

Medical emergencies in the pediatric dental patient

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Abstract

A review of the literature on medical emergencies in the dental office revealed that the majority of recommendations for treating medical emergencies are oriented towards the adult patient, and recommendations for the management of medical emergencies in the child patient are not available. The potential emergencies that may be encountered by the pedodontist are discussed with respect to their symptoms, treatment, and precautions with special emphasis given to specific modifications necessary for the pediatric patient.

Introduction

Medical emergencies which are life-threatening can and do occur in the dental office. Most of the recommendations for treating medical emergencies in the dental office are oriented towards the adult patient,¹⁻¹⁷ and recommendations for the management of medical emergencies in the child patient are not readily available. The pedodontist must have equipment specifically for the pediatric dental patient (see preceding article, "Basic Emergency Kit for the Pedodontist.") The dosages of emergency drugs as well as the techniques for providing supportive therapy for the pediatric dental patient need to be altered.¹⁸⁻²¹ Since consideration must be given to the persons in the reception room some of whom in a pedodontic practice approach the age and size where adult recommendations for emergency therapy may apply, the pedodontist must be capable of treating medical emergencies in adults as well as in children.

This article will discuss the responsibilities of the pedodontist with respect to medical considerations for patients and then present the potential medical emergencies that might occur in the pedodontic office, with a discussion of the symptoms, treatment, and precautions for each.

The pedodontist has an obligation to the patient to perform dental treatment in a manner that does not impose any unnecessary medical risks as a result of that treatment. It is the pedodontist's responsibility to

seek consultation with the patient's physician prior to dental treatment if the patient has an underlying systemic condition that could result in complications while undergoing dental treatment.^{1, 2, 5, 15, 16} In some cases, minor preventive measures may be recommended by the physician prior to dental treatment. Other patients may best be managed in a hospital environment due to the seriousness of the underlying disease and the increased potential for a life-threatening episode during dental treatment.

When confronted with a medical emergency, the pedodontist should remain calm and act swiftly and definitively in order to provide immediate therapy without causing undue panic in the patient or the auxiliary personnel. The pedodontist should be concerned with maintaining Airway, Breathing, and Circulation and then should treat symptomatically.⁵ The pedodontist should never administer a drug without a definite indication for its use and should also avoid multiple drug therapy since it will complicate the diagnosis for medical personnel.^{14, 22}

Be aware of modifications in emergency therapy for children.

The best treatment for medical emergencies is **prevention**. By consulting the physician of patients who have underlying disease states, the pedodontist can minimize emergency complications, and his being prepared can reduce the severity of the emergency.^{1, 2, 5, 6, 9, 14, 15}

The following section describes the possible medical emergencies that may arise in the pedodontic office, their symptoms, and treatment. These recommendations have been collated from an extensive review of the dental literature¹⁻¹⁷ and texts on pediatric medicine.¹⁸⁻²¹ With the exception of cardiopulmonary resuscitation (CPR) techniques and resuscitative equipment (see preceding article, "Basic emergency kit for the pedodontist"), most of the modifications for emergency treatment of medical emergencies in the child patient are related to drug dosages. These modifica-

tions will be italicized through the following section. A quick reference chart is provided at the end of this article.

The emergencies of cardiovascular accident, cardiac arrest, myocardial infarction, and angina pectoris, which are most likely to occur in adults in the reception area of a pedodontic office, have already been extensively reported in dental literature and will not be discussed at this time.

Pediatric dosage schedule

The dosage schedules presented for children in each of the following emergency situations are reported as a range. The first dose in the range corresponds to the approximate dose for a 30-pound child, and the second dose corresponds to a 60-pound child. The milligrams per kilogram dose is listed along with the maximum dose. The adult dose is based on a 150-pound adult. However, the author recommends that a concise reference chart and instructions in an emergency kit list the doses as a range to facilitate the estimation of the proper dose to be given during an emergency. If the dosages were listed as milligrams per kilogram, it would be too time-consuming and impractical to calculate the exact dose to be given during an emergency episode especially if the exact weight of the child is unknown or cannot be readily determined by the pedodontist.

