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GDC 'Highly Recommended' CPD topic
Medical Emergencies

ABCDE Assessment and the Out-of-Hospital Cardiac Arrest

Abstract: Whilst life-threatening emergencies are a rare occurrence in dental practice, a sound knowledge of the assessment of the critically unwell patient is vital for a positive patient outcome in a medical emergency. Automated External Defibrillators (AEDs) are now routine equipment in the out-of-hospital resuscitation of cardiac arrest and their use in dental practice is expected. This paper will discuss the assessment of the unwell adult patient using the Airway, Breathing, Circulation, Disability and Exposure (ABCDE) approach and the management of an adult cardiac arrest.

CPD/Clinical Relevance: Clinicians should be aware of the correct assessment of a critically unwell patient and the management of an out-of-hospital cardiac arrest (OHCA)

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There are few studies investigating the incidence of medical emergencies in dental practice. The most recent study surveying GDPs in Germany found that 93% had dealt with at least one emergency in the preceding year.¹ Whilst life-threatening emergencies were relatively uncommon, 3.5% of dentists encountered an acute coronary syndrome, 1.1% anaphylaxis, 0.8% airway obstruction, 0.6% stroke and 0.3% experienced a patient

in cardiac arrest. Many of these emergencies have specific therapies that are beyond the scope of this article, but can be found in the medical emergencies section of the British National Formulary (BNF).² Being able to assess unwell patients rapidly, recognize illness and instigate appropriate treatment can help prevent deterioration and avoid cardiac arrest. Recognizing a cardiac arrest early and managing it appropriately improves the chances of survival.

scissors for removing clothes and a razor for removing excess body hair. The equipment should be regularly checked and immediately accessible. This list does not include the recommended contents of the emergency drug box. Details of these drugs can be found in the dental section of the BNF.²

Patient assessment

Basic principles

When approaching an unwell patient, it is important to distinguish between the conscious patient who is able to respond to commands and the unresponsive patient who does not. Should a responsive patient become unresponsive at any stage, rapid assessment is required to ensure early recognition of a patient requiring cardiopulmonary resuscitation (CPR). This step-wise approach is detailed in Figure 1.

It is vital that CPR is started immediately in an unresponsive patient who is not breathing properly; CPR should be given in a ratio of 30 compressions to two rescue breaths.

Minimum equipment for cardiac arrest management in general dental practice

The Resuscitation Council (UK) recently updated their recommendation for equipment that should be available in dental practice (Table 1).³ The list includes personal protective equipment, such as gloves, facemask and aprons, equipment to support the patient's airway and breathing, such as emergency airways, suction, oxygen cylinder and various oxygen delivery devices. It must also include equipment to aid circulation, including an AED, adhesive defibrillator pads,

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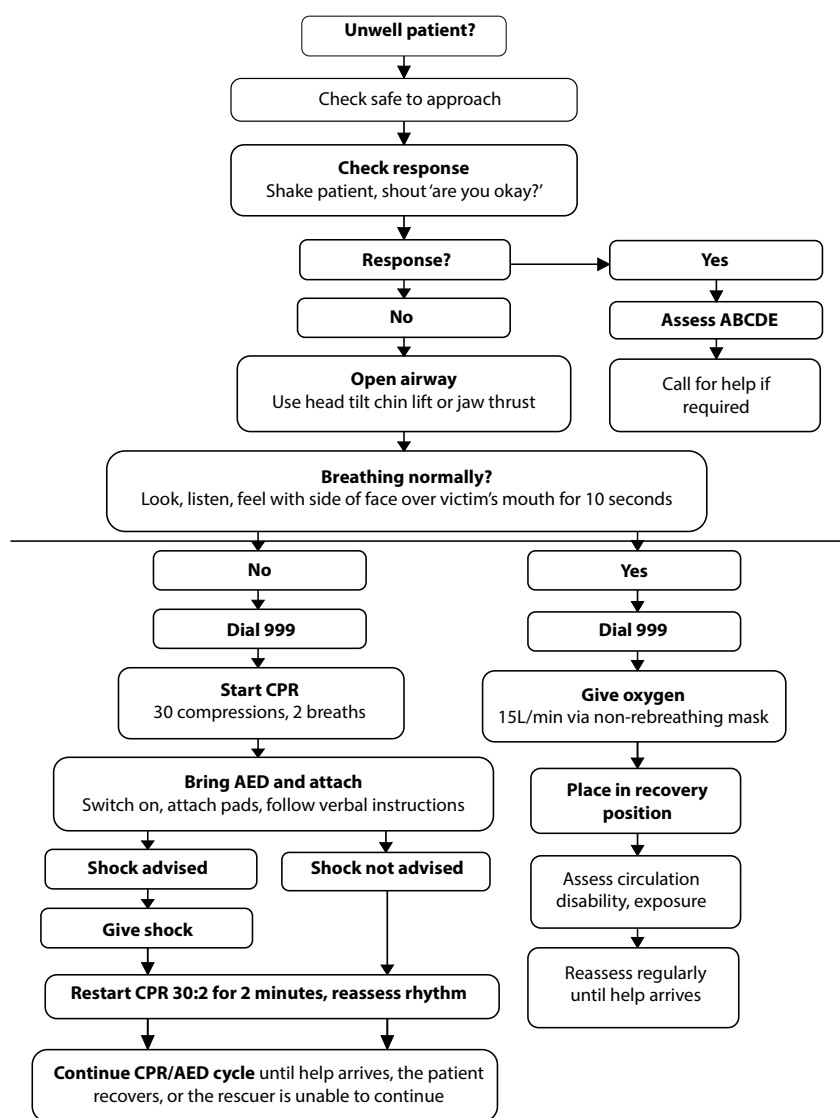


