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REVIEW ARTICLE

USE OF EMERGENCY DRUGS IN MEDICAL EMERGENCY CONDITIONS IN PAEDIATRIC DENTAL OFFICE

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ABSTRACT

This review focus on several emergency drugs which should be always present in the pediatric dental office for the treatment of medical emergencies or to prevent their occurrence in dental clinic. Drugs used for adults can be inadequate for treatment of medical emergencies in a pediatric dental patient. So emergency drugs should be individually prepared for use or they can be commercially available as emergency drug kit. This drug kit should contain all emergency drugs with recommended dose for use by the pedodontist according to the needs of emergency and training of the dental practitioner.

INTRODUCTION

Although rare, medical emergencies can occur in the dental office. While the majority of medical emergencies occur in adult patients, pediatric medical emergencies can occur too. All possible drug interactions (e.g. local anaesthetics etc.) in dentistry have the potential to develop allergic reactions, which may lead to life-threatening conditions. In dental practice the most common emergency occurs after drug administration most often local anaesthetics, parenteral administration of antibiotics, analgesics and sedatives. Most commonly in pediatric dental office, emergency occurs due to anxiety of dental treatment and fear of pain during treatment or while inject in local anaesthesia (Kumar and Mukhi, 2014). These emergencies occur quickly, without warning, and with possible severe consequences due to the child's under-developed physiology and due to their small oxygen reserves. Successful resolution of the emergency requires early recognition of the problem and gives definitive treatment to the patient (Schwartz, 2012). This article provides guidelines for developing a practical emergency kit for use by the pedodontist. This kit should contain the necessary drugs to enable the pedodontist to treat effectively any medical emergency. Since some of the pediatric patients almost approach the age and size of adults, so the dentist must be capable of treating medical emergencies in adults as well as children. This responsibility should not be limited to the dental operatory because emergencies can happen with parents,

grandparents, and relatives in the reception room also. The pedodontist should be trained in providing basic life support for the child and should have the necessary equipment and drugs available for treating potential emergencies (Goepferd, 1979).

DISCUSSION

Emergency drugs will discuss in the following section for definitive treatment for the most common emergencies happened in the dental office. Emergency drugs may be divided into two categories. The first category is the drugs that are essential and should be part of every emergency drug kit. The second category is drugs that are useful but they are optional depending on the training of the practitioner in emergency medical procedures. Thus, emergency drug kits will vary from office to office.

The following steps are taken for all emergencies:

- Discontinue the dental treatment immediately
- Activate the office emergency system
- Call for assistance
- The oxygen and emergency drug kit is brought to the site of the emergency
- Attend to the patient
- Position the patient to ensure an open and unobstructed airway

- Monitor vital signs
- Support respiration and circulation
- Provide definitive treatment

Emergency drugs that can be administered orally, intramuscularly/ intralingually and intranasally will be discussed.

a) Oxygen

- Oxygen is a colorless, odorless, tasteless gas which is utilized by the body for respiration. Oxygen is an essential drug which is indicated in every emergency condition except in hyper-ventilation syndrome in which partial pressure of oxygen level is already high. It has played a major role in respiratory care. Oxygen therapy is useful in treating hypoxemia like in acute asthmatic attack (Walsh and Smallwood, 2017). Asthma is a common disorder of young patients and may be associated with allergies or elevated blood eosinophil counts.
- Allergic reactions are one source of hyper-reactivity response and are triggering source of the asthmatic attacks.
- Asthmatic attack is sudden in onset with tightness in the chest and commonly with cough, dyspnea, and wheezing sounds. There is difficulty in respiration.
- The termination of attack is commonly accompanied by productive cough with thick, stringy mucus. Episodes usually are self-limiting but severe episodes may require medical assistance.

Oxygen is very useful in syncope by maintaining oxygen level. Syncope is defined as a transient loss of consciousness and posture due to cerebral ischemia caused by a reduction in blood supply to the brain.