Anaphylaxis

Anaphylactic shock is an immediate and explosive, resultant allergic response to the introduction of a substance to which the patient has been previously sensitized. The reaction can occur immediately after the administration of the offending drug or can be delayed up to two hours following oral administration.⁷

Symptoms

The patient may experience itching and develop a rash, anxiety, restlessness, an acute fear that something is wrong, headache, nausea, respiratory difficulty, wheezing, cyanosis, rapid and weak pulse, a sudden drop in blood pressure, cardiac arrhythmia, and cardiac arrest.

Treatment

Keep calm to avoid panic in the patient and your staff. While an assistant calls a physician and an ambulance, you should administer *epinephrine 1:1000* in the dose of 0.125–0.25 cc for children (0.01 mg/kg up to a maximum dose of 0.025 mg/kg) and of 0.5 cc for adults i.v. or inject into the venous area underneath the tongue.²⁴ It may be of value to inject one-half the dose at the site of the original administration of the

offending drug and one-half the dose i.v. or sublingually. Repeat after five min if the first dose is ineffective, up to a maximum of three doses. Following the administration of epinephrine, the patient should be placed in a supine position, and *Benadryl should be administered i.m. in the dose of 25–50 mg for children (5 mg/kg/24 hr to a maximum of 300 mg for children)* and of 50–100 mg for adults. This will competitively inhibit the effects of further histamine release. (It will not counter the effects of histamine already released.) Oxygen should be given. In the event of severe laryngeal edema causing respiratory obstruction, a cricothyroid membrane puncture may be necessary to obtain an airway to save the patient's life. The patient should be treated by medical personnel as soon as possible.

Precautions

A thorough medical history is important, and patients with previous reactions to drugs or insect bites should be suspect. No unnecessary drugs should be administered. Any physician or dentist who gives a large number of injections should have the necessary emergency equipment, drugs, and knowledge of emergency procedures for treating anaphylaxis.

Allergic reaction

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

The patient may experience itching, skin rash, hives, and swelling of the face, hands, and eyelids. The patient may have nasal congestion and sneezing and, in severe cases, may experience respiratory difficulty and laryngeal edema.

Treatment

In the case of a mild reaction, the patient should be referred to a physician immediately. If the reaction is moderate, the patient should be given *Benadryl orally or i.m. in the dose of 25–50 mg for children (5 mg/kg/24 hr to a maximum of 300 mg)* and of 50 mg for an adult. A physician should be consulted, and the patient should be seen immediately for observation. If the symptoms progress rapidly and respiratory difficulty ensues, treat as outlined for anaphylaxis.

Acute asthmatic attack

Bronchial asthma 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.

Symptoms

A history of asthma is an important factor in diagnosing an attack. The patient will exhibit a rapid and full pulse, wheezing characterized by prolonged expirations, a normal or elevated blood pressure, and possible cyanosis.

Treatment

Many asthmatic patients have their own medical inhalers which they use when an attack arises. If this is the situation, the patient's use of the inhaler may be all that is needed for relief. If the inhaler is of the chromalin type, however, it is for the prevention of an attack and not treatment. If the patient has no inhaler, *epinephrine 1:1000 should be given subcutaneously in the dose of 0.125–0.25 cc for children (0.01 mg/kg to a maximum dose of 0.025 mg/kg) and 0.25–0.5 cc for adults. Repeat after 20 min if there is no relief. Oxygen should be administered! The patient should be kept semierect to avoid compromising the airway. The patient should be referred to medical personnel immediately for evaluation and further therapy.*

Precautions

A history of asthma and previous attacks stimulated by anxiety is important. Consultation with the patient's physician may be indicated, and premedication might be considered. If the patient has an attack, dental treatment should be terminated and should not be resumed until consultation with the child's physician has been accomplished. If the patient begins wheezing and has no history of asthma, an anaphylactic reaction must be suspected.

Syncope

Syncope, the common faint, is characterized by a sudden drop in blood pressure and bradycardia (40–60 beats per min) via neurogenic mechanisms. There is capillary pooling of blood and dilation of the vascular bed leading to decreased cerebral perfusion.

Symptoms

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 upwards, and loss of consciousness.

