General medicine and surgery for dental practitioners: part 3. Management of specific medical emergencies in dental practice

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IN BRIEF

- Discusses treatment for specific emergencies and where appropriate the drugs used.
- Recognises signs and symptoms of relevant medical emergencies.
- Outlines routes of drug administration appropriate to dental practitioners.

PRACTICE

CORE VERIFIABLE CPD PAPER

In this paper, the actions needed to manage specific medical emergencies are discussed. Each emergency requires a correct diagnosis to be made for effective and safe management. Contemporary management in dental practice avoids the intravenous route when drugs are required to treat the emergency.

INTRODUCTION

The basic principles discussed in the previous paper[1] in this series should be applied to all medical emergency situations. The cornerstone of emergency management is the ABCDE approach (Airway, Breathing, Circulation, Disability, Exposure). Emergencies can usually be anticipated by obtaining a thorough medical history.[2] Once the nature of the emergency has been established, more specific management must be instituted, underpinned by the ABCDE approach.

Examples of medical emergencies that can arise in dental practice are listed in Table 1. The diagnosis and management of specific medical emergencies is discussed below.

VASOVAGAL SYNCOPE (SIMPLE FAINT)

Vasovagal syncope or the simple faint is the most common medical emergency to be seen in dental practice. It results in loss of consciousness as a result of inadequate cerebral perfusion. It is essentially a reflex, which is mediated by autonomic nerves, leading to widespread vasodilatation in the splanchnic and skeletal vessels and bradycardia, resulting in diminished cerebral perfusion. Fainting can be precipitated by pain or emotional stress, changes in posture or hypoxia. Some patients are more prone to fainting than others and it is wise to treat fainting-prone patients (established from the history or previous experience) in the supine position.

A similar clinical picture may be seen in 'carotid sinus syndrome'. Mild pressure on the neck in such patients (usually the elderly) leads to a vagal reaction producing syncope. This situation may progress to bradycardia or even cardiac arrest.

Signs and symptoms – fainting

- Patient feels faint/light headed/dizzy
- Pallor, sweating
- Pulse rate slows
- Low blood pressure
- Nausea and/or vomiting
- Loss of consciousness.

Treatment of fainting

- Lie the patient flat and raise the legs – recovery will normally be rapid
- A patent airway must be maintained
- If recovery is delayed, oxygen (15 litres per minute) should be administered and other causes of loss of consciousness be considered.

ASTHMA

Asthma is a potentially life-threatening condition and should always be taken seriously.[3] An asthma attack may be precipitated by exertion, anxiety, infection or exposure to an allergen. It is important to gain some idea of the severity of attacks from the history. It is vital to gather information related to precipitating factors, effectiveness of medication, hospital admissions due to asthma and the use of systemic steroids.

It is important that asthmatic patients bring their usual inhaler(s) with them – if the inhaler has not been brought it must be in the emergency kit or treatment should be deferred. If the asthma is in a particularly severe phase elective treatment may be best postponed. Drugs that may be prescribed by dental practitioners, particularly non-steroidal anti-inflammatory drugs (NSAIDs), may worsen asthma and are therefore best avoided.

Use of inhalers in patients with asthma

Inhalers

Even if an inhaler is used properly around 50% of aerosol will be deposited in the mouth and only 10% reach the airways below the larynx.

Table 1 Summary of medical emergencies that may be encountered in dental practice

Vasovagal syncope (faint)
Hyperventilation/'panic attack'
Acute asthma attack
Angina/myocardial infarction
Epileptic seizures
Diabetic emergencies
Allergies/hypersensitivity reactions
Choking and aspiration
Adrenal insufficiency
Cardiac arrest

GENERAL MEDICINE

1. History taking and examination of the clothed patient
2. The drug box, equipment and basic principles of management
3. **Management of specific medical emergencies in dental practice**
4. Infections and infection control
5. Immunological disease and dental practice

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Procedure for using an inhaler:

- Remove the mouthpiece cover
- Shake the inhaler and breathe out
- Patient should place mouthpiece in his/her mouth with lips and teeth closed around it
- At the start of inspiration the patient should press the canister down and continue to inhale slowly and deeply
- Mouthpiece should be removed from mouth and lips closed
- Patient should hold breath for up to 10 seconds if possible and then breathe out normally
- Wait 30 to 60 seconds before repeating.

