Medical emergencies: the drug box, equipment and basic principles

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INTRODUCTION

Medical emergencies in dental practice are uncommon but can occur at any time. All members of the dental team need to be aware of their role in the event of a medical emergency and should be trained appropriately with regular practice sessions.

In December 2013, the Resuscitation Council (UK) provided up to date information regarding a minimum equipment and drug list for medical emergencies in dentistry. Quality standards for cardiopulmonary resuscitation (CPR) practice and training have been updated.¹ It is evident from the updated guidance that there is an increased emphasis on the importance of CPR in the dental setting.

Anticipation of potential medical emergencies that might arise should be highlighted by taking a thorough medical history. A risk assessment should be made by considering the patient's American Society of Anaesthesiologists (ASA) classification category. The ASA classification is summarised below. If medication is normally used, a check should always be made to ensure that this has been taken as usual.

- ASA I healthy
- ASA II mild systemic disease – no functional limitation

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Table 1 Contents of the emergency drug box and routes of administration

Drug	Route of administration
Oxygen	Inhalation
Glyceryl trinitrate (GTN) spray (400 micrograms per actuation)	Sublingual
Dispersible aspirin (300 mg)	Oral (chewed)
Salbutamol aerosol inhaler (100 micrograms per actuation)	Inhalation
Adrenaline injection (1:1000, 1 mg/ml)	Intramuscular
Glucagon injection (1 mg)	Intramuscular/subcutaneous
Oral glucose solution/gel (GlucoGel)*	Oral
Midazolam 10 mg or 5 mg/ml (buccal or intranasal)	Infiltration/inhalation

*Alternatives: two teaspoons of sugar/three sugar lumps; 200 ml milk; non-diet Lucozade 50 ml; Coca-Cola non-diet 90 ml – if necessary this can be repeated at 10-15 minutes

Table 2 Suggested minimum equipment for medical emergency management (adapted from Resuscitation Council [UK])

Oxygen
Glyceryl trinitrate (GTN) spray (400 micrograms per actuation)
Dispersible aspirin (300 mg)
Salbutamol aerosol inhaler (100 micrograms per actuation)
Adrenaline injection (1:1000, 1 mg/ml)
Glucagon injection (1 mg)
Oral glucose solution/gel (GlucoGel)*
Midazolam 10 mg or 5 mg/ml (buccal or intranasal)

- ASA III severe systemic disease – definite functional limitation
- ASA IV severe disease – constant threat to life
- ASA V moribund
- ASA VI patient being ventilated for organ donation purposes.

THE EMERGENCY DRUG BOX

Patients should only undergo dental treatment in situations where appropriate equipment and drugs are available and have not passed their expiry date.

A minimum list of drugs to be included in the emergency drug box is summarised in Table 1. The list is based on that given in the Resuscitation Council (UK) document on medical emergencies and resuscitation in dentistry.²

The Resuscitation Council (UK) recommends that such kits should be standardised.² Wherever possible, they recommend that drugs in solution should be carried in a pre-filled syringe or kit. All drugs should be stored together, ideally in a purpose-designed container.

The intravenous route for emergency drugs is no longer recommended for dental practitioners. Formulations have now been developed that allow other routes to be used. These are quicker and user-friendly. Oxygen must always be available in a format that allows delivery at flow rates up to 15 litres per minute.

EQUIPMENT AND TRAINING

The Resuscitation Council (UK) has recommended the equipment shown in Table 2² as the minimum that should be available. Named individuals should be nominated to check equipment. This should be carried out at least weekly and audited.

It is a public expectation that automated external defibrillators (AEDs) should be available in the healthcare environment and dentistry is not considered an exception.²

All emergency medical equipment should be latex-free and single-use wherever possible.

STAFF TRAINING

Staff should be trained in the management of medical emergencies to a level that is appropriate to their level of clinical responsibility. This training should be updated on at least an annual basis. It is important that new members of staff have medical emergency training incorporated into their induction programme. A full record should be kept of training. Staff should know who to contact in the event of help being required and designated emergency phone numbers should be readily available.

