoea, wheezing and tiredness, and also for changes in the face (e.g. expression, pallor, cyanosis or jaundice), neck (e.g. lumps) or hands (e.g. finger clubbing, Raynaud phenomenon, rashes).

Facial movement and sensation should be assessed in the course of testing the cranial nerves (Ch. 13). Eyes and ears should be observed and examined (Fig. 2.13). Maxillary, mandibular or zygomatic deformities or swellings may be more reliably confirmed by inspection from above (maxillae, zygomas) or behind (mandible). The degree and direction of opening of the mandible should be assessed; this can be disturbed in temporomandibular joint (TMJ) disease and

Table 2.11 *Drug names and possible identification*

Drugs ending in …	Possible type of drug[a]
-am	Benzodiazepines
-ase	Fibrinolytics
-apine	Antipsychotics
-asone/one	Corticosteroids
-azine	Antipsychotics
-azole	Azole antifungals
-azosin	α-adrenoreceptor blockers
-cillin	Penicillins
-cin	Some antimicrobials
-coxib	Newer non-steroidal anti-inflammatory drugs (NSAIDs)
-cycline	Tetracyclines
-dopa	Antiparkinsonian agents
-dronate/dronic	Bisphosphonates
-erol	β_2 agonists (used for asthma)
-fibrate	Fibrates
-gatran	Newer oral anticoagulants (NOACs)
-imab/umab	Monoclonal antibodies (MoAbs)
-ipine	Calcium-channel blockers
-lukast	Leukotriene-receptor antagonists
-navir	Protease inhibitors (PIs)
-nitrate	Nitrates
-olol	Beta-blockers
-ovir	Antivirals
-parin	Heparins
-prazole	Proton-pump inhibitors (PPIs)
-pril	Angiotensin-converting enzyme inhibitors (ACEIs)
-relin	Gonadorelin analogues
-salazine	Salicylate derivatives
-sartan	Angiotensin-receptor antagonist
-setron	$5HT_3$ antagonists
-statin	Statins
-terol	β_2-adrenergic agonist
-tidine	H_2-receptor antagonists
-triptan	$5HT_1$ agonists
-tropium	Antimuscarinic bronchodilators
-vudine	Nucleoside reverse transcriptase inhibitors (NRTIs)

[a]Always check in *British National Formulary* (BNF).



Fig. 2.12 Café-au-lait patch indicative of neurofibromatosis.

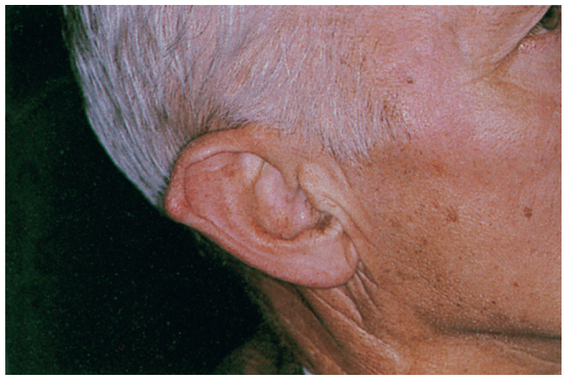


Fig. 2.13 Gouty tophi.



Fig. 2.14 Salivary gland swelling.

other conditions causing restricted mouth-opening (trismus) discussed in Chapter 4.

Inspection of the major salivary glands may reveal swelling of the parotid gland, which causes outward deflection of the lower part of the ear lobe, best observed by looking at the patient from behind (Fig. 2.14).

Examination of the neck is crucial. The patient should be observed from the front but also the neck should be palpated, as swollen lymph nodes are sometimes a sign of disease (Fig. 2.15). One-third of the body's lymph nodes are in the neck.

Hands can show a number of features. Deformities can be seen in arthritis (Fig. 2.16). Palmar erythema may occur in liver disease and rheumatoid arthritis. Finger-clubbing may be congenital or is seen in cardiorespiratory disease and liver cirrhosis. Koilonychia (spoon-shaped nails) is seen in iron deficiency; leukonychia (white nails) in liver cirrhosis; nail defects in lichen planus (Fig. 2.17), chronic candidosis and psoriasis; nail haemorrhages in infective endocarditis; and pigmentation in drug use (e.g. zidovudine; Fig. 2.18). Raynaud phenomenon can be a feature of connective tissue disorders. Finger-joint deformities can occur in rheumatoid arthritis. Dupuytren contracture (Ch. 4) may be seen in alcoholic cirrhosis and muscle contractures in cerebral palsy.

