

Review Article

Innovative Strategies for Managing Medical Emergencies in the Dental Office

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ABSTRACT:

Dentists must be prepared to manage medical emergencies which may arise in practice. Every Dental specialist should have the knowledge to identify and manage a potentially life-threatening situation. Prompt recognition and efficient management of an emergency by the specialist results in a satisfactory outcome. Though rare, emergencies do occur in a dental clinic. The ultimate goal in the management of all emergencies is the preservation of life. The prime requisite in managing an emergency is maintenance of proper Position (P), Airway (A), Breathing (B), Circulation (C), and Definitive treatment (D). An efficient and well prepared dental team can make all the difference in the event of a medical emergency. The purpose of this article is to provide a vision to the commonly occurring medical and dental emergencies and complications in dental practice and their management.

Keywords: Medical emergencies, Emergency drugs, Basic life support, Complications

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INTRODUCTION

Life threatening emergencies in the dental surgery are fortunately rare but they do happen in practice of dentistry. They can happen to anyone – a patient, doctor, member of office staff or person who is merely accompanying a patient. A number of factors exist today that can increase the likelihood of such incidents such as increasing number of older patients seeking dental treatment, therapeutic advances in medical profession, growing trend towards longer dental appointments and increasing use and administration of drugs in dentistry. Although any medical emergency can develop in the dental office, most such situations are entirely stress induced (eg. Pain, fear, anxiety) or involve pre-existing conditions that are exacerbated when patients are placed in stressful environments. Stress induced situations include vasodepressor syncope and hyperventilation, whereas pre-existing medical conditions that can be

exacerbated by stress include most acute cardiovascular emergencies, bronchospasm (asthma) and seizures.¹ Malamed conducted a 10 year study of more than 30,000 medical emergencies that occurred in dental office and the results demonstrated that stress and acute pain accounted for approximately 74% of all emergencies, most of which occurred while the patient was in the treatment chair, 16.7% occurred when patient was in the waiting room, either before or after the treatment. It is therefore vital for all dental office staff to be familiar with the handling of emergency situations.²

The collapse of patient in dental surgery is a disturbing experience for all concerned – even if the outcome is complete recovery. Emergencies should be prevented wherever possible by careful assessment of the patient. *Forewarned is forearmed* applies especially to emergencies.³ McCarthy (1971) has estimated that through the effective implementation of stress

reduction procedures, 90% of life threatening situations can be prevented and remaining 10% deaths are classified as sudden, unexpected death unpreventable.¹

The ultimate goal for a dentist managing a medical emergency is to prevent the death of the victim, a goal achieved through office preparation, prompt recognition and effective management. Goldberger stated “when you prepare for an emergency, the emergency ceases to exist.” The best treatment of a emergency complication is prevention: obtaining and routinely updating the detailed history, vital signs, familiarity with all the essential, pertinent diagnoses and medications, preparing careful dental treatment plans in co-operation with the patient’s physician, if necessary, in compromised medical cases, considering drug contraindications, side-effects and interactions. This preventive thinking is the only proper patient management concept to avoid the need for medical emergency treatment.⁴

CLASSIFICATIONS OF LIFE THREATENING SITUATIONS⁵

Several methods are available for the classification of medical emergencies.

1. System oriented classification

Major organ systems are listed in this classification and life threatening situations associated with that system are included.

- Infectious diseases
- Immune diseases
- Allergy
- Angioneurotic edema
- Contact dermatitis
- Anaphylaxis
- Skin and appendages
- Eye
- Ear, nose and throat
- Respiratory tract
- Asthma
- Cardiovascular system
- Arteriosclerotic heart disease
- Angina pectoris
- Myocardial infarction
- Heart failure
- Blood
- Gastrointestinal tract and liver
- Obstetrics and gynaecology
- Nervous system
- Unconsciousness
- Syncope
- Hyperventilation syndrome
- Vasodepressor syncope
- Orthostatic hypotension
- Convulsive disorders
- Epilepsy
- Drug overdose reactions
- Cerebrovascular accident

- Endocrine disorders
- Diabetes mellitus
- Hyperglycemia
- Hypoglycemia
- Thyroid gland
- Hyperthyroidism
- Hypothyroidism
- Adrenal gland
- Acute adrenal insufficiency

Drawback

It is approach of choice for educational purposes but faulty from clinical standpoint

2. Cardiovascular and noncardiovascular emergencies⁶

It is other system of classification of life threatening situation. This system can assist doctor in preparing a workable treatment plan for prevention of such situations.