Spacer device

- Only works with an aerosol inhaler
- Removes the need for coordination between actuation of an inhaler and inhalation
- Reduces velocity of aerosol leading to increased passage into the airway
- Reduces side effects from 'preventer' medicines.

Spacer procedure

- As with inhaler
- Inhalation should be within 30 seconds of actuation.

Signs and symptoms of asthma

- Breathlessness (rapid respiration - more than 25 breaths per minute)
- Expiratory wheezing
- Use of accessory muscles of respiration
- Tachycardia.

Life-threatening asthma – signs and symptoms

- Cyanosis or slow respiratory rate (less than eight breaths per minute)
- Bradycardia
- Decreased level of consciousness/confusion.

Treatment of asthma

- Most asthma attacks will respond to the patient's own inhaler, for example salbutamol (may need to repeat after 2-3 minutes)
- If no rapid response, or features of severe asthma, call an ambulance
- A medical assessment should be arranged for patients who require additional doses of bronchodilator to end an attack
- A spacer device may need to be used if patient has difficulty using the inhaler
- If the patient is distressed or shows any of the signs of life-threatening asthma, urgent transport to hospital should be arranged
- Fifteen litres per minute of oxygen should be given while awaiting transfer. Up to 12 actuations from the salbutamol inhaler via a spacer device should be used and repeated every 10 minutes. In the British National Formulary[4] a technique is described for a 'home made' space device. A hole can be cut out the base of a paper or plastic cup. The mouthpiece of the inhaler is pushed through this. The open end of the cup can then be applied to the mouth when the inhaler is activated.
- All patients, including those who have chronic obstructive pulmonary disease should be given high flow oxygen as even if these patients are dependent on 'hypoxic drive' to stimulate their respiration, they will come to no harm in the short term.

HYPERVENTILATION

Anxiety is the principal precipitating factor of hyperventilation. When hyperventilation persists it can become extremely distressing to the patient.

Signs and symptoms of hyperventilation

- Anxiety
- Light headedness/dizziness
- Weakness
- Paraesthesia
- Tetany (see below)
- Breathlessness
- Chest pain and/or palpitations.

Treatment of hyperventilation

A calm and sympathetic approach from the practitioner is important. The ABCDE approach will lead to safe identification of the condition.

- Exclude other causes for the symptoms (ABCDE approach)
- Encourage the patient to rebreathe their own exhaled air to increase the amount of inhaled carbon dioxide – a paper bag placed over nose and mouth allows this
- If no paper bag is handy, the patient's cupped hands could be an alternative.

Hyperventilation leads to carbon dioxide being 'washed out' of the body, producing an alkalosis. If hyperventilation persists, carpal (hand) and pedal (foot) spasm (tetany) may be seen (Fig. 1). Rebreathing exhaled air helps to return the situation to normal relatively quickly.

CHEST PAIN

Most patients who experience chest pain from a cardiac origin in the dental surgery are likely to have a previous history of cardiac disease. If a patient uses medication to control known angina they should have brought this with them or it should be readily to hand in the emergency kit. Similarly, it is important to check that the patient has taken their normal medication on the day of their appointment.

Classically, the pain of angina is described as a 'crushing' or 'band-like' tightness of the chest, which may radiate to the left arm or mandible. There are many variations, however. The pain of myocardial infarction (MI) will often be similar to that of angina but more severe and, unlike angina, will

Fig. 1 A demonstration of carpal spasm

Table 2 Possible causes of chest pain
Angina
Myocardial infarction
Pleuritic: for example pulmonary embolism
Musculoskeletal
Oesophageal reflux
Hyperventilation
Gall bladder and pancreatic disease

Fig. 2 A midazolam preparation used in the treatment of epileptic seizures

Table 3 NICE guidelines for sending a patient with epilepsy to hospital after a fit
Status epilepticus
High risk of recurrence of fits
First fit
Difficulty in monitoring the patient's condition

not be relieved by glyceryl trinitrate (GTN). In cases of angina, the patient should use their GTN spray, which will usually remove the symptoms. Dental treatment may be best left until another day if there is an attack, according to the practitioner's discretion. More severe chest pain always warrants postponement of treatment and an ambulance should be called.