Treatment

Place the patient in Trendelenburg's position, administer oxygen, loosen tight clothing around the neck,

place a cold towel on the forehead, and pass an ammonia inhalant under the nose for stimulation. If the patient does not respond, get immediate medical help and institute supportive therapy as necessary until help arrives.

Precautions

Patient positioning, *i.e.*, as it is employed in four-handed dentistry, can reduce the likelihood of fainting as it is more apt to occur with the patient in an upright or semiupright position. The incidence of fainting is higher in males than females and greatest in males under 25 years of age.²⁵ A common predisposing factor has been suggested to be lack of food.

Respiratory obstruction

This emergency arises when the upper respiratory passages become obstructed by one of several means. The obstruction may be caused by the tongue, vomitus, blood, or a foreign object lodged in the region of the glottis.

Symptoms

If an object or foreign material becomes lodged in the oropharynx, the patient's attempts to dislodge the object will be manifested by choking, coughing, and wheezing. Laryngeal spasm may occur. The patient will make a violent attempt to breathe, may become cyanotic, and will lose consciousness if the obstruction is severe.

Treatment

Attempts should be made to remove the object. First, suction the oral cavity. Then, if the obstruction persists, attempt removal by delivering four sharp blows to the back between the shoulder blades while supporting the patient's chest with the other hand. A small child may be held upside down for this procedure. Additional attempts at dislodging the object may be made via the Heimlich maneuver. If these attempts fail, position the head for maximum opening of the airway and attempt to ventilate the patient, utilizing oxygen. If visual access can be obtained, attempt to remove the object with properly contoured forceps. If the obstruction cannot be dislodged, a cricothyroid membrane puncture will be necessary to open an airway to save the patient's life. If the foreign body passes, the patient must be referred immediately for radiographic examination to determine the location of the object and for immediate treatment if the object is found to be in the lungs.

Epileptic seizure

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.

Symptoms

Many epileptic patients will experience an aura of impending seizure. Grand mal seizures are characterized by clonic-tonic convulsions, loss of consciousness, oozing of saliva from the mouth, incontinence, and cyanosis. Petit mal seizures are usually characterized by a trance-like state with a lack of motor disturbances.

Treatment

If the patient has an aura of impending seizure or if a seizure begins, place the patient on the floor away from equipment and instruments to avoid injury to the patient. Restrictive clothing should be loosened, an adequate airway should be maintained, and the patient should be allowed to rest after the seizure terminates. The patient may experience irritability and confusion upon regaining consciousness and should be observed until there is a return to a normal state. The dental treatment should be discontinued for the day, and the patient should be escorted from the office by a responsible individual and evaluated by a physician as soon as possible. If the seizure is prolonged (4 min or more), immediate medical assistance is needed, and i.v. Valium (5 mg increments) may be necessary to terminate the seizure.

Insulin shock

Diabetic hypoglycemia usually occurs in a patient who has a history of diabetes. The reaction is the result of a net excess of insulin due either to an overadministration of insulin or to the patient not having eaten properly, perhaps having skipped a meal.

Symptoms

There is usually a history of diabetes, and a history of the events of the day may indicate a potential problem. The patient may have a rapid pulse, a normal or decreased blood pressure, and an increased respiration rate with shallow respirations. The patient may be hungry, experience dizziness and weakness, mental confusion, disorientation, and irritability. Severe reactions include nausea and vomiting, delusions, aphasia, ataxia, and a loss of consciousness.

Treatment

With a patient history of diabetes and a determination that the patient is not acting normally and

seems to be out of sorts, the pedodontist should administer oral sugar in whatever form available. A recommendation is a commercially available, concentrated glucose solution (glucose). If the patient has lapsed into unconsciousness, which is rare in the dental office, *50% dextrose should be given intravenously, 20–30 cc for children and 50 cc for adults.*

Precautions

Diabetics should be questioned as to how they feel and whether or not they are controlled. If the patient is controlled, it should be determined if the proper routine has been adhered to. If the patient is an uncontrolled diabetic or seems to be reacting strangely, treatment should be postponed until the patient has been evaluated and cleared by his physician for dental treatment.