Cardiovascular emergencies

- Stress related
- Non stress related

Non-cardiovascular emergencies

- Stress related
- Non stress related

Non-cardiovascular emergencies

Stress related

- Vasodepressor syncope
- Hyperventilation syndrome
- Hypoglycemic reactions
- Epilepsy
- Acute adrenal insufficiency
- Thyroid crisis
- Asthma

Non stress related

- Orthostatic hypotension
- Overdose reaction
- Hyperglycemia
- Allergy

Cardiovascular emergencies

Stress related

- Angina pectoris
- Acute myocardial infarction
- Heart failure
- Cerebral ischaemia and infarction

Non stress related

- Acute myocardial infarction

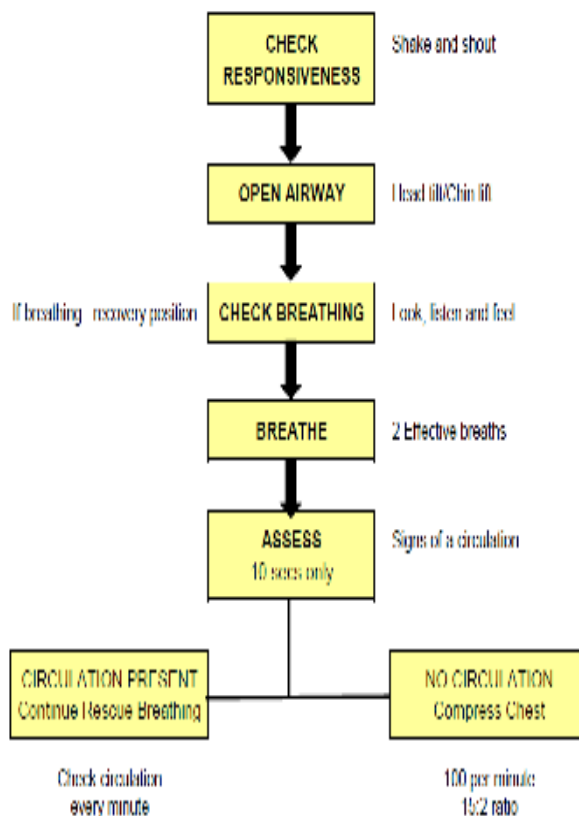
• Prevention and Management⁷:

Prevention is not always enough, the entire dental office staff must be prepared fully to assist in the recognition and management of any potential emergency situation.

Preparation of dental staff members and office should include the following minimal requirements.⁸

Table 1: Preparation of the dental office & staff for medical emergencies.⁸

Preparation of the dental office & staff for medical emergencies.	
Basic Life Support	
<ul style="list-style-type: none"> Annually BLS for Healthcare Providers ALL dental office employees 	<ul style="list-style-type: none"> In the dental office Ventilate mouth-to-mask, NOT mouth-to-mouth
Dental Office Emergency Team	
<p>MEMBER #1 1st on scene of emergency Stay with victim; yell for 'HELP'; administer BLS, as needed</p> <p>MEMBER #2, on hearing call for HELP ... Obtains (1) emergency drug kit; (2) portable O₂ cylinder; and (3) AED and brings to site of emergency</p>	<p>MEMBERS #3, #4 and on, assigned ancillary tasks such as:</p> <ul style="list-style-type: none"> Monitoring vital signs (BP, heart rate & rhythm) Assist with basic life support Activate EMS (9.1.1.) Hold elevator in lobby while waiting arrival of EMS Prepare emergency drugs for administration Keep written time line record during emergency
<ul style="list-style-type: none"> Doctor remains the 'responsible' party during management of medical emergencies. Tasks CAN be delegated. Office personnel should be interchangeable during emergency management. 	
Activation of EMS (Emergency Medical Services)	
<p>WHEN: As soon as YOU, the doctor, think it is necessary. For example: (1) unable to make a diagnosis; (2) know the diagnosis but are uncomfortable with it (e.g. cardiac arrest); and (3) whenever you think EMS is warranted.</p>	