THE 'ABCDE' APPROACH

Medical emergencies can often be prevented by early recognition. Signs such as abnormal patient colour, pulse rate or breathing can signal an impending emergency.

It is important to have a systematic approach to an acutely ill patient and to remain calm. The principles are summarised in the 'ABCDE' approach (Table 3).

Ensure that the environment is safe. It is important to call for help at an early stage – this includes anything from other members of the dental team to calling for an ambulance with paramedic support. A continuous reappraisal of the patient's condition should be carried out. The airway must always be the starting point for this. Without a functioning, oxygenated airway, all other management steps are futile. It is important to assess the success or otherwise of manoeuvres or treatments given, remembering that some therapies may take time to work.

Table 3 The ABCDE approach to an emergency patient

A	Airway
B	Breathing
C	Circulation
D	Disability (or neurological status)
E	Exposure (in dental practice, to facilitate placement of AED paddles) or appropriately exposing parts to be examined

If the patient is conscious, ask them how they are. This may give important information about the problem (for example, the patient who cannot speak or tells you that they have chest pain). If the patient is unresponsive, the patient should be shaken and asked 'Are you all right?' If they do not respond at all, have no pulse and show 'no signs of life' they have had a cardiac arrest and should be managed as described later. They may respond in a breathless manner and should be asked 'Are you choking?'³

Airway (A) – assessment and management

Airway obstruction is a medical emergency and must always be managed quickly. Usually, a simple method of clearing the airway is all that is needed. A head tilt, chin lift (Fig. 1) or jaw thrust (Fig. 2) will open the airway. Patients who are suddenly unable to speak are in real danger and establishing a patent airway is critical. It is important to remove any visible foreign bodies, blood or debris and the use of suction may be beneficial. Clearing the mouth should be done with great care with a 'finger sweep' in adults to avoid pushing material further into the upper airway.³ Simple

Fig. 1 The 'head tilt, chin lift' manoeuvre for opening up the airway

Fig. 2 The 'jaw thrust' manoeuvre for opening up the airway. Avoids neck extension

Fig. 3 Different sizes of Guedel oro-pharyngeal airways – to be used in the unconscious patient

adjuncts, such as oropharyngeal airways (Fig. 3) may be used. An impaired airway may be recognised by some of the signs and symptoms summarised in Table 4.

It is important to administer oxygen at high concentration (15 litres per minute) via a well-fitting face mask with a port for oxygen (Fig. 4) and a rebreathe mask. Even patients with chronic obstructive pulmonary disease who may retain carbon dioxide should be given a high concentration of oxygen. Such patients may depend on hypoxic drive to stimulate respiration but in the short-term a high concentration of oxygen will do no harm.

Breathing (B) and circulation (C)

Look, listen and feel for signs of respiratory distress. This should be done while keeping the airway open and the clinician should:

- Look for chest movement
- Listen for breath sounds at the victim's mouth
- Feel for air on the rescuer's cheek with the rescuer's head turned against the patient's mouth

Fig. 4 Oxygen delivered from a 'D' type cylinder

Table 4 Signs of airway obstruction

Inability to complete sentences or speak
'Paradoxical' movement of chest and abdomen ('see-saw' respiration)
Use of accessory muscles of respiration
Blue lips and tongue (central cyanosis)
No breathing sounds (complete airway obstruction)
Stridor (inspiratory) – obstruction of larynx or above
Wheeze (expiratory) – obstruction of lower airways for example, asthma or chronic obstructive pulmonary disease
Gurgling – suggests liquid or semi-solid material in the upper airway
Snoring – the pharynx is partly occluded by the soft palate or tongue

- This should be done for no more than ten seconds to determine normal breathing
- If there is any doubt as to whether breathing is normal, action should be as if it is not normal that is, to CPR.

Agonal gasps refer to abnormal breathing present in up to 40% of victims of cardiac arrest. CPR should therefore be carried out if the victim is unconscious (unresponsive) and not breathing normally. Agonal gasps should not delay the start of CPR as they are not normal breathing.

If the unconscious patient is breathing normally the patient should:

Be turned into the recovery position (essentially on their side – best learnt as a practical exercise)

- Send for help or call for an ambulance
- Ensure that breathing continues.

