

REVIEW ARTICLE

A Review of Medical Emergencies in Dental Practice

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ABSTRACT

Background: Medical emergencies in dental practice are those adverse medical events that may present in the course of dental treatment. Each of those events requires a correct diagnosis for effective and safe management. The contemporary dentist must be prepared to manage expeditiously and effectively those few problems that may arise with specific response. Basic life support is all that is required to manage many emergency situations, with the addition of specific drug therapy in some others.

Objectives: The aims of this paper are to provide an overview of medical emergencies that can present in dental practice, highlight the basic emergency medications and equipment that should be available in a dental clinic, outline the prevention and management of such emergencies, describe the specific response to some of the more common medical emergencies that can present in the course of a dental treatment and make recommendation for training and preparedness for handling medical emergencies.

Methodology: Review of available literature on the subject matter via electronic search engines of Google- PubMed and Medline.

Results: Medical emergencies are quite common in dental practice and the most common, from scientific studies and anecdotal evidences, is syncope; and dental surgeons, their staff and offices are usually ill prepared to handle these emergencies.

Conclusion: Medical emergencies may be rare but they are challenging occurrences in the dental clinic, tasking the knowledge, skills and materials available to the practice. Adequate staff training and availability of appropriate drugs and equipment are essential in the management of emergencies that may arise in the dental clinic.

Recommendation: An improvement in the training of dental surgeons including realistic simulation training in the management of medical emergencies, at the undergraduate, post-graduate and the continuing education levels.

Keywords: Essential drugs, specific response, surgeons, training, treatment, management

INTRODUCTION

Medical emergencies in dental practice are those adverse medical events that may present in the course of dental treatment. Usually, they are not rare in practice, and

therefore, every dental practitioner needs the knowledge and skill for the diagnosis and management of medical emergencies. Although, most are not life-threatening, they however do occur with potentially serious

consequences, and could lead to significant morbidities.^{1,2,3,4,5} Their reported incidence is not clear, with reports of common occurrence by some while others insist that they are uncommon or under-reported.^{1,4,5,6}

Medical emergencies occurring in dental practice can be alarming and the keys to minimizing these alarms include thorough history and general examination of the patient, and having a good working knowledge of how to manage them, should they arise.⁷ Studies show that less than 50% of practising dentists had previous knowledge of basic life support (BLS) and/or judged themselves capable of diagnosing the possible cause(s) of emergencies during a dental visit. In fact, available evidence suggests that many dentists on graduation do not feel competent in managing medical emergencies, while some feel insecure in doing so; a problem requiring an improved undergraduate training.^{4,8,9,10,11} The most common justification given for this lack of knowledge and/or skill were: lack of training and update after primary qualification; and lack of learning and training during the undergraduate program.⁶

The emergencies that can occur vary from the minor conditions such as the common fainting spell to the life-threatening ones such as cardiac arrest or anaphylaxis.¹² These emergencies are most likely to occur during and after local anaesthesia, primarily during tooth extraction and endodontic treatment. Though most of these complications are mild, about one-tenths are considered to be serious and nearly half of the patients are known to have some underlying disease, the most common of them being cardiovascular.¹³ Prevention of these emergencies and preparation for management entail an adequate patient evaluation, staff training and retraining and availability of appropriate medications and equipment in the dental clinics.^{12,14}

The aim of this review is to provide an overview of these emergencies that present in dental practice, highlight the basic emergency medications and equipment that should be present in a dental clinic, outline the prevention and management of such emergencies, describe the specific response to some of the more common ones and make recommendations for training and preparedness for handling medical emergencies.

TYPES OF MEDICAL EMERGENCIES

- a) **Sudden Loss of Consciousness:** This is usually caused by fainting, acute hypoglycaemia, myocardial infarction, cardiac arrest, anaphylactic shock, stroke, adrenal shock and circulatory collapse secondary to corticosteroid therapy.
- b) **Acute Chest Pain:** This is usually as a result of angina pectoris and myocardial infarction.
- c) **Difficulty in Breathing:** This may be from acute asthmatic attack, anaphylactic shock, foreign body obstruction, bronchospasm, and laryngospasm.
- d) **Seizure:** This could be an isolated event or from epilepsy and other causes of impairment of consciousness.
- e) **Others:** Local anaesthetic toxicity (overdose), haemorrhage, drug reaction/interaction, trauma, psychiatric emergencies, thyroid storm, insulin shock and hyperventilation syndrome.