- It arises out of psycho-physiologic responses are rarely life threatening and can be managed readily by the alert dental office team.
- In the presyncope stage patient feels light headed or dizzy, possibly nauseous, uncomfortable or agitated.
- They will appear pale and sweaty with a thready slow pulse and hypotension with increased heart rate.
- In the syncope stage patient loses consciousness, generalised muscle relaxation followed by seizures. Management depends upon the medical condition of the patient.
- The patient may exhibit a slow and weak pulse, a decreased or normal blood pressure, increased respiratory rate, pallor, cold and clammy skin, dilated pupils, eyes rolled upward.

Oxygen is delivered with a clear full face mask for the spontaneously breathing patient. Patients in which breathing repeatedly stops and start again, a bag-valve-mask device provide for that patient. So whenever possible, oxygen should be administered with the exception of the patient who is hyperventilating. The oxygen should be available as a portable unit with an "E" size cylinder that is capable of delivering greater than 90% oxygen at a flow of 5 L/min for a minimum of 60 minutes².

b) Adrenaline: It has a very rapid onset and short duration of action, usually 5-10 minutes. This is the drug of choice for

the emergency treatment of anaphylaxis and can also be useful for treatment of asthma if patient does not respond to the beta 2 agonist like albuterol or salbutamol. It is available as 1: 1000, which equals 1 mg per mL for SC/IM/Intra lingual injections. It can be given in a maximum dose of 0.05 - 0.3 mg. This is also can be prepared as diluted to 1: 10,000 for IV administration. Adrenaline is also delivered in case of anaphylactic reaction. Anaphylaxis is potentially life threatening immune reaction to foreign material. It is an immediate and explosive event, and it results as an allergic response to the introduction of a substance to which the patient has been previously sensitized. This reaction can occur immediately after the administration of the offending drug or can be delayed up to two hours following oral administration. Typically, in 1 to 15 minutes, the signs and symptoms starts appear as –

- Patient feels uneasy
- Becomes agitated and flushed
- Palpitations
- Paresthesia (sensation of pins and needles)
- Pruritus (itching)
- Hives
- Throbbing in the ears
- Itching
- Rashes
- Anxiety
- Restlessness
- Acute fear
- Headache
- Nausea
- Cyanosis

For children up to 12-18 yrs of age, 500 mcg (0.5 ml) can be given with a repeat dose of 300 mcg (0.3 ml). For age range of children between 6-12 years, 300 mcg (0.3 ml) can be given. For children less than 6 years, 150 mcg (0.15 ml) dose can be used (Mohideen *et al.*, 2017). But it can be associated with high risk if it is use for a patient with ischemic heart disease. Same amount of dose can also be use for asthmatic patient which is unresponsive to a beta-2 agonist. The dose of adrenaline in case of cardiac arrest is 1mg intravenously.

c) Antihistaminics: Antihistamines are drugs that block histamine release from histamine-1 receptors. These receptors are located in the airways, blood vessels and gastrointestinal tract (stomach and esophagus). These drugs are mostly used to treat allergies or cold and flu symptoms. Stimulation of these receptors can lead to conditions such as a skin rash or inflammation, a narrowing of the airways (bronchoconstriction), hay fever, or motion sickness. Histamine-1 receptors are also found in the brain and spinal cord. An allergic reaction is the specific change in the reactivity of tissues to antigenic substances. Specifically, it is the reaction resulting when a second dose of antigen reacts with fixed antibodies.

Symptoms:

- Itching
- Skin rash
- Hives
- Swelling of the face, hands, and eyelids
- Nasal congestion

- Sneezing
- Respiratory difficulty and laryngeal edema in severe cases

Antihistamines are very good at relieving symptoms of an allergic reaction, such as: edema (swelling), inflammation (redness), itch, rash, red and watery eyes, a runny nose, sneezing. Oral administration of antihistamines is advisable for mild non-life-threatening allergic reactions. Parenteral administration (IM) is required for life-threatening reactions. Diphenhydramine should be administered i.m. in the dose of 25-50 mg for children (5mg/kg/24 hr to a maximum of 300 mg) (Stephen 2) Chlorpheniramine should be administered i.m/oral in the dose of 1-2 mg per 6 hourly up to a maximum dose of 8 mg/day (Mohideen *et al.*, 2017).