Hair can show features in several conditions. Alopecia may be autoimmune, may be seen in lichen planus, or may occur after radiation.



Fig. 2.15 Cervical lymphadenopathy.



Fig. 2.16 Arthritis.



Fig. 2.17 Lichen planus nail deformity.

Hirsutism is a feature of adrenogenital syndrome or Cushing disease, or may be caused by ciclosporin, corticosteroids, minoxidil, phenytoin or androgenic steroids.

The face may be unusual in many syndromes, such as Down syndrome or mucopolysaccharidoses. It may exhibit bruising from trauma

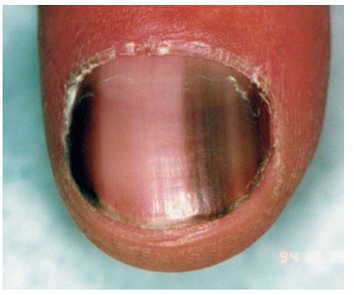


Fig. 2.18 Nail discolouration may be seen after trauma or in local disease, such as fungal infections, in drug use (as here) or in systemic disease.



Fig. 2.19 Subconjunctival haemorrhage associated with zygomatic fracture.

(Fig. 2.19) or purpura; cushingoid facies due to Cushing disease or corticosteroid treatment; and a mask-like facies in scleroderma. Facial telangiectasia is seen in hereditary haemorrhagic telangiectasia, cirrhosis and CREST (*c*alcinosis, *R*aynaud, o*e*sophageal dysfunction, *s*cleroderma, *t*elangiectasia) syndrome. Facial palsy may indicate stroke or Bell palsy. Neurofibromatosis (Fig. 2.20), tumours (Fig. 2.21) and cysts (Fig. 2.22) may present as lumps. Infection may cause swelling (Fig. 2.23). Myxoedema may indicate hypothyroidism. 'Butterfly rash' over the face may indicate systemic lupus erythematosus, while angiofibromas may underlie tuberous sclerosis (epiloia; Fig. 2.24). A malar flush can be seen in mitral valve stenosis, xanthelasmas in hyperlipidaemia, and cyanosis in hypoxia – cardiac or respiratory disease. Pallor is seen in anaemia or before an imminent faint; purpura may occur in thrombocytopenia or trauma; hyperpigmentation can be racial, or due to suntan, Addison disease or chronic drug (e.g. phenothiazine) use; and hypopigmentation can be caused by vitiligo (Fig. 2.25).

Eyes may show features of disease. Exophthalmos can be seen in hyperthyroidism, and ptosis in myopathy and Horner syndrome. Blue sclerae can be features of infancy and osteogenesis imperfecta.



Fig. 2.20 Neurofibromatosis.



Fig. 2.21 Basal cell carcinoma.



Fig. 2.22 Sebaceous cyst.



Fig. 2.23 Cat scratch disease.



Fig. 2.24 Tuberous sclerosis showing adenoma sebaceum.



Fig. 2.25 Vitiligo.



Fig. 2.26 Exfoliative cheilitis.

Conjunctival haemorrhage can indicate trauma, fractured zygoma or purpura. Jaundice can imply liver disease.

The lips can show cheilitis (e.g. factitious; Fig. 2.26), lichen planus (Fig. 2.27) or erythema multiforme. Angular stomatitis can be associated with denture-related stomatitis, anaemia, haematinic deficiency, diabetes, human immunodeficiency virus (HIV) and other diseases (Fig. 2.28). Lip swelling may be seen after trauma and in infections, neoplasms, allergies, Crohn disease, sarcoidosis or angioedema. Lip pigmentation may underlie Peutz–Jeghers syndrome. 'Hanging jaw' is a feature of myasthenia gravis.

Lumps may indicate neoplasms (Fig. 2.29). *Salivary gland* swellings can represent mumps, Sjögren syndrome, sialosis or tumour (Ch. 4).