Anecdotal evidence from general hospitals in Anambra State suggest that the most commonly occurring medical emergency is syncope and this is similar to findings in Lagos, Nigeria, Fiji Islands, Jerusalem in Israel and Germany.^{8,3,15,1} It, however, contrasts with a Brazilian study which found the most common emergency in dental practice to be pre-syncope, with syncope rated as the sixth most common.⁶ This evidence further exposed the non-preparedness to handle medical emergencies similar to findings

elsewhere, which is unhealthy for the practice and calls for improvement.^{4,8,9,10,11}

BASIC MEDICATIONS AND EQUIPMENT

The essential drugs which should be part of the emergency kit in every dental practice in addition to oral carbohydrates which are considered essential include:^{12,13,14,16,17,18,19,20, 21, 22,23,24,25,26}

1. Essential Drugs

a) *Oxygen*

This is indicated for every emergency except in hyper-ventilation syndrome. Oxygen is delivered with a clear full face mask for the spontaneously breathing patient and a bag-valve-mask device for the apnoeic patient. Therefore, whenever possible, with the exception of the patient who is hyperventilating, oxygen should be administered. For the management of a medical emergency it should not be withheld from the patient with chronic obstructive lung disease, even though the patient may be dependent on low oxygen levels to breathe if they are chronic carbon dioxide retainers. Short term administration of oxygen to get them through the emergency should not depress their drive to breathe.

If the patient is conscious, or unconscious and still spontaneously breathing, oxygen should be delivered at a flow rate of 6-10litres per minute which is appropriate for most adults, and if the patient is unconscious and apnoeic, a flow rate of 10-15liters per minute will suffice. A positive pressure device may be used in adults, provided that the flow rate does not exceed 35liters per minute.

b) *Adrenaline*

This is the drug of choice for the emergency treatment of anaphylaxis, and also for asthma which does not respond to the drug of first choice, albuterol or salbutamol. Adrenaline is also indicated for the management of cardiac arrest, but in the dental setting, it may not likely be given, since intravenous access may not be available. It has a very rapid onset and

short duration of action, usually 5-10minutes, when given intravenously. However, it may be associated with high risks if given to a patient with ischemic heart disease.

For emergency purposes, it is available in two formulations: as 1:1,000 which equals 1mg per ml, for intramuscular, including intralingual, injections, and 1:10,000, which equals 1 mg per 10 mL for intravenous injection. Initial dose for the management of anaphylaxis is 0.3 to 0.5 mg intramuscularly or 0.1 mg intravenously. These doses should be repeated as necessary until resolution of the event. Similar doses should be considered in asthmatic bronchospasm which is unresponsive to a beta-2 agonist, such as albuterol or salbutamol. The dose in cardiac arrest is 1mg intravenously.

c) *Nitroglycerin*

This drug is indicated in acute angina or myocardial infarction. It is characterized by a rapid onset of action. For emergency purposes it is available as sublingual tablets or a sublingual spray.

d) *Antihistamines*

An antihistamine is indicated for the management of allergic reactions. Whereas mild non-life threatening allergic reactions may be managed by oral administration, life-threatening reactions necessitate parenteral administration of either diphenhydramine or chlorpheniramine.

e) *Salbutamol*

This is a selective beta-2 agonist. Salbutamol is the first choice drug for bronchospasm. By inhalation it provides selective bronchodilation with minimal systemic cardiovascular effects. It has peak effect in 30-60minutes and duration of 4-6hours.

f) *Aspirin*

Aspirin is a more newly recognized life-saving drug. It has been shown to reduce overall mortality from acute myocardial infarction. The purpose of its administration

during an acute myocardial infarction is to prevent the progression from cardiac ischemic injury to infarction.

g) Oral Carbohydrate

An oral carbohydrate source, such as fruit juice or non-diet soft-drink, should be readily available. Whereas this is not a drug, and probably should not be included in this list, it should be considered essential. If this sugar source is kept in a refrigerator it may not be appreciated that it is a key part of the emergency armamentarium. It is indicated in the management of hypoglycemia in conscious patients.