Oral Diphenhydramine Liquid Dosing (12.5mg/5ml)² :

Age	Dose
Under 3 months	Consult physician
4-11 months	¼ tsp 4-6 every hrs
12-23 months	½ tsp 4-6 every hrs
2-3 years	¾ tsp 4-6 every hrs
4-5 years	1 tsp 4-6 every hrs
6-8 years	1 ¼ tsp 4-6 every hrs
9-10 years	1 ½ tsp 4-6 every hrs
11 years	1 ¾ tsp 4-6 every hrs
12+ years	2 tsp 4-6 every hrs

d) Nitroglycerin: This belongs to a group of medicines called nitrates or vasodilators. It relaxes the muscles surrounding blood vessels (arteries and veins) and helps more blood and oxygen to reach the heart. It is also used to control or lower the blood pressure during some surgical procedures. This drug is not addictive. This is used for the treatment of angina pectoris. In case, if patient is allergic to aspirin or if patient is on warfarin therapy, this drug can also be useful for treatment of acute myocardial infarction (Chapman, 2003). It has a rapid onset of action. It is available as oral and transmucosal preparations, transcutaneous patches, and IV solutions. Sublingual tablets or spray are more suitable forms for dental office. Sublingual aerosol spray Up to 3 spray doses can be given to the patient in 0.4mg/dose (Chapman, 2003). Sublingual tablets in dose of 0.3-0.5 mg can also be used to treat angina pectoris (Venkateswarlu and Vanaja, 2010).

e) Oral Carbohydrate: Oral carbohydrates such as fruit juice or non-diet soft drink are used to manage early hypoglycemia in conscious patients. Diabetic hypoglycaemia usually occurs in a patient who has a history of diabetes. The reaction is the result of a net excess of insulin either due to an overadministration of insulin or to the patient not having eaten properly, perhaps having skipped a meal.

Symptoms:

- Sweating
- Hunger
- Tremor
- Agitation with progression drowsiness
- Confusion and coma.

Oral carbohydrates act rapidly to restore blood sugar level. Missed meal can be the possible etiology for hypoglycemia in case of insulin-dependent diabetic patient.

f) Glucagon: Oral glucose provide food high in carbohydrate in Conscious patients. But if patient is unconscious, glucagon can be use to manage hypoglycaemia. It can be given by intramuscular route. It acts within 10 min after administration. In pediatric patients dose of 0.5 mg can be given. Alternative for glucagon, 50% IV dextrose use for treatment of severe hypoglycemia. Pediatric dose of 50-100 ml can be use. Children over 8 years of age and whose weigh more than 25 kg, 1 mg of Glucagon solution given by IM route. But children less than 8 years of age or weighing less than 25 kg, 0.5 mg of glucagon solution can be given (Maluvelil *et al.*, 2016).

g) Salbutamol: Salbutamol is a short-acting selective beta-2 adrenergic receptor agonist. This is the first drug of choice for relief in acute asthmatic attack. It is available in the form of a metered dose inhaler (MDI). 2-3 inhalations are safe for pediatric use. They drugs cause bronchodilation with less side effects in cardiovascular system. These inhalers are also available with spacer. Spacer increases the dose deposition in the respiratory tract and increases its potential. It has peak effect in 30 min to 1 h and duration of action is 4-6 h. In a child patient, 1 spray/1-2 min can be given. These inhalers can be use up to 3 times if required (Mohideen *et al.*, 2017).

h) Benzodiazepines: Benzodiazepines are used for a range of health issues, including anxiety, stress and sleep disorders. They are use to manage recurrent seizures (status epilepticus) in dental office. An epileptic seizure is an intermittent disorder of the nervous system presumably caused by a sudden discharge of cerebral neurons resulting in an almost instantaneous disturbance of sensation, loss of consciousness, and convulsive movements. This is not a disease but rather a complex symptom characterised by chronic recurrent paroxysmal changes in neurologic function that are caused by abnormal activity in the brain.