Figure 1. Step-wise approach to assessing the unwell patient.

The condition of an unwell patient can change rapidly. It is essential to re-evaluate the patient constantly.

Safe approach

Ensure the scene is safe for the rescuer, others and the victim. Forgetting this can escalate a single casualty to multiple casualties. Wear personal protective equipment, such as gloves, if indicated.

Response

Asking the patient a simple question, such as their name, can give

good insight into their Airway, Breathing, Circulation, Disability and Exposure (ABCDE) status. An appropriate answer will show the airway is patent, breathing is sufficient and circulation is maintaining cerebral perfusion. A conscious patient who is unable to speak may be in respiratory distress. A confused response may indicate hypoxia or hypoglycaemia, amongst other causes.

If the patient is non-responsive to verbal questions alone, a shake and verbal prompt ('shake and shout') should be given. If a positive response is given, continue to assess via the ABCDE approach. If unresponsive, immediately assess as per the

Gloves, aprons, eye protection
Pocket mask with oxygen port
Portable suction with Yankauer suction tip
Oropharyngeal airways (sizes 0–4)
Self-inflating bag with reservoir (adult)
Self-inflating bag with reservoir (child)
Clear face masks for self-inflating bag (sizes 0–4)
Oxygen cylinder (CD size)
Non-rebreathing mask with reservoir
Appropriate oxygen tubing
Automated external defibrillator (AED)
Adhesive defibrillator pads
Razor
Scissors

Table 1. Minimum emergency equipment recommended for primary dental care by the resuscitation council.

unresponsive approach detailed later. A lack of response is evidence of a critically ill patient.

ABCDE approach in the responsive patient

Airway

Remove any dental equipment at the onset of assessment in order to alleviate any potential source of airway obstruction. Noisy breathing can give a clue as to the origins of an obstruction. Common noises include stridor; a high pitched, inspiratory noise which is a sign of upper airway obstruction encountered with anaphylaxis and foreign body inhalation, or wheezing; a coarse, classically expiratory noise and a sign of lower airway obstruction, such as in acute asthma.

A patient with mild airway obstruction may be coughing and be able to answer questions. A patient with severe airway obstruction will not be able to speak. Failure of the patient to move air at all is a sign of complete airway obstruction and will rapidly kill the patient if not dealt with immediately.