Features that make chest pain unlikely to be cardiac in origin are: pains that last less than 30 seconds, however severe, stabbing pains, well-localised left submammary pain and pains that continually vary in location. Chest pain that improves on stopping exertion is more likely to be cardiac in origin than one that is not related. Pleuritic pain is sharp in character, well localised and worse on inspiration.

Oesophagitis can produce a retrosternal pain that worsens on bending or lying down. A complicating factor in differentiation from cardiac chest pain is that GTN, due to its action on the muscle of the oesophagus, may ease the pain.

Musculoskeletal pain will often be accompanied by tenderness to palpation in the affected region or on movement. As mentioned earlier, hyperventilation may produce chest pain. A list of possible causes of chest pain is given in Table 2.

It is clearly important to exclude angina and myocardial infarction in the patient complaining of chest pain.[5,6] If in doubt, treat as cardiac pain until proven otherwise.

Signs and symptoms – myocardial infarction

- Severe, crushing chest pain which may radiate to the shoulders and down the arms (particularly the left arm) and into the mandible
- The skin becomes pale and clammy
- Shortness of breath
- Pulse becomes weak and patient may become hypotensive
- Often there will be nausea and vomiting
- Not all patients fit this picture.

Treatment of myocardial infarction

- The practitioner should remain calm and reassuring
- Call 999 immediately
- Most patients will be best managed in the sitting position but patients who feel faint should be laid flat
- Administer high flow oxygen (15 litres per minute)
- Give sublingual GTN spray
- Give 300 mg aspirin orally to be chewed (if no allergy) – ensure that when handing over to the receiving ambulance crew that they are made aware of this
- A patient who has had surgical dental treatment should be highlighted to the ambulance crew as any significant risk of haemorrhage may affect the decision to use thrombolytic therapy
- If the patient becomes unresponsive, the practitioner should check for 'signs of life' (breathing and circulation) and start CPR.

EPILEPTIC SEIZURES

The history will usually reveal the fact that a patient has epilepsy.[2] A history should obtain information with regard to the nature of any seizures, their frequency and degree of control. The type and efficacy of medication should be determined. Signs and symptoms vary considerably.

Signs and symptoms – epilepsy

- The patient may have an 'aura' that a seizure is about to occur
- Tonic phase – loss of consciousness, patient becomes rigid and falls and becomes cyanosed
- Clonic phase – jerking movements of the limbs, tongue may be bitten
- Frothing at the mouth, urinary incontinence
- The seizure often gradually abates after a few minutes. The patient may remain unconscious. They may remain confused after consciousness has been regained
- Hypoglycaemia may present as a fit and should be considered (including in epileptic patients) – blood glucose measurement at an early stage is therefore wise.

In patients with a marked bradycardia (pulse rate less than 40 beats per minute) the blood pressure may drop to such an extent that it causes transient cerebral hypoxia leading to a brief fit. This is not a true fit and represents a vasovagal episode.

Treatment of an epileptic seizure

The decision to give medication should be made if seizures are prolonged (with active convulsions for 5 minutes or more [status epilepticus] or seizures occurring in quick succession). If possible, high flow oxygen should be administered. The possibility of the patient's airway becoming occluded should be constantly remembered and the airway must therefore be protected.

- As far as possible, ensure safety of the patient and practitioner (do not attempt to restrain)
- Midazolam given via the buccal or intranasal route (10 mg for adults). The buccal preparation is marketed as 'Epistatus®' (10 mg/ml), (Fig. 2). A paediatric formulation, Buccolam® (5 ml) is now licenced for use.[7]
- For children (Epistatus®):
  - Child 1-5 years, 5 mg
  - Child 5-10 years, 7.5 mg
  - Child over 10 years, 10 mg
- The parents of some children with poorly controlled epilepsy will carry rectal diazepam. As part of pre-treatment preparation, it is wise to arrange with the parent for them to be on hand to administer this should a seizure occur
- In the absence of rapid response to treatment, call an ambulance.

Criteria for sending a patient with epilepsy to hospital after a seizure have been developed by the National Institute for Health and Care Excellence and are summarised in Table 3.

DIABETIC EMERGENCIES

The history should be used to assess the degree of diabetic control achieved by the patient. A history of recurrent hypoglycaemic episodes and markedly varying blood glucose levels (from the patient's measurements) suggest that a patient attending for dental treatment is more likely to develop hypoglycaemia. It is wise to treat diabetic patients early in the day and ensure that they have had their normal medication and something to eat before attending.