Diabetic acidosis

The opposite reaction in the diabetic with inadequate insulin is ketone production which gives rise to ketosis, clinically manifested as diabetic acidosis. The diabetic patient with an infection, *e.g.*, acute dental abscess, is more susceptible to this type of reaction.

Symptoms

The following symptoms take a relatively long period of time to develop, and the chances of sudden development in the dental office are quite rare. Along with a history of diabetes, the patient will exhibit excessive thirst, frequent urination, malaise, loss of appetite, acetone (fruity) breath, and nausea. In late stages, the patient experiences vertigo and abnormally deep respirations and finally lapses into a coma.

Treatment

If the above symptoms are present after questioning a diabetic patient, the pedodontist should refer the patient immediately to medical personnel. The patient should be kept warm, placed in a supine position, and given oxygen. Supportive therapy should be carried out as necessary.

Drug toxicity

The patient undergoes symptoms manifested as a result of overdose or excessive administration of a drug. Complications depend upon a sufficient concentration of the drug in the blood stream resulting from inadvertent injection intravascularly at a rate greater than the body's capacity for neutralization or elimination of the drug, or the administration of too large a dose. Example: the toxic dose of Xylocaine for an adult is 300–500 mg and for the child is 3.5 mg/lb, or approximately 100 mg for a small child.

Symptoms

General symptoms are excitement of the central nervous system followed by depression. The symptoms of stimulation of the central nervous system are apprehension, anxiety, restlessness, confusion, tremors (not present with Xylocaine), rapid breathing, increased blood pressure and heart rate, and visual disturbances. The symptoms of the depression stage are stupor, unconsciousness, convulsions, inefficient respiration progressing to respiratory failure, cyanosis, weak and rapid pulse, a drop in blood pressure, and finally, peripheral vascular collapse.

Treatment

Place the patient in a supine position and suction mouth and throat. Administering oxygen for this may prevent occurrence of severe symptoms and allow the body to metabolize the drug excess. Get medical help.

The following emergency situations may occur as the results of dental treatment. However, with adequate medical history records, the pedodontist should easily recognize their possibility and consult with the proper medical personnel. Most often, patients with the potential risks listed below should be treated in an environment where immediate and specialized medical attention can be obtained, and the patient can be monitored closely before, during, and after treatment.

Angioneurotic edema (nonhereditary)

This form of giant urticaria is characterized by local painless swellings of subcutaneous tissues or submucosal tissue of various parts of the body. The past history will include prior episodes and food and drug allergies.

Symptoms

The patient will most often exhibit single, localized, painless swellings (can be multiple) on the face, hands, and genitalia with the tongue and pharynx rarely affected. The disease is caused by an allergic response to foods, drugs, infection, or emotional stress.

Treatment

These episodes can be prevented by consultation with the physician and proper antihistamine therapy. If an episode occurs, *Benadryl should be given i.m. in the dose of 25–50 mg for a child (5 mg/kg/24 hr to 300 mg maximum dose) and 50–100 mg for an adult.* The patient should be referred immediately for medical attention.

Angioneurotic edema (hereditary-familial)

This type is a frequently recurring edema of tissue and is triggered by trauma to patients who have a

family history of this type of reaction. The trauma induces histamine release either locally or widespread.

Symptoms

Again, a good history can alert the dentist to the possibility, and precautions can be taken via consultation with the physician and close cooperation with medical facilities. The onset of symptoms may take up to several hours. The lips, face under the eyes, tongue, and neck are the first areas to manifest obvious swelling after trauma, *i.e.*, extraction. Edema of the neck tissues, uvula, epiglottis, soft palate, and vocal cords causes difficulty in breathing and asphyxia in severe cases.

Treatment

Again, adequate history, precautions, and preventive therapy is a must. With the onset of symptoms, a physician and an ambulance should be summoned, and *Benadryl should be given i.m. in the dose of 25–50 mg for a child 5 mg/kg/24 hr to a maximum of 300 mg) and 50–100 mg for an adult.* If symptoms continue and the patient experiences respiratory difficulty, *Epinephrine 1:1000 should be given i.v. or by sublingual injection in the dose of 0.125–0.25 cc for children (0.01mg/kg to a maximum dose of 0.025 mg/kg) and of 0.5 cc for adults.* If the patient continues to have respiratory difficulty which progresses to respiratory obstruction, a cricothyroid membrane puncture may be necessary to establish an airway.