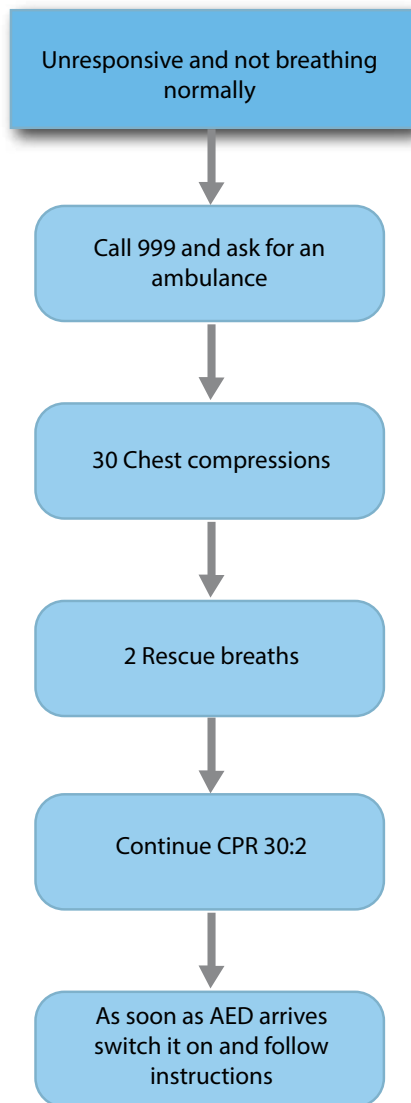


Figure 2. Adult basic life support algorithm (reproduced with the kind permission of Resuscitation Council UK).

If a patient is choking on a foreign body, encourage coughing. If this does not clear the airway, perform five back slaps followed by five abdominal thrusts, stopping once the obstruction has cleared.⁴

In a conscious patient, assessment should not progress until the rescuer is confident that the airway is open. An assistant should be sent to bring the medical emergency drug box and equipment as conditions such as acute asthma, or anaphylaxis have specific treatment initiated at this stage.



Figure 3. Effective chest compressions.

Oxygen must be administered to every unwell patient via a non-rebreather mask at a rate of 15L/min as soon as it is available. The reservoir bag should be primed with oxygen from the cylinder first by blocking the outlet on the bag until it is full. Room air is composed of 21% oxygen, using oxygen into a face mask increases this to 45%, but using a reservoir bag connected to oxygen on high flow improves oxygen concentration to 85%. Giving high levels of oxygen turns the lungs into a reservoir which can keep oxygen levels in the blood adequate for a number of minutes should a patient stop breathing.⁵

In situations with reduced consciousness levels, airway adjuncts, such as oropharyngeal or nasopharyngeal airways may be needed. These may not be tolerated in the conscious patient. If a patient is unresponsive, a head tilt and chin lift or jaw thrust should be used to open the airway.

Breathing

Observation of the patient can reveal signs of a breathing problem, including cyanosis and increased respiratory rate. Respiratory distress may be indicated by the use of accessory muscles, such as trapezius and sternocleidomastoid.

The patient's respiratory rate should be assessed, with the first responder counting breaths for 15–30 seconds and multiplying accordingly to give the number

of breaths per minute. The normal range is 12–20 breaths per minute. Respiratory rate is a sensitive marker of systemic wellbeing and persistent elevation or reduction should alert the clinician to a potential acute illness.

Call 999 and summon an ambulance at this stage if there is concern that the patient is critically ill.

Circulation

If the patient is breathing normally, assess their circulation. An assessment of the pulse should be made, depending on the rescuer's ability and confidence. Feel for a central pulse by palpating for the carotid pulse in the neck, noting the rate and rhythm. The quality of the pulse can also be felt, whether it be weak and difficult to detect or strong and bounding. The normal heart rate is 60–100 beats/minute and can vary greatly between patients.

Check the hands, which will look pale and feel cold and sweaty in a shocked patient. Capillary refill time is also a useful gauge of adequate blood flow. Pressure should be applied for five seconds with the assessor's thumb on a central area of the patient, such as forehead or sternum. The resulting blanching should resolve in less than two seconds. A prolonged capillary refill time can be a sign of shock.

If available, pulse oximetry and blood pressure monitors can give useful information regarding oxygen levels, pulse rate and blood pressure. Oxygen saturations should be above 95%. If blood flow to the hands is poor, or the patient is cold, it may be difficult for the pulse oximeter to gain an accurate reading. This in itself can be a sign of significant acute illness. A continuously reducing blood pressure or a systolic blood pressure below 100 mmHg should be considered significant.