A dentist in general practice is much more likely to encounter hypoglycaemia than hyperglycaemia since the latter has a much slower onset. It should be remembered that diabetic control may be adversely affected by oral sepsis, leading to an increased risk of complications.[8]

Signs and symptoms – hypoglycaemia

- Trembling
- Hunger
- Headache
- Sweating
- Slurring of speech
- 'Pins and needles' in lips and tongue
- Aggression and/or confusion
- Seizures
- Unconsciousness.

Treatment of hypoglycaemia

- Lay the patient flat (remember A, B, C)
- If the patient is conscious, give 10-20 g oral glucose (3 lumps of sugar, 2-4 teaspoons of sugar or 100 ml of a sugary drink such as Coca Cola) or GlucoGel® (Fig. 3)
- If the patient is unconscious give 1 mg glucagon intramuscularly (or subcutaneously)
- Get medical help.

Patients who do not respond to glucagon (a rarity) or those who have exhausted their supplies of liver glycogen will require 20 ml of intravenous glucose solution (20-50%) and should be managed under medical supervision or by the attending ambulance team. It can take glucagon 5-10 minutes to be effective and the patient's airway must be protected at all times.

Once the patient regains consciousness and has an intact gag reflex, they should be given glucose orally and a high carbohydrate food. If full recovery is achieved and the patient is accompanied they may be allowed home but should not be allowed to drive. The patient's general medical practitioner should be informed of the event.

The principle of treatment of hyperglycaemia is through intravenous rehydration. This should be carried out under medical supervision and is beyond the scope of this discussion.

ALLERGIES/HYPERSENSITIVITY REACTIONS

Anaphylaxis

Anaphylaxis is a type 1 hypersensitivity reaction involving IgE to which free antigen binds leading to the release of vasoactive peptides and histamine. Penicillin and latex are the most likely causes in dentistry. Local anaesthetics are rarely responsible.[9] A rare but potential cause is chlorhexidine[10] and patients should be questioned about this before use of mouthwashes containing this medicament.

Signs and symptoms - anaphylaxis

- Itchy rash/erythema
- Facial flushing or pallor
- Upper airway (laryngeal) ooedema and bronchospasm leading to stridor, wheezing and possibly hoarseness
- A respiratory arrest may occur leading to cardiac arrest
- Vasodilatation leading to low blood pressure and collapse which may progress to cardiac arrest.

Initial treatment of anaphylaxis

- The ABCDE approach should be employed while the diagnosis is being made
- Manage airway and breathing by administering 15 litres per minute of oxygen
- Restore blood pressure by lying the patient flat and raising the legs.

In life-threatening anaphylaxis (hoarseness, stridor, dyspnoea, cyanosis, drowsiness, confusion or coma) adrenaline should be administered.

- Administer 0.5ml of 1 in 1,000 adrenaline IM and repeat at 5 minute intervals if no improvement
- The optimum site for injection is the anterolateral mid-third of the thigh.

Chlorphenamine (antihistamine) and hydrocortisone (steroid) need not be given by non-medical 'first responders'. As a result, the only drug required to be administered by dental practitioners is adrenaline. The other drugs will be administered by ambulance personnel, if necessary.

Many patients with a history of anaphylactic reactions will carry an 'EpiPen' which contains 300 micrograms of adrenaline. This may be used if such a patient has an anaphylactic reaction in the dental surgery (Fig. 4). Variations in the doses of adrenaline that may be given to different age groups are summarised in Table 4.

Angiooedema

Angiooedema is triggered when mast cells release histamine and other chemicals into the bloodstream producing rapid swelling. This may be life-threatening if the airway is involved. It may be precipitated by substances such as latex and penicillin. There is a hereditary component. Signs and symptoms are summarised in Table 5.

Hereditary angiooedema (HANE) is caused by complement activation resulting from a deficiency of the inhibitor of the enzyme C1 esterase. It is usually inherited as autosomal dominant and may not present until adulthood. C1 esterase inhibitor concentrates are available to supplement the deficiency. Such supplements should be administered before dental treatment if such treatment has previously triggered the onset of angiooedema.