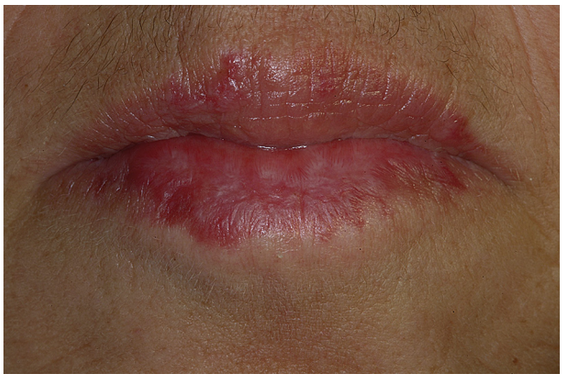


Fig. 2.27 Lichen planus on lips.



Fig. 2.28 Angular stomatitis.



Fig. 2.29 Osteoma.

Jaw prognathism and thickened facies can be features of acromegaly. *Cervical lymph node* enlargement is seen in HIV and other infections, malignancy and leukaemia.

Loss of weight or emaciation can be features of anorexia, malignant disease, tuberculosis or HIV infection.

Speech disturbances may suggest drug intoxication, hyposalivation, learning disorder, and neurological or muscle diseases.

Inpatients must always have a full physical examination before an operation, which may include inspection, palpation, percussion and auscultation, and covers examination of at least the following systems:

- Lymph nodes
- Cardiovascular – pulse, blood pressure, heart sounds
- Respiratory – respiratory rate, lung expansion, tracheal position, lung sounds
- Gastrointestinal – any swelling or restriction of movement or tenderness, together with palpation for masses and tenderness
- Neurological – especially the cranial nerves.

Most evidence shows that the history and physical examination often reveal most, if not all, of the clinically useful data. Before any investigations are initiated, the patient's consent must be obtained. Confidentiality must be respected; the history, examination and investigation findings should not be divulged except when there is expressed consent.

INVESTIGATIONS

Investigations are useful only when the appropriate tests are requested, and interpreted in the light of the history, clinical findings, knowledge and experience. It is useless and potentially dangerous to request investigations, the results of which will have no influence on the diagnosis or management.

Screening for latent medical problems is *sometimes* appropriate, mainly when effective action can be taken on the basis of the results. Several relevant treatable conditions, particularly hypertension and diabetes, are frequently unsuspected. For example, blood and urine glucose levels may be abnormal in 5% or more of dental patients. However, it is important not to undertake testing that may cause unnecessary anxiety, trauma, delay or expense.

Many studies have shown the *disadvantages* of 'routine' and 'screening' tests, even preoperatively, carried out with little focus; too often, trivial or inexplicable findings are revealed and unnecessary anxiety and stress caused.

PREOPERATIVE TESTS

Preoperative tests may provide information to reduce possible harm or increase benefit to the patient by altering surgical or sedation/anaesthetic management, and may help risk assessment and guide discussion with the patient that is relevant to informed consent. They may predict postoperative complications and establish a baseline measurement for later reference. Before any investigation is requested, however, it is important for there to be a high enough likelihood of finding an abnormal result and for an abnormal result genuinely to change the patient's management. Most preoperative tests (typically, a full blood count, prothrombin time [PT] or international normalized ratio [INR], activated partial thromboplastin time [APTT], basic metabolic panel and urinalysis) performed on elective surgical patients prove to be normal: findings influence management in under 3% of patients tested. In almost all cases, no adverse outcomes are observed when clinically stable patients undergo elective surgery, irrespective of whether an abnormal test is identified. Preoperative testing is appropriate in symptomatic patients and those with risks factors for which diagnostic testing can provide clarification of a patient's surgical risk. The National Institute for Health and Care Excellence (NICE; formerly the National Institute for Health and Clinical Excellence) guidelines are generic and lack consensus (http://publications.nice.org.uk/preoperative-tests-cg3; accessed 25 May 2013); hospitals may have their own guidelines and individual clinicians remain ultimately responsible.

Table 2.12 *Grades of surgery*

Grade	Examples of procedures
1	Excision of lumps and bumps, incision of abscesses, tooth removal
2	Arthroscopy, herniorrhaphy, tonsillectomy, varicose veins
3	Hysterectomy, thyroidectomy, endoscopic prostatectomy
4	Major bowel, head and neck, lung and joint surgery, and joint replacement Neurosurgery Cardiovascular surgery

(adapted from NICE).

For the purpose of preoperative tests, NICE categorizes surgical procedures into four grades on the basis of complexity and physiological insult (Table 2.12).