2. Other Drugs

In addition to the essential drugs a number of other drugs should be considered as part of an emergency pack, in a dental practice. These include:

- i) **Glucagon:** For intramuscular management of hypoglycemia.
- ii) **Atropine:** This anti-muscarinic, anticholinergic drug is indicated for the management of hypotension, which is accompanied by bradycardia.
- iii) **Ephedrine:** This drug is a vasopressor agent which may be used to manage significant hypotension. It has similar cardiovascular actions as adrenaline, except that ephedrine is less potent and has a prolonged duration of action, lasting 60-90 minutes.
- iv) **Corticosteroids:** Corticosteroids such as hydrocortisone may be indicated in the prevention of recurrent anaphylaxis. Hydrocortisone may also play a role in the management of an adrenal crisis. The notable drawback in their use in emergencies is the slow onset of action, which approaches one hour.
- v) **Morphine:** This is indicated in the management of severe pains such as occurring myocardial infarction, being listed in recommendations for advanced cardiac life support as the analgesic of choice for this purpose.

vi) **Naloxone:** In situations which include morphine in the emergency pack, or where opioids are used as part of a sedation regimen, naloxone should also be present for the emergency management of inadvertent overdose. Doses should ideally be titrated slowly in 0.1mg increments to effect.

vii) **Nitrous Oxide:** This is a reasonable second choice if morphine is not available to manage pain from a myocardial infarction. For management of pain associated with a myocardial infarction, it should be administered with oxygen, in a concentration approximating 35%, or titrated to effect.

viii) **Benzodiazepines:** The management of seizures which are prolonged or recurrent, also known as status epilepticus, may require administration of a benzodiazepine. In most dental practices, it would not be realistic to assume that the dentist could achieve venipuncture in a patient having an active seizure, and so, the need arises for a water-soluble agent such as midazolam or lorazepam as the drug of choice for status epilepticus and can be administered intramuscularly. Otherwise, the drug of choice is intravenous diazepam.

ix) **Flumazenil:** The benzodiazepine antagonist flumazenil should be part of the emergency pack for an effective use of benzodiazepines. Dosage is 0.1-0.2mg intravenously, incrementally.

Finally, in addition to having the above drugs available, a small amount of basic equipment should be readily available viz. stethoscope, sphygmomanometer, oxygen delivery system, intravenous fluids/lines, syringes and needles. Dentists should also consider having an automated external defibrillator (AED), for the emergency treatment of cardiac arrest. Usage of this latter piece of equipment is easily learned and only requires strong knowledge of basic Cardio-Pulmonary

Resuscitation (CPR) with a small amount of additional training.^{16,24,25}

PREVENTION OF MEDICAL EMERGENCIES

Most practicing dentists have faced a medical emergency in their practice but often overlook effective preventive measures. The proper and accurate assessment of a patient, including an evaluation of history and physical examination of the patient, patient's previous medical and surgical history, in order to make informed decisions about treatment options, are all essential and paramount in the prevention of emergencies.²⁷

Secondly, all staff in dental practice should have appropriate training: dental practitioners, dental surgery assistants, receptionists and other cadres,, inclusive. A team approach to the management of medical emergencies should be developed. Protocols should be put in place so that all members of staff know their roles in the management of emergency situations. The dental team should regularly practice drills within the dental practice setting.¹⁴ All dentists should be competent in basic life support (BLS) resuscitation. That is, they should be able to assess breathing and circulation and to carry out effective expired air resuscitation (EAR) and Cardio-pulmonary resuscitation (CPR) if required. They should also encourage their staff to attend courses on basic resuscitation and run practice drills with surgery staff. A wall poster can assist in retention of learnt techniques.¹²

MANAGEMENT OF MEDICAL EMERGENCIES^{12,14,26,28,29}

A) General Response

When an emergency is immediately life-threatening such as complete laryngeal obstruction, cardiac arrest associated with acute myocardial infarction, or bronchospasm associated with anaphylaxis, there is no time to delay; an immediate diagnosis must be made and definitive treatment initiated. It is

recommended that the DRSABC basic sequential steps for all emergency situations be invoked. These steps are to ensure an adequate delivery of oxygenated blood to the brain prior to the delivery of definitive care (DRSABC):^{12,14}

i. D = Check for Danger.

Ensure your safety and then safety of patient. The patient/victim may need to be moved.

ii. R = Assess Responsiveness

The most important assessment that decides much of your following actions is a simple tap or shake and a command "**Are you okay?**" This will quickly tell you whether the person's life is in immediate danger. A casualty who can respond with a few words has an airway, can breath and has a circulation. A person who is unresponsive may have none and is at risk of aspiration and airway obstruction. Keep in mind a simple assessment of level of consciousness (**AVPU**)

A-alert

V-response to verbal stimulus

P-response to pain

U-unresponsive

iii. S= Send or Shout for Help

Shout for or send an assistant for help (colleague, nearby hospital, Airtel medical helpline, 911). Ask them to seek, then return and confirm that help is on the way.

iv. A = Check the Airway for Obstruction

Open the airway by head tilt and chin lift. If the casualty is a victim of trauma, then the cervical spine may need to be protected so, use jaw thrust to open the airway and hold the head to keep the head and neck still and in alignment with the rest of the body and apply a rigid neck collar or an improvised one, whichever is available. Finger sweep may clear airway of blood clot, denture or other causes of obstruction.

v. B = Assess Breathing

The breathing must be assessed quickly. If there is no breathing, start rescue breathing. Consider intubation to protect the airway, and if the breathing is inadequate, the rescuer may need to give assisted rescue breathing.