CHOKING AND ASPIRATION

Prevention is important by the use of rubber dam, instrument chains, mouth sponges etc during dental treatment. Careful suction of the oral cavity and close observation minimises risk.

In a patient suspected of having aspirated a foreign body, they should be encouraged to cough vigorously in attempt to clear the airway and 'cough up' the object. A foreign body may lead to either mild or severe airway obstruction. Signs and symptoms that aid in differentiation of the degree of airway obstruction are shown in Table 6. In a conscious victim it is useful to ask the question 'Are you choking?'. An algorithm for the management of a choking patient has been published by the Resuscitation Council (UK)[11] and is given in Figure 5.

Back blows are delivered by standing to the side of the victim and slightly behind. The chest should be supported with one hand and the victim leant well forwards so that when the obstruction is dislodged it is expelled from the mouth rather than passing further down the airway. Up to five sharp blows should be given between the shoulder blades with the heel of the other hand. After each back blow a check should be made to see if the obstruction has been relieved.

If back blows fail, up to five abdominal thrusts should be given.

- Stand behind the victim and put both arms around the upper part of their abdomen and lean them forwards
- The rescuer's fist should be clenched and placed between the umbilicus and lower end of the sternum
- The clenched fist should be grasped with the other hand and pulled sharply inwards and upwards
- This should be repeated up to five times

Fig. 3 GlucoGel® for use in hypoglycaemia

Fig. 4 An 'Epipen' for use in anaphylactic reactions. It contains 300 micrograms of adrenaline

Table 4 Variation in dose of intramuscular adrenaline with age

Adult (or child over 12 years)	500 micrograms (0.5 ml)
Child (6-12 years)	300 micrograms (0.3 ml)
Child (less than 6 years)	150 micrograms (0.15 ml)
All refer to IM doses of adrenaline (1:1000)	

Table 5 Signs and symptoms of angiooedema

Swelling around eyes, lips, throat and extremities
Laryngeal oedema and bronchospasm
Acute allergic oedema may develop alone or be associated with anaphylactic reactions

Table 6 Management of a choking victim (adapted from Resuscitation Guidelines Resuscitation Council [UK]) – signs and symptoms
General signs of choking
Attack occurs while eating/misplaced dental instrument/restoration
Victim may clutch his neck
Signs of mild airway obstruction
Response to question 'Are you choking?' - Victim speaks and answers 'YES'
Other signs
Victim is able to speak, cough and breathe
Signs of severe airway obstruction
Response to question 'Are you choking?' - Victim unable to speak - Victim may respond by nodding
Other signs
Victim unable to breathe
Breathing sounds wheezy
Attempts at coughing are silent
Victim may be unconscious

Table 7 Risk factors for stroke
Hypertension
Smoking
Diabetes mellitus
Cardiac and peripheral vascular disease
Atrial fibrillation
Previous transient ischaemic attack (TIA) – focal CNS disturbances caused by vascular events such as microemboli and occlusion leading to ischaemia. By definition, symptoms last for less than 24 hours
Obesity
Hyperlipidaemia
Excess alcohol intake

- The back blows and abdominal thrusts should be continued in a cyclical fashion
- Chest thrusts, similar but quicker than chest compressions using two fingers should be employed in infants (under 1 year of age) rather than abdominal thrusts.

ADRENAL INSUFFICIENCY

Adrenal crisis may result from adrenocortical hypofunction leading to hypotension, shock and death. It may be precipitated by stress induced by trauma, surgery or infection. It is rare that this would happen as a result of dental treatment and if a patient collapses other causes are much more likely and should be considered first.