BASIC LIFE SUPPORT OR CARDIOPULMONARY RESUSCITATION(CPR)¹⁴**Table 2: Flow chart for basic life support****Adult Basic Life Support**

Emergency drugs and equipment^{9,10,11,13,15}

These must be available in every dental office. It should be as simple as possible to use. Pallasch's statement that "complexity in a time of adversity breeds chaos" is all true. The doctor should remember three things in preparing and using emergency drug kits:

1. Drug administration is not necessary for the immediate management of medical emergencies.
2. Primary management of all emergency situations involves BLS
3. When in doubt, never medicate.

Drugs that should be promptly available to the dentist can be divided into two categories.

1. **Essential drugs:** The first category represents those drugs that may be considered essential.
2. **Supplemental drugs:** The second category contains drugs that are also helpful and should be considered as part of the emergency kit.

ESSENTIAL DRUGS

Oxygen

Indication

Oxygen is indicated for every emergency except hyperventilation.

Dose

Initial adult dose 100%: inhalation

Availability

Oxygen should be available in a portable source, ideally in an "E"-size cylinder that holds more than 600 liters and provides oxygen for approx. 30 mins.

Epinephrine

Indication

Epinephrine is the drug of choice for the emergency treatment of anaphylaxis, asthma and cardiac arrest.

Mechanism of action

Epinephrine has a rapid onset and short duration of action, usually 5–10 minutes when given intravenously.

Availability

For emergency purposes, epinephrine is available in two formulations. It is prepared as 1:1,000, which equals 1 mg per mL, for intramuscular injections to treat cases of acute allergic reactions and acute asthmatic attack. It also is available as 1:10,000, which equals 1 mg per 10 mL, for intravenous injection in management of cardiac arrest.

Dose

Initial doses for the management of anaphylaxis and asthma are 0.3–0.5 mg intramuscularly or 0.1 mg IV. Dose in cardiac arrest is 1 mg intravenously

Nitroglycerin

Indication

This drug is indicated for acute angina or myocardial infarction.

Mechanism of action

It is characterized by a rapid onset of action. Its primary mechanism of action is through vasodilation, which results in a decrease in venous return to the heart and therefore a reduction in the work of cardiac muscle. In turn, this reduces myocardial oxygen consumption.

Dose

With signs of angina pectoris, 0.3 or 0.4 mg should be administered sublingually. Relief of pain should occur within minutes. If necessary, this dose can be repeated twice more in 5-minute intervals provided that systolic blood pressure remains above 90 mm Hg.

Injectable antihistamine

Indication

An antihistamine is indicated for the management of allergic reactions.

Availability

Two injectable agents may be considered, either diphenhydramine (Benadryl) or chlorpheniramine.

Dose

Recommended doses for adults are 25–50 mg of diphenhydramine or 10–20 mg of chlorpheniramine.

Albuterol

Indication

A selective β_2 agonist such as albuterol (Ventolin) is the first choice for management of bronchospasm.

Duration of action

It has a peak effect in 30–60 minutes, with a duration effect of 4–6 hours.

Dose

Adult dose is 180 to 200 micrograms, which is two sprays, to be repeated as necessary. Pediatric dose is 90 to 100 micrograms, or one spray, repeated as necessary.

Aspirin

Indication

Acute myocardial infarction

Mechanism of action

Role of aspirin as a drug in medical emergencies is derived from this inhibition of thromboxane, as it inhibits platelet aggregation.

Availability

Aspirin is available as 81-, 162.5-, 325-, 500-, or 650-mg tablets.