If the patient is not breathing normally:

- Ensure an ambulance is called, this may necessitate leaving the victim, but in a dental setting the practitioner should not be working alone
- Chest compressions should be started with the patient in the fully supine position on a firm surface:
 - Kneel/stand at the side of the patient
 - Place the heel of one hand in the centre of the patient's chest and the other hand on top of the first hand – it will usually be possible to do this without removing the victim's clothes. If there is any doubt, outer clothing should be undone/removed
 - Interlock the fingers of both hands avoiding pressure over the ribs, upper abdomen or the lower end of the sternum
 - The clinician should be positioned vertically above the patient's chest. With

straight arms the sternum should be depressed 4-5 cm

- After each compression all the pressure should be released so that the rib cage recoils to its rest position but the hands should be maintained in contact with the sternum
- The rate should be approximately 100 times per minute (a little less than two compressions per second)
- After 30 compressions the airway should be opened using head tilt and chin lift and two rescue breaths should be given. This may be carried out using a bag and mask or mouth-to-mouth (with the nostrils closed between thumb and index finger) or mouth-to-mask
- Practical skills are best learnt on a resuscitation course but certain principles are given below:
 - Inflations should make the chest rise. About one second should be taken to do this
 - The chest should be allowed to fall while maintaining the airway. Two breaths should be given
 - Hands should be returned to the sternum without delay to continue the chest compressions in a ratio of 30:2
- Only stop to recheck the patient if normal breathing starts, otherwise resuscitation should be continued until:
 - Qualified help takes over
 - The rescuer becomes exhausted.

If rescue breaths do not make the chest rise:

- Check for visible obstruction(s) in the mouth and remove it/them if possible
- Make sure that the head tilt and chin lift are adequate
- Do not waste time attempting more than two breaths each time before continuing chest compressions.

Fig. 5 Guidelines for post-exposure prophylaxis (PEP)

Carrying out these manoeuvres is tiring and if there is more than one rescuer CPR should be alternated between them every two minutes. The algorithm for adult basic life support is given in Figure 5.

Circulation (C)

Circulatory assessment should never delay the start of CPR. Simple observations to make a gross assessment of circulatory efficiency are given in Table 5. By far the most common cause of a collapse that is essentially circulatory in origin is the simple faint (vaso-vagal syncope). A rapid recovery can be expected in these cases if the patient is laid flat and the legs raised. Prompt management is required as cerebral hypoxia has devastating consequences if prolonged. Causes other than a faint must be considered if recovery does not happen quickly.

Checking the carotid pulse to diagnose cardiac arrest can be unreliable, even when attempted by some health care professionals.⁴ Checking the carotid pulse should only be carried out by those proficient in doing this. The latest guidelines highlight the need to identify agonal gasps (as well as the absence of breathing) as a sign to commence CPR and lay no particular emphasis on checking the carotid pulse.

Disability (D)

The term disability refers to an assessment of the neurological status of the patient. Primarily it refers to the level of consciousness (in trauma patients a more widespread neurological

examination is required). Hypoxia or hypercapnia (increased blood levels of carbon dioxide) are possible causes, together with certain sedative or analgesic drugs.

It is important to exclude hypoxia or hypotension as a cause for any alteration in conscious level. Attention to the airway, giving supplemental oxygen and supporting the patient's circulation (by lying them supine and raising their legs) will in many cases solve the problem. All unconscious patients who are breathing and have a pulse should be placed in the recovery position if they are unable to protect their own airway.

A rapid gross assessment can be made of a patient's level of consciousness using the AVPU method: are they alert? Do they respond to vocal stimuli? Do they respond to painful stimuli? Or are they unresponsive?

A lapse into unconsciousness may be the result of hypoglycaemia – if the blood glucose level is less than 3 mmol/litre when checked by a glucose measuring device (Table 2) then glucagon should be injected by the subcutaneous or intramuscular route.

Exposure (E)

Exposure refers to loosening or removal of some of the patient's clothes. For example, for the application of defibrillator paddles (in dental practice) or if the patient has been involved in a traumatic incident (usually in hospital) for examination purposes. It is important to bear in mind the patient's dignity as well as the potential for clinically significant heat loss.