The NICE recommendations are in the form of 'look-up' tables set out by surgery grade and ASA grade (http://www.nice.org.uk/nicemedia/live/10920/29090/29090.pdf; accessed 30 September 2013):

- Plain chest X-ray (radiograph)
- Resting electrocardiogram (ECG)
- Full blood count
- Haemostasis – including PT, APTT and INR
- Renal function – including tests for potassium, sodium, creatinine and/or urea levels
- Random blood glucose
- Urine analysis (urine dipstick tests – test for pH, protein, glucose, ketones, blood/haemoglobin).

There are also recommendations for sickle cell test and pregnancy tests, and:

- blood gases – for ASA grades II and III only
- lung function (peak expiratory flow rate, forced vital capacity and forced expiratory volume) – for ASA grades II and III only.

Chest radiograph (X-ray)

The likelihood of identifying undiagnosed cardiorespiratory disease and the desirability of re-evaluating patients with known conditions need to be balanced against the radiation exposure. In general, ASA I patients do not require preoperative chest X-rays (CXRs), with the *possible* exception of smokers over the age of 60 who are undergoing grade 3 or 4 surgery. Certain types of surgery *may* warrant a CXR at some point in the patient's work-up (e.g. cardiothoracic, oesophageal, and major head and neck surgery). ASA III patients with cardiovascular disease undergoing anything more than grade 1 surgery should probably have a CXR. This should not be repeated if one has been done within 6 months unless the patient's symptoms or signs have changed; in many cases, it could be argued that echocardiography provides more useful information and avoids radiation exposure. Respiratory disease that has changed in its nature or severity with time is a probable indication for CXR, with the exception of patients between the ages of 16 and 40 undergoing grade 1 surgery.

Electrocardiogram

An electrocardiogram (ECG) may on occasion provide evidence of asymptomatic cardiovascular disease and, in those with known cardiac disease, is useful in estimating risks of GA and surgery. An ECG should be obtained for smokers, for patients with a history or symptoms of cardiac, respiratory or renal disease undergoing grade 4 surgery, and for all patients over the age of 60, regardless of the grade of surgery.

Full blood count (full blood picture)

Full blood count (FBC) may identify and quantify pre-existing anaemia and help assessment of the patient's likely tolerance of any blood loss. FBC is probably indicated in all patients undergoing grade 3 or 4 surgery, particularly in patients with cardiovascular or respiratory disease, for all patients with renal disease, and for all patients over 60 undergoing grade 2 surgery. The white cell count (WCC) may be useful if infection is suspected, and the platelet count where there is suspicion or a history of bleeding tendency.

Haemostasis tests

Haemostatic tests include the platelet count, PT, INR and APTT (Ch. 8). Indications for such tests preoperatively are patients taking anticoagulants; those on haemodialysis; those with a past history or family history of abnormal bleeding, bruising, or liver, kidney or vascular disease; before surgery with the potential to cause a large blood loss so that the need for transfusion is likely; before surgery for cancer, especially where liver metastases may have resulted in a bleeding tendency; and before arterial reconstructive surgery. Investigations should also be considered when regional anaesthesia is planned, particularly using spinal and epidural techniques.

Renal function tests (urea and electrolytes)

Renal function should be assessed in all patients with known renal disease, diabetes, liver dysfunction, and those with an ileus, who are parenterally fed or who are likely to have intravenous fluid administration and perioperative fluid loss.

All adults and children should have urea and electrolyte tests (U&Es) before grade 4 surgery (U&Es are otherwise not generally required in children). These tests are needed in all adults of ASA III or those undergoing grade 3 surgery. Older patients may have asymptomatic deteriorating renal function, so U&Es should be obtained for those aged 60 and over, and before grade 3 surgery. In patients with cardiovascular disease, U&Es are needed in those aged 60 and over undergoing grade 2 surgery.

Sickle test

A sickle test should be requested for all patients of African and West Indian origin, and probably also for those of Mediterranean and Indian origin.

IMAGING

X-RAYS (RADIOGRAPHY)

Radiography, fully discussed elsewhere (see https://www.gov.uk/government/publications/the-ionising-radiation-medical-exposure-regulations-2000), is particularly helpful diagnostically since it is inexpensive, rapidly achieved and widely available. Conventional radiography is useful for imaging: bone and joint disease, fractures and dislocations, antral and dental disease (Table 2.13). Plain X-rays have a relatively low radiation dose and special procedures can achieve soft-tissue imaging, albeit with a higher radiation dose.