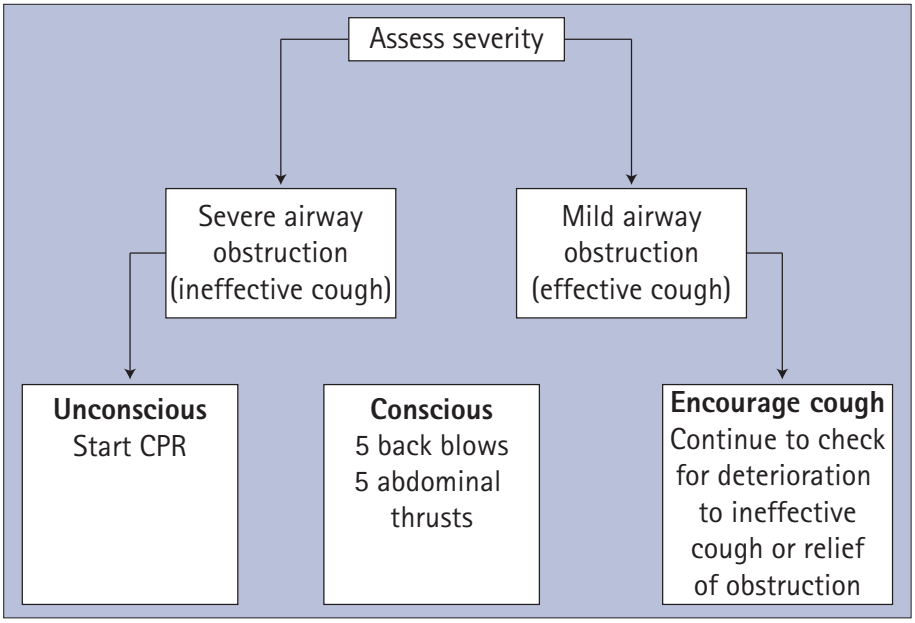

Fig. 5 Algorithm for management of the choking patient (Resuscitation Council (UK))

Signs and symptoms – adrenal crisis

- The patient loses consciousness
- The patient has a rapid, weak or impalpable pulse
- The blood pressure falls rapidly.

It is important in the history to ascertain whether the patient has recently used or is currently using corticosteroids. Some patients carry a 'steroid warning card'. Acute adrenal insufficiency can often be prevented by the administration of a steroid boost before treatment. Studies have suggested that dental surgery may not require supplementation.[12] More invasive procedures, however, may still require cover. Patients who are systemically unwell (for example patients with a significant dental abscess) are also recommended to have a prophylactic increase in steroid dose.[13]

The guidance for patients with Addison's disease is to double the patient's steroid dose before significant dental treatment under local anaesthesia and continue this for 24 hours.[13]

Treatment of adrenal crisis

- Lay the patient flat and raise their legs
- Ensure a clear airway and administer oxygen (15 litres per minute)
- Call an ambulance.

STROKE

Stroke may be either haemorrhagic or embolic in aetiology but clinically the effects are essentially the same. Risk factors for stroke are summarised in Table 7. Signs and symptoms vary according to the site of brain damage. There may be loss of consciousness and weakness of limbs on one side of the body. One side of the face may become weak. Stroke causes an upper motor neuron lesion therefore the forehead muscles of facial expression will be unaffected. Speech may become slurred.

In 2009, the Stroke Association recommended following the FAST approach to assess whether the patient has had a stroke. The acronym represents the following:

- Facial weakness
- Arm weakness
- Speech problems
- Telephone 999 if any of the above.

Initial management of stroke

- FAST approach to assess likely diagnosis
- ABCDE approach. The airway should be maintained and an ambulance called
- High flow oxygen (15 litres per minute) should be given via a non-rebreathe mask
- The patient should be carefully monitored for any further deterioration (AVPU system: Alert, Voice response, Pain response, Unresponsive)
- If the patient is or becomes unconscious and is breathing, they should be placed in the recovery position.

LOCAL ANAESTHETIC EMERGENCIES

Allergy to local anaesthetic is rare but should be managed as any other case of anaphylaxis. When taken in the context of the number of local anaesthetics administered, complication rates are low.[14] The signs and symptoms in allergy are those of anaphylaxis.

Fainting in association with the injection of local anaesthetic is more common and can usually be avoided by administering the local anaesthetic while the patient is supine.

Local anaesthetic toxicity is avoided by sensible dose limitation,[15] aspiration and slow injection. Early signs of overdose

are excitation followed by central nervous system depression, which can lead to respiratory arrest. Emergency treatment of local anaesthetic over dosage is essentially basic life support with maintenance of a patent functioning airway. Medical management may involve the injection of lipid emulsions,[16] but this is not expected in dental practice.

CONCLUSIONS

Medical emergencies in the dental practice are not common. It is important that each member of the dental team knows what their role should be in the event of such a situation arising, however. Adherence to basic management principles such as the ABCDE approach and regular updates and practice facilitates safe patient management.

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