Disability

Check the conscious level of the patient. A basic method used on hospital wards, and easily utilized within a primary care setting, is the 'AVPU' scale, with patients grouped into responsiveness categories by being **Alert**, responsive to **Verbal** stimulus, responsive to **Painful** stimulus, such as pinching the trapezius muscle, or **Unresponsive** to voice and pain. Remember, if a patient is unresponsive, they must be re-assessed rapidly (Figure 1) and CPR started



Figure 4. Mask and one-way valve.

if breathing is abnormal. Recognizing the need for CPR is the absolute priority in such patients.

If there is access to a glucometer, check the blood glucose level. A reading of less than 4 mmol/L indicates hypoglycaemia.

Exposure

In dental practice, performing ‘exposure’ properly should involve loosening any tight clothing and looking for any signs, such as rashes, swelling, or bleeding, which may point to the cause of illness. After assessing this remember to keep the patient warm.

Reassessment

Following completion of the ABCDE assessment, findings should be reviewed and the cause of illness established if possible. Ensure treatment specific to the suspected condition has been given and help is on the way, if appropriate. Reassess the patient via the



Figure 5. Self-inflating bag and mask.

ABCDE approach. In a conscious patient who has responded well to treatment this may be simply by maintaining constant verbal contact. Repeat assessment every time a treatment is given to the patient, or his/her clinical condition changes. This allows the clinician to monitor the response to treatment given and ensures any deterioration is recognized quickly.

The Out-of-Hospital Cardiac Arrest (OHCA)

Any unresponsive patient who is not breathing normally should be treated as a cardiac arrest and CPR commenced immediately (Figure 2). Effective bystander CPR doubles the chance of survival, early arrival of ambulance crew triples the chance of survival and the presence of a shockable rhythm confers a five times greater chance of survival from OHCA.⁶

Pitfalls in recognizing a cardiac arrest

Agonal breathing

Often, an arresting patient will breathe abnormally. Agonal breathing, where the chest moves ‘out of sync’ with the abdomen, can occur in approximately 40% of cardiac arrest patients and may be accompanied by gasping and strange sounds.^{7,8} This should not be confused with normal breathing. If the patient is breathing abnormally, CPR should be started.

Abnormal movements

During cardiac arrest, in the early stages patients can have abnormal movements or loose urinary continence in a similar appearance to someone undergoing a seizure. If there is any doubt that a patient has a cardiac output, CPR should begin.

Chest compressions

Chest compressions should be commenced at a rate of 100–120 compressions per minute, using songs such as ‘Staying Alive’ to help the rescuer keep time if needed.⁹

Compressions should be applied to the centre of the chest to a depth of 5–6 cm, with arms and shoulders held locked (Figure 3). Between each compression, the chest should be allowed to recoil fully. It is not uncommon for a patient to suffer rib fractures as a result of receiving effective resuscitation. This is not a reason to stop or reduce the effectiveness of chest compressions. The delivery of effective chest compressions is tiring. The person delivering chest compressions should be rotated regularly with minimum interruption to CPR to prevent the rescuer from becoming exhausted.

Airway management

For rescue breaths to be effective, the airway must be open. Manual opening involves either a head tilt and chin lift or a jaw thrust. A head tilt should be avoided if there is a mechanism of injury or pre-existing condition which could result in cervical spine injury. In this situation, it is recommended to use a jaw thrust or chin lift with an assistant immobilizing the patient’s head and neck. If this does not open the airway sufficiently,



Figure 6. Management of the airway using two person bag and mask technique.



Figure 7. Oropharyngeal airway.

a head tilt should be used regardless of concerns for the cervical spine.¹⁰

When the airway is opened, any debris, vomit or secretions should be removed with an aspirator or portable suction. Dentures can be removed if poorly fitting or causing an obstruction, or left *in situ* for an improved oral seal.

During CPR, rescue breaths should be delivered using an oxygen-delivery device such as the bag and mask, or mask and one-way valve (Figures 4 and 5). These should be attached directly to the oxygen cylinder. Again, the reservoir bag should be filled with oxygen from the cylinder first by blocking the outlet on the bag until it is full. The Resuscitation Council recommend a size CD oxygen cylinder which contains 460 litres of oxygen when full. This gives approximately 30 minutes of oxygen at 15 L/min and it may

be worth considering having a larger cylinder if working in an isolated location where an ambulance may take some time to arrive.