Dose

A minimum of 162 mg should be given immediately to any patient with pain suggestive of acute myocardial infarction.

Oral carbohydrate

Indication

Its use is indicated in the management of hypoglycemia in conscious patients.

Source

An oral carbohydrate source, such as fruit juice or nondiet soft drink, should be readily available.

Aromatic ammonia

Use

Aromatic Ammonia is used to stimulate respiration in the case of syncope or to disrupt respiratory pattern in hyperventilation.

Dose

1 ampule crushed waved under patient's nose.

Mechanism of action

Noxious odor stimulates the respiratory center of the medulla.

Adverse effects

Cardiovascular: Increases blood pressure and heart rate.

Respiratory: Can cause bronchospasm.

Supplementary drugs

In addition to the six drugs discussed above, several other drugs should be considered as part of an emergency kit, as shown in Table 2.

Glucagon

Indication

The presence of this drug allows intramuscular management of hypoglycemia in an unconscious patient. The ideal management of severe hypoglycemia in a diabetic emergency is the intravenous administration of 50% dextrose. Glucagon is indicated if an intravenous line is not in place and venipuncture is not expected to be accomplished, as may often be the case in a dental office.

Mechanism of action

It has actions that oppose insulin and its administration raises plasma glucose.

Duration of action

Its anti-hypoglycemic effect occurs within 15 minutes if given intramuscularly. Its duration of action is approximately 90 minutes.

Dose

The dose for an adult is 1 mg. If the patient weighs less than 20 kg, the recommended dose is 0.5 mg.

Availability

Glucagon is available as a 1-mg formulation that requires reconstitution with its diluent immediately before use.

Atropine

Indication

This antimuscarinic, anticholinergic drug is indicated for the management of hypotension that is accompanied by bradycardia.

Availability

Atropine is available in numerous strengths, ranging from 50 micrograms per mL to 1 mg per mL.

Dose

A concentration approximating 0.5 mg per mL (IM) or two 10 mL syringes with 1 mg per syringe (IV) would be suitable for emergency purposes.

Ephedrine

Indication

This drug is a vasopressor that may be used to manage significant hypotension.

Dose

For the treatment of severe hypotension, it is ideally administered in 5-mg increments intravenously. Intramuscularly it should be given in a dose of 10–25 mg.

Availability

It is formulated as either a 25- or 50-mg per mL solution.

Corticosteroid

Indication

Administration of a corticosteroid such as hydrocortisone may be indicated for the prevention of recurrent anaphylaxis and in the management of an adrenal crisis.

Mechanism of action

Corticosteroids provide membrane-stabilizing effects, reduce leukotriene formation, and reduce histamine release from mast cells.

Dose

The prototype for this group is hydrocortisone (Solu-Cortef) that may be administered in a dose of 100 mg as part of the management of these emergencies.

Morphine

Indication

Morphine is indicated for the management of severe pain that occurs with a myocardial infarction and congestive heart failure.

Advantages

ACLS recommendations list morphine as the analgesic of choice for this purpose. It has the beneficial effects of being an excellent analgesic and having good mood-altering properties to help manage the stress.

Dose

Emergency kits may contain 10 mg/ml morphine sulphate (two 2 ml ampules) or 50 mg/ml meperidine (2 ml ampules).

Naloxone**Mechanism of action**

Naloxone is an antagonist at all opioid receptors, and therefore blocks all of the actions of morphine or any other opioid.

Duration of action

Following intravenous administration, it has an onset of action of 1–2 minutes and a peak effect in 5–15 minutes.

Dose

Doses ideally should be titrated slowly in 0.1-mg increments to effect.

Availability

It is formulated as either a 0.02-, 0.4-, or 1.0-mg per mL solution.

Nitrous oxide¹³**Indication**

Nitrous oxide is a reasonable second choice if morphine is not available to manage pain from a myocardial infarction.

Dose

It should be administered with oxygen, in a concentration approximating 35%, or titrated to effect.