C = Assess Circulation

Quickly assess circulation, and if there is no circulation, chest compressions / cardiac massage must be started immediately. If there is bleeding, use direct compression to stop further blood loss. Once DRSABC have been assessed and secured, give consideration to other aspects of emergency care and positioning of the patient/victim. Some patients may deteriorate after the initial assessment. It is, therefore, best to consider **DRS-ABC as a cycle**, performed regularly while awaiting the help sent for.

The procedures are basically the same however it must be noted that whereas in adults the focus is on early defibrillation, in children the focus is on early ventilation.¹⁴

B) Specific Responsesi. Syncope (Common fainting)

This is defined as a transient loss of consciousness due to cerebral ischaemia caused by a reduction in blood supply to the brain. Vasodilatation causes pooling of blood in the peripheral circulation, while vagal stimulation causes slowing of the heart, leading to a dramatic fall in blood pressure and a fainting spell. It presents with feeling of light headedness or dizziness and patients may possibly be nauseated, uncomfortable or agitated and will appear pale and sweaty with a thready slow pulse and hypotension.

Management

- Vasovagal syncope in a fit, healthy young patient:

Lay the patient flat. Relieve any compression on the neck and maintain an airway. Raise patient's legs. Supplemental

oxygen is indicated. Once pulse and blood pressure recover, slowly raise patient to seated position.

- In patients with significant medical problems, or when syncope is prolonged or complicated by seizure activity:

In addition to the above, the patient should be transferred to a hospital environment for further assessment as indicated.

ii. Anaphylaxis

This is a potentially life-threatening hypersensitivity reaction to foreign material. It presents with urticarial rash, angioedema, hypotension, tachycardia and bronchospasm.

Management

Assess the degree of cardiovascular collapse (pulse and blood pressure) and airway obstruction (upper - angioedema; lower - bronchospasm), and stop further administration of the offending drug(s)/agent(s). Give oxygen and monitor consciousness, airway, breathing, circulation, pulse, blood pressure. If in shock, angioedema or bronchospasm, then raise legs if blood pressure is low. Give adrenaline and repeat every five minutes while waiting for help/ambulance.

Paediatric doses of adrenaline

Children over 12years: 500mcg (0.5ml).
Children 6-12years: 300mcg (0.3ml).
Children less than 6years: 150mcg (0.15ml). Repeat in 5 minutes if no improvement. Reduce dose to 300mcg (0.3ml) for small 12-18year olds.

iii. Acute Chest Pain (Myocardial Infarction)

Victims usually have varying degrees of atheromatous coronary occlusion. Myocardial infarction (MI) is usually initiated by rupture or erosion of a thin cap which overlies these atheromatous plaques. It presents with persisting central chest pain, with possible radiation to the

left or right arms, jaw, or neck. There may be nausea or vomiting, a sense of impending doom, restlessness and shortness of breath, pallor with cold sweaty skin. Associated pump failure leads to hypotension, raised venous pressure, tachycardia and possibly, pulmonary oedema.

Management

Reassure the victim, keep warm, sit up if breathless, but lay flat if faint. Give glyceryl trinitrate tablets to chew or spray, under the tongue, and repeat in 5 minutes; if pain is unrelieved, activate emergency medical service. Give high flow oxygen by face mask, and 300mg aspirin chewed or sucked if there is no allergy.

iv. Cardiac Arrest

This usually presents with a collapse, and there is no respiration or pulse.

Management

Commence CPR and activate avenues to get help. In the first instance begin with Basic Life Support until AED arrives then move to the AED algorithm.

v. Foreign Body – Upper Airway Obstruction

Severe or complete upper airway obstruction due to a foreign body rapidly progresses to unconsciousness and cardiac arrest within minutes and presents with distress, choking, coughing and cessation of breathing.