Table 2.13 *Radiographs recommended for demonstrating various head and neck sites*

Region required	Standard views	Additional views
Skull[a]	Postero-anterior (PA) 20	Submento-vertex (SMV)
	Lateral	Tangential
	Townes (1/2 axial view)	
Facial bones	Occipito-mental (OM)	Zygoma
	OM 30 Lateral	Reduced exposure SMV
Paranasal sinuses	OM for maxillary antra	Upper occlusal or lateral SMV
		Dental panoramic tomography (DPT), tomography
Orthodontics	DPT	
	Cephalometric lateral skull	
Pre- and post-osteotomy	DPT	
	Cephalometric lateral skull	
	Cephalometric PA skull	
Nasal bones	OM 30	
	Lateral	
	Soft tissue lateral	
Mandible	DPT	Lateral obliques
		PA mandible
		Mandibular occlusal
Temporomandibular joints	Transcranial lateral obliques or DPT (mouth open and closed)	Transpharyngeal Arthrography Reverse Townes Reverse DPT Consider CT scan/ MRI

[a] CT scanning is valuable in craniofacial injuries.

Radiography requests are essential to enable the radiographic staff to provide the best or most appropriate radiographs for the region under investigation:

1. Fill in the request form as fully as possible with full, relevant, clinical findings.
2. Request the region required rather than specific views, except for dental panoramic tomography, when the term 'DPT' will suffice.

COMPUTED (AXIAL) TOMOGRAPHY

A computed tomography (CT) or computed axial tomography (CAT) scan is a type of repeated special radiograph taken across 'slices' of the body to build up a complex image, using several beams simultaneously from a number of different angles (Fig. 2.30). Cone beam CT (CBCT) is a variant, increasingly used in dentistry for implant work especially (see below).

Advantages

- CT provides good anatomical representation of hard tissues (bone and cartilage).
- It is generally better than magnetic resonance imaging (MRI) for examining lymph nodes.
- It provides good cross-sectional representation.

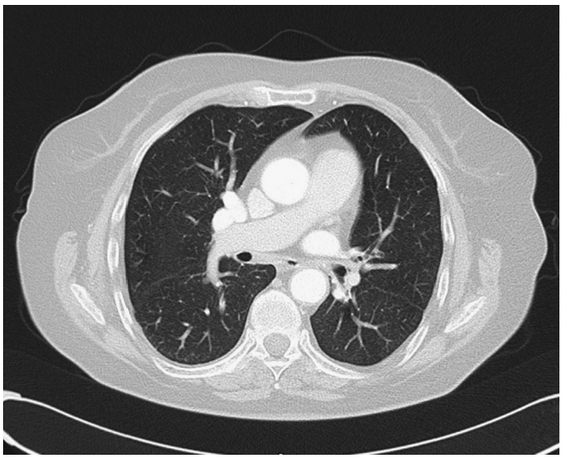


Fig. 2.30 Computed tomography scan of chest.

- Multiplanar reconstruction is possible from the raw data of the initial examination.
- Three-dimensional reconstruction is possible.
- It provides guidance for biopsies.
- Compared with MRI:
  imaging is more rapid (in seconds – compared with MRI, which takes minutes)
  it is less affected by motion artefact, since it is quicker
  it can be used on patients for whom MRI is inappropriate (e.g. claustrophobics, or people with pacemakers or ferrous or paramagnetic aneurysm clips).

Disadvantages

- CT gives a significant radiation dose.
- It provides phasic imaging of vascular structures and tumours.
- It is an expensive procedure.
- The whole CT procedure may take up to 1 hour, but often takes less than 30 minutes.
- Some patients experience claustrophobia in the CT scanner.

Indications

CT allows visualization of 3–10-mm sections of the body in two dimensions with enough clear distinction between black, grey and white areas of the image to allow pathological diagnosis in many cases.

It is particularly useful in examining the chest or abdomen. CT using contrast media makes it possible to visualize abnormalities more clearly.

Contraindications

Contraindications include pregnancy and history of severe allergies; this may preclude the use of a contrast agent.