Injectable benzodiazepine**Indication**

The management of seizures that are prolonged or recurrent, also known as status epilepticus, may require administration of a benzodiazepine.

Dose

Adult doses to consider for lorazepam are 4 mg intramuscularly, or midazolam 5 mg intramuscularly.

Flumazenil**Indication**

Flumazenil (Romazicon) should be part of the emergency kit when oral or parenteral sedation is used.

Mechanism of action

This specific antagonist to the benzodiazepine receptor reverses benzodiazepine-induced unconsciousness, sedation and amnesia.

Dose

Dosage is 0.1 to 0.2 mg intravenously, incrementally.

Table 4: Essential drugs used in medical emergencies in dentistry

Drug	Indication	Initial adult dose
Oxygen	Almost any medical emergency	100%: inhalation
Epinephrine	Anaphylaxis	0.1 mg IV or 0.3–0.5 mg IM
	Asthma unresponsive to albuterol	0.1 mg IV or 0.3–0.5 mg IM
	Cardiac arrest	1 mg IV
Nitroglycerin	Pain of angina	0.3–0.4 mg sublingual
Antihistamine (diphenhydramine or chlorpheniramine)	Allergic reactions	25–50 mg IV, IM 10–20 mg IV, IM
Albuterol	Asthmatic bronchospasm	2 sprays (180 µg–200 µg) inhalation
Aspirin	Myocardial infarction	160 mg–325 mg
Pediatric doses (approximate, not to exceed the adult doses listed above)		
Epinephrine = 0.01 mg/kg		
Diphenhydramine = 1 mg/kg		
Albuterol = 1 spray (90–100 µg)		

Supplementary emergency drugs

Drug	Indication	Initial adult dose
Glucagon	Hypoglycemia in unconscious patient	1 mg IM
Atropine	Clinically significant bradycardia	0.5 mg IV or IM
Ephedrine	Clinically significant hypotension	5 mg IV, or 10–25 mg IM
Hydrocortisone	Adrenal insufficiency	100 mg IV or IM
Morphine or nitrous oxide	Recurrent anaphylaxis	
Naloxone	Angina-like pain unresponsive to nitroglycerin	Titrate 2 mg IV, 5 mg IM ~35%, inhalation
Lorazepam or midazolam	Reversal of opioid overdose	0.1 mg IV or 0.4 mg IM
Flumazenil	Status epilepticus	4 mg IM or IV
	Benzodiazepine overdose	5 mg IM or IV
		0.1 mg IV

Recent advances in managing medical emergencies in the dental office

1. Integration of Artificial Intelligence (AI) for Early Detection

AI-driven patient monitoring systems can analyze real-time physiological data and predict potential emergencies before they escalate. Wearable devices that monitor heart rate, oxygen saturation, and blood pressure can alert the dental team to early signs of distress.

2. Enhanced Emergency Response Training

- Mandatory certification in Advanced Cardiovascular Life Support (ACLS) for dental professionals.
- Regular simulation-based training with high-fidelity manikins to improve response efficiency.
- Interdisciplinary training sessions involving emergency medical services (EMS) to ensure seamless collaboration.

CONCLUSION

Emergencies can and do happen. Most dentists will, at some point in their career, be faced with an in-office emergency. With proper prevention techniques, 90 percent of medical emergencies can be avoided. Preparedness for an emergency should be tailored to each dental office. The ADA mandates specific training and emergency drugs and equipment necessary for dentists who use conscious sedation, deep sedation, or general anesthesia. Dental offices should require all staff members to be certified in cardiopulmonary resuscitation, including basic life support. Emergency numbers should be clearly displaced near all telephones in the office. Clinicians should understand the operation of all emergency equipment including which equipment is needed for which emergencies. The frequent trial runs of emergency situations are excellent opportunities for members of the dental team to master their roles in

emergency care. Preparing for medical emergencies can seem overwhelming. It takes time, financial resources, and continual practice and review. However, not taking the proper prevention and preparation steps may be devastating for both the patient and the dentist. An efficient and well prepared dental team can make all the difference in the event of a medical emergency.

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