Symptoms:

- Grand mal epilepsy characterized by tonic-clonic convulsions
- Loss of consciousness
- Oozing of saliva from the mouth
- Incontinence
- Cyanosis.
- Petit mal seizures are usually characterized by a trance-like state with a lack of motor disturbances.

Side effects can include dizziness, drowsiness, poor coordination, and feelings of depression. First drugs of choice are diazepam. IV diazepam 5-10 mg is the recommended dose for pediatric patients. It is rapid in action and can stop all types of seizures. An alternative drug for status epilepticus is midazolam or lorazepam. Pediatric dose of diazepam is 0.5 mg/kg for 2-5 year olds and 0.3 mg for 6-11-year-old children. Pediatric dose for lorazepam is 0.05-0.1 mg/kg. Midazolam 0.1-0.3 mg/kg in recommended for child patients.

i) Flumazenil: Flumazenil is the antagonist of benzodiazepine. Benzodiazepine use for sedation and it also causes depression of respiratory system. Flumazenil antagonizes these effects induced by benzodiazepines administration. Dosage is 0.1-0.2 mg IV increments with a maximum dose of 1 mg.

- j) Aromatic Ammonia:** It is used in management of syncope. It stimulates the respiratory system and helps the patient to get in conscious position. Aromatic ammonia is available as inhalant buds. Inhalant buds 0.3 ml are use. It should be administered after maintaining patent airway of the patient.
- k) Atropine:** This is an anticholinergic drug and it is used to manage hypotension accompanied with bradycardia. Atropine can be use as both IV as well as IM. Pediatric dose of atropine sulphate: 0.02 mg/kg for IV route and 0.04 mg/kg for intramuscular injection. Maximum dose for IV injection is 1 mg (Malamed, 2015).
- l) Aspirin:** Aspirin is a anticoagulant drug and it helps to reduces death rate in children in case of acute myocardial infarction. It helps by preventing further clot formation and thus increases the blood flow to heart. In a child patient, 10-15 mg/kg dose is recommended. It is contraindicated in asthma, bleeding disorders, and if a patient is hypersensitive to aspirin (Uyamudu and Odai, 2012).
- m) Naloxone:** Naloxone is an opioid antidote and it antagonizes the effect of opioid-induced respiratory depression. This should be used for the emergency management of morphine overdose. For intramuscular injection, 0.01 mg/kg are advisable in children. The dose involves titration in 0.1 mg increments. It should be administered at a slower rate to give more beneficial effect.
- n) Corticosteroids:** Corticosteroids are the drugs which use for management of anaphylaxis and adrenal insufficiency. Drugs like hydrocortisone are generally use. Their onset of action is slow which 1 h on IV administration. So their use is limited in emergency cases. Pediatric dose is 50-100 mg (Haas, 2010).

Corticosteroids like prednisolone 30-60 mg orally can be given along with high flow oxygen in case of bronchial asthma. Asthma is due to reversible airway obstruction characterized by hypersensitivity, bronchial inflammation, smooth muscle spasm and hypertrophy, mucosal congestion and hyper secretion, all of which compromise bronchial patency. This is a type of pulmonary incompetency manifested by a recurrent paroxysm of dyspnea of a characteristic wheezing type and is caused by a narrowing of the smaller bronchi and bronchioles.

Summary

Although medical emergencies in dental offices can be a challenge to the dental practitioner and the team, but with a proper skill set, training, and carefulness, many of the emergencies can be effectively managed. The presence of emergency drugs and equipments in the dental office could prove to be the deciding factor with respect to the outcome of treatment. In the case of a medical emergency, with proper knowledge and training, a dentist can successfully manage the emergency condition until the emergency services arrive.

Conclusion

Medical emergencies can be rare but can occur as a challenge in the dental clinic and it can task the knowledge, skills and materials available. Working with children is more difficult because of their young age and differences in the physiological and psychological anatomy. Thus prevention, by taking a good history and physical examination, is better and cheaper than being rely on the therapeutic measures. Adequate staff training and availability of emergency drugs and equipment are all essential to the management of emergencies that can happen in the dental clinic. Every dentist should know the therapeutic dose for child patient and thorough knowledge about the treatment procedures to avoid complications or reduce them to a minimum level.

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