Management

Partial obstruction: Encourage the patient to cough up or spit out. If there is poor air entry, increasing high pitched stridor or respiratory distress, manage as for complete airway obstruction.

Complete obstruction: The victim cannot speak, breathe or cough. If he is in the dental chair sit him up, turn patient side on in chair. Support the chest with one hand and deliver five sharp back blows between the shoulder blades with the heel of the other hand. If back blows fail, five

abdominal thrusts (Heimlich) should be done.

Unconscious obstruction: Commence CPR with finger sweep between each cycle. It is important to consider cricothyroidotomy if there is no air entry at all.

vi. Epilepsy

In a major seizure there is a sudden spasm of muscles producing rigidity (tonic phase). Jerking movements of the head, arms and legs may occur (clonic), then unconsciousness, with noisy or spasmodic breathing, excessive salivation and urinary incontinence. Status epilepticus occurs when a convulsion lasts longer than 30 minutes or when a tonic-clonic seizure occurs repeatedly.

Management

Remove dangerous objects from the mouth and around the patient e.g. dental cart. Loosen tight clothing, avoid restraining the patient or forcing open the mouth and do not insert any object into the mouth. Turn the victim into a stable side position (recovery position) as soon as the seizure stops, open and maintain a clear airway and avoid aspiration. Check for breathing and if absent, follow the guidelines for collapse. Allow the victim to sleep under supervision at the end of the seizure and on recovery, reassure. Paraldehyde or diazepam injections could be administered to break the seizures.

• **Transfer to hospital under the following conditions:**

- a) First fit b) tonic phase lasts longer than 5 minutes c) repeat seizure d) any post-seizure respiratory difficulty e) patient has suffered an injury and f) post-seizure confusion greater than 5 minutes.

vii. Hyperventilation

Prolonged rapid deep breathing often in very anxious patients can lead to profound metabolic changes that may

result in loss of consciousness. A fall in arterial CO₂ concentration causes cerebral vasoconstriction and respiratory alkalosis. The patient may notice tingling of the fingers or lips, tetanic spasm of the peripheries and dizziness, eventually, becoming unconscious due to cerebral hypoxia. The patient is apnoeic for a period due to reduced respiratory drive with low arterial carbon dioxide concentration. As the arterial carbon dioxide level rises and cerebral vasoconstriction reverses, the patient starts breathing and regains consciousness. Hyperventilation recommences and the cycle continues with further loss of consciousness.

Management

Reassure the patient if conscious, then, re-breathe into paper bag to increase inspired carbon dioxide. In the unconscious patient, maintain airway until patient regains consciousness.

viii. Diabetic Emergencies

The most common diabetic emergencies are: low blood sugar - hypoglycaemia in patients on anti-diabetic medications and high blood sugar - hyperglycaemia, particularly diabetic ketoacidosis.

Hyperglycaemia: Clinical symptoms include thirst, increased urine output and dehydration, and also, there may be hypotension, progressive reduction in level of consciousness, coma or cessation of urinary output in severe cases.

Management

Primary assessment and resuscitation (DRS-ABC) is to secure the airway, breathing and circulation. Then transport to a hospital facility.

Hypoglycaemia: Clinical symptoms of hypoglycaemia include sweating, hunger, tremor, agitation, with progressive drowsiness, confusion and coma. Assume any diabetic with impaired consciousness

has hypoglycaemia until proven otherwise.

Management

Conscious patients can usually be treated with rapid acting oral carbohydrates, e.g. fruit juice, packets of granulated sugar, glucose powder dissolved in water. After 10 minutes this short acting carbohydrate should be followed up with food which contains longer acting carbohydrate. The victim should not be left alone until all the dangers of hypoglycaemia are resolved. If the patient is unconscious, attend to the airway, breathing and circulation. Protect the victim from more injury and activate the EMS.

It is recommended that any victim of medical emergencies who suffers loss of consciousness be discharged to the care of a reasonable adult, and never be allowed to go home, unaccompanied.

CONCLUSION

Medical emergencies may be rare but challenging occurrences in the dental clinic, tasking the knowledge, skills and materials available. Prevention, by ensuring good history and physical examination, is better and cheaper than embarking on therapeutic measures. Adequate staff training and availability of appropriate drugs and equipment are all essential to the management of emergencies that may arise in the dental clinic.

RECOMMENDATION

We recommend an improvement in the training of dental surgeons with realistic simulation training in the management of medical emergencies, at the undergraduate, post-graduate and continuing education levels. We also recommend availability of emergency drugs and equipment as well as regular safety drills in dental clinics.

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