Cardiac arrest can occur as a result of several causes. These are summarised in Table 6. It has been suggested⁵ that cardiopulmonary resuscitation can be performed effectively in the dental chair.

Table 5 Simple methods of circulatory assessment

Signs

Are the patient's hands blue or pink, cool or warm?

What is the capillary refill time?*

Pulse rate (carotid or radial artery), rhythm and strength

Symptoms

Is there a history of chest pain/does the patient report chest pain?

*If pressure is applied to the finger nail to produce blanching, the colour should return in less than two seconds in a normal patient. Remember that local causes such as a cold environment could also delay the response

Interruptions to chest compression in resuscitation are common and are associated with a reduced chance of survival.⁶ Chest compression-only CPR is a way to increase the number of compressions but is only effective for a period of about five minutes.⁶ For this reason the technique is not recommended. The principle on which compression-only CPR works is that during the first few minutes after a non-asphyxial cardiac arrest (in an adult) the blood oxygen content remains high and therefore at this stage ventilation is less important than chest compression.

DEFIBRILLATION

Defibrillation refers to the termination of fibrillation. It is achieved by administering a controlled electrical shock to the heart, which may restore an organised rhythm enabling the heart to contract effectively. Early defibrillation is important. Ventricular fibrillation (VF) is the most common cause of cardiac arrest. It is a rapid and chaotic rhythm and as a result the heart is unable to contract effectively. The only effective treatment for VF is defibrillation and the sooner the shock is given, the greater the chance of survival.⁷

The provision of defibrillation has been made easier by the development of automatic external defibrillators (AEDs). AEDs use voice and visual prompts to guide rescuers and are suitable for use by lay people and healthcare professionals.⁸ The device analyses the victim's heart rhythm, determines the need or otherwise for a shock and then delivers a shock. The wAED algorithm is given in Figure 6. CPR should not be interrupted or delayed to set up the AED.

Placement of AED pads

Use of the AED is a skill that requires practical training and experience. The victim's chest must be sufficiently exposed. Excessive chest hair can stop the pads adhering properly and if markedly so must be rapidly removed if possible. Razors are available in AED kits. Resuscitation should never be delayed for this reason.

One pad should be placed to the right of the sternum below the clavicle and the other in the left side mid-axillary line, centred on the fifth intercostal space. This electrode works best if orientated vertically. This position should be clear of any breast tissue.

ONGOING MANAGEMENT AFTER INITIAL TREATMENT OF A MEDICAL EMERGENCY

An ambulance with paramedic support should be called at the earliest opportunity as part of

the management of any significant medical event. If the dental practitioner feels competent and confident that the emergency has been managed satisfactorily and the patient is stable they should still not be allowed to leave the dental practice unaccompanied or be allowed to drive a motor vehicle. The decision will be easier to take in some circumstances than others. For example, the patient who has an angina attack in the surgery responds very quickly to their normal GTN and who has a clear history of similar episodes and makes a complete recovery will usually be well enough to be allowed home.

If a patient remains unwell or there is any doubt at all, they should undergo assessment by a medical practitioner. Before any transfer is made the patient's condition should be stabilised so long as that does not delay ongoing treatment. It is important that a written summary is given to the receiving team so that the treatment that has been undertaken and its timing are made clear. A working party of The Royal College of Physicians published a report on a system for assessing acutely ill patients intended for use across the NHS in its entirety.⁹ The National Early Warning Score (NEWS) considers six simple physiological parameters. These are:

- Respiratory rate
- Oxygen saturation
- Temperature
- Systolic blood pressure
- Pulse rate
- Level of consciousness (using the AVPU system mentioned above).

If the information suggested by this template can be provided by the dentist then it is helpful in the transfer process.

SUMMARY

Medical emergencies in dental practice are not common but could occur at any time. Adherence to basic principles is critical for effective management. Such events are less alarming and best managed if they have been anticipated and if mechanisms are in place for dealing with them.

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Fig. 6 An algorithm for resuscitation involving the use of an AED

Resuscitation Council (UK), 2010.

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