Procedure

1. Patients may be asked not to eat beforehand.
2. Patients may have to swallow or be injected intravenously with contrast material that will show up against the tissue on the final pictures.

3. Patients must lie on a couch, which will move through the scanner.
4. The radiographer can see, hear and communicate with the patient (by means of a two-way microphone and speaker system) at all times.
5. The scanner will take a series of pictures.
6. Patients must lie still while images are being taken in order to ensure that they are in focus, and may be asked to hold their breath so the scan is not blurred.

CONE BEAM CT (CBCT)

This is CT in which the X-rays are divergent, forming a cone. CBCT is useful in implantology, endodontics and orthodontics, for accurate visualization of the jaws, teeth and roots (erupted and non-erupted) and of anomalous structures that conventional 2D radiography cannot capture.

SCINTIGRAPHY/NUCLEAR MEDICINE

Radionuclide (radioisotope) scans can be particularly useful for detecting abnormalities in bone, salivary glands, thyroid gland and lymph nodes. The common radionuclide agents used include technetium-99^{m} (Tc-99m) – labelled diphosphonates for bone scans, and gallium for imaging lymph nodes.

Radionuclide scanning involves administration of a radionuclide with an affinity for the organ or tissue of interest, and recording of the distribution of radioactivity. A very small amount of a mildly radioactive liquid is injected into a vein, usually in the arm; after the injection, the patient will have to wait up to 3 hours before the scan can be taken. The distribution of the radionuclide is detected in the tissue/organ under examination where the isotope is concentrated, by a gamma camera, which produces the images or scans after processing by a computer. Detectors record activity in retaining organs at the time of acquisition. Time/activity curves can be plotted to provide functional analysis. The images can then be produced on film or coloured paper, or as graphs or numerical data. The amount of radioactivity given to a patient is small, not dangerous either to the patient or to anyone nearby, and usually clears from the body within 24 hours.

POSITRON EMISSION TOMOGRAPHY

Radioactive molecules made from radionuclides (radioactive isotopes) with short half-lives, such as ^{11}C, ^{15}O or ^{13}N, are injected intravenously. Depending on the type of molecule injected, positron emission tomography (PET) can provide information on different biochemical functions. For example, if glucose is used, the PET scan will show an image of glucose metabolism, or how much energy the body is using in a specific area (such as the brain or a tumour).

MAGNETIC RESONANCE IMAGING (NUCLEAR MAGNETIC RESONANCE)

Magnetic resonance imaging (MRI) is a safe, non-invasive procedure that allows three-dimensional images of internal organs to be created with radio waves and large powerful electromagnets to align hydrogen atoms (protons) within the body (Fig. 2.31).

Advantages

- There is no ionizing radiation.
- MRI provides new, rapidly developing, good multiplanar imaging.



Fig. 2.31 Magnetic resonance image of head and neck.

- It provides good soft-tissue differentiation, which is better than that with CT.
- It provides good imaging of bone marrow.
- It provides good imaging of perineural infiltration.
- Pictures can be taken from multiple angles.
- It can be performed through clothing and through dense tissue such as bone.
- There is less distortion from dental restorations than with CT.

Disadvantages

MRI is dangerous for people with pacemakers or defibrillators and inappropriate for those with ferrous or paramagnetic aneurysm clips (Ch. 5). Currently, MRI is relatively expensive and time-consuming (it can take anything from 30 minutes to 1 hour and 30 minutes, or even 2 hours), and is rather noisy; some ———patients experience claustrophobia. It can also be affected by motion artefact, since it is slow. Gadolinium contrast medium is injected intravenously in up to 30% of MRI scans to improve the clarity.

Indications

MRI, like CT, can be used to produce cross-sectional views of the body or a body part, but can also obtain other views such as sagittal. It allows a clear distinction between black, grey and white areas of the image to aid pathological diagnosis in many cases.

Again like CT, MRI can be used on any part of the body but is frequently employed to examine the head and brain, since it is in this region that it produces clearer results than CT. MRI is also useful for detecting abnormalities in soft tissues and in chest or abdominal examination.

Contraindications

These include:

- presence of a cardiac pacemaker, defibrillator or monitor
- presence of vascular or surgical clips
- presence of any type of orthopaedic prosthesis, rods or pins
- presence of dentures or appliances of any type in the mouth, which must be removed before the scan (implants, fixed crowns or restorations are not contraindications; see below)