Ideally, two people should manage the airway, with one person holding the mask *in situ* and opening the airway and the second ventilating the patient, either directly through the one-way valve, or via the self-inflating bag (Figure 6). It should not take longer than ten seconds to deliver two rescue breaths. The rescuer performing CPR should feel for the rise and fall of the chest, allowing feedback to be given to the rescuers managing the airway. CPR must recommence immediately after two rescue breath attempts, whether they have been successful or not. Care should be taken not to over-inflate, forcing air into the stomach and consequent regurgitation, leading to aspiration which can further compromise the airway.

Oropharyngeal airways (Figure 7) can be used as an adjunct to help maintain the upper airway, but CPR should not be stopped during attempted airway placement. If placement fails, the rescuers should continue with bag and mask, or mask and valve ventilation and maintain the airway with



Figure 8. AED case and standardized symbol.

a head tilt and chin lift or jaw thrust.

The rationale for automated external defibrillation

Automated External Defibrillators can automatically detect a patient's heart rhythm and instruct the rescuer to deliver a shock when ineffective rhythms are present. The benefits of using an AED are significant.

Over 70% of all OHCA's have a cardiac aetiology.^{11,12,13} Of these, approximately 36.5% have a shockable rhythm.¹⁴ Time to shock is the most important factor in survival from these rhythms and an early shock delivered by a lay person is significantly better than a later shock delivered by a medical professional. Delays in defibrillation lead to poor outcomes.¹⁵

The current recommendation from the Resuscitation Council is that all dental practices must have immediate access to an AED in an arrest situation.³ The General Dental Council have endorsed this recommendation and expect all premises that treat patients to have an AED on site.¹⁶

Using the AED

AEDs can be used with minimal training and are easily recognized by the standardized AED symbol (Figure 8). Once an AED is switched on and connected to the pads, it will automatically detect whether the rhythm is shockable or non-shockable and give verbal instructions to guide the rescuer through CPR and shock delivery.

Once CPR has started, a second rescuer must immediately bring the AED, turn it on and follow the verbal instruction. During



Figure 9. AED with adhesive pads illustrating pad position and scissors.

this time, CPR should continue uninterrupted. One pad is placed on the right side of the sternum and one on the left side of the chest wall (Figure 9), with care being taken not to place the pad on any breast tissue. A razor should be available to remove excess body hair. If pad placement is prevented by excess moisture, the skin should be dried.

Once the pads are placed, the AED will ask the rescuers to pause CPR to allow the machine to analyse the rhythm. If a shock is required, the machine will ask the rescuers to deliver the shock. Before delivering the shock, oxygen masks must be moved at least one metre away from the patient and care taken to ensure no one is touching the patient. Following delivery of the shock, CPR should be restarted immediately and continued for two minutes before the rhythm is reanalysed.

Continuing CPR

CPR should continue until qualified help arrives. It is extremely unusual for a patient to recover from a cardiac arrest with CPR/rescue breaths alone. If there is



Figure 10. The recovery position.

any doubt, continue CPR. Only stop CPR if the rescuer is exhausted, or the patient is showing signs of regaining consciousness and breathing normally.

Recovery

If, after thorough assessment, the patient is breathing normally without any aid to open the airway, but unresponsive, he/she may be placed in the recovery position (Figure 10). The victim is placed on his/her side with the head tilted back and slightly towards the ground. This should keep the airway clear and decrease choking on secretions or vomit. This is not a secure airway, however, and breathing should be reassessed constantly and CPR begun immediately if indicated.

Debrief following medical emergencies

Following a medical emergency, staff should be debriefed, allowing feedback to be shared between team members on positive aspects of management and areas where improvement could be made.

Training

The management of medical emergencies improves through regular practice as the quality of CPR is affected by the time since last training in basic life support (BLS).¹⁷ The General Dental Council expect all dental health professionals to undergo BLS training on a yearly basis. Members of

the dental team should have clearly defined roles in a medical emergency scenario. All staff members must be aware of the location of the emergency drugs box and emergency equipment.

Summary

Medical emergencies are not a frequent occurrence in dental practice. The ability to assess an ill patient systematically can ensure appropriate management is instigated quickly and may avoid deterioration if an emergency does occur. In an unresponsive patient who is not breathing, rapid assessment, delivery of chest compressions, calling an ambulance and assessment of electrical rhythm using an AED should be the priority. Frequent medical emergency training, equipment checks and practise of emergency scenarios form part of a dental professional's personal CPD and are a mandatory component of practice training.

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