Adrenal crisis

This condition comes about as the result of insufficient corticosteroid output during a stimulus such as a stressful situation. The cause of the condition may be destruction of the adrenal glands, *i.e.*, Addison's disease, tuberculosis, or adrenal tumor, or atrophy of the adrenal glands in situations requiring long-term steroid therapy, *i.e.*, asthma, the leukemias, or rheumatoid arthritis. Consultation with the physician for the maintenance dose of the steroids for dental treatment is necessary before any treatment is performed, and it may be advantageous to perform the treatment in an environment where immediate emergency medical assistance is available.

Symptoms

An adequate medical history and history of past episodes should alert the dentist to potential problems. During a crisis, the patient will exhibit weakness, pallor, perspiration, and a weak and rapid pulse. A severe reaction can progress to hypotension and cardiovascular collapse.

Treatment

Administer oxygen and supply necessary supportive therapy while an assistant phones for medical help and an ambulance. A trained practitioner can inject *Decadron (dexamethasone sodium phosphate) i.v. or i.m. in a dose of 1–4 mg for children and 6–10 mg for adults.*

Remember: treatment of patients with a history of angioneurotic edema or adrenal insufficiency due to pathologic changes or chronic steroid therapy might best be performed in a hospital setting where immediate emergency help is available. It is always wise to

consult the patient's physician when treating someone with an underlying disease that could lead to serious complications.

Summary

The pedodontist is obligated to have the necessary equipment, drugs, and knowledge to provide immediate and proper emergency therapy when a medical emergency arises in the office. The equipment and emergency kit should be inspected; drugs should be replaced as needed; and a record should be kept of the

MEDICAL EMERGENCY—QUICK REFERENCE

Emergency	Signs and symptoms	Treatment
1. Anaphylaxis	Acute anxiety, rash, itching, respiratory distress, wheezing, cyanosis, severe drop in blood pressure	Epinephrine 1:1000 i.v. or intralingual, 0.125–0.25 cc (child), 0.5 cc (adult), oxygen, Benadryl i.m. 25–50 mg (child), 50–100 mg (adult)—hospitalization
2. Allergic reaction	Itching, swelling of face, hands, and eyelids, rash	Mild —Benadryl orally 25–50 mg (child), 50–100 mg (adult)—physician. Moderate —Benadryl i.m. 25–50 mg (child), 50–100 mg (adult),—physician
3. Acute asthmatic attack	Wheezing, rapid and full pulse, prolonged expirations	Mild —patient use own medical inhaler, oxygen. Severe —Epinephrine 1:1000 subcutaneously 0.125–0.25 cc (child), 0.25–0.5 cc (adult), semierect position, oxygen—physician
4. Syncope	Slow, weak pulse, drop in blood pressure, cold, clammy skin, dilated pupils, loss of consciousness	Trendelenburg position, oxygen, loosen clothing, cold towel on forehead, ammonia stimulant
5. Respiratory obstruction	Choking, coughing, wheezing, violent attempts to breathe, cyanosis	Blows on back, Heimlich maneuver, suction, ventilate, attempt removal with forcep, cricothyrotomy
6. Epileptic seizure	Grand mal—clonic-tonic convulsions, frothing at mouth, unconsciousness	Patient on floor, protect from injury, loosen clothing—physician
7. Insulin shock	Hunger, weakness, dizziness, mental confusion, disorientation, irritability	Oral sugar if conscious, 50% dextrose, i.v., 20–30 cc (child), 50 cc (adult), if unconscious—physician
8. Diabetic acidosis	Thirst, frequent urination, loss of appetite, fruity (acetone) breath, vertigo, coma	Keep warm until hospitalized
9. Drug toxicity	Central nervous system excitement, then central nervous system depression—convulsions, unconsciousness	Supportive treatment until hospitalized
10. Cerebrovascular accident (CVA)	Hemiplegia, slow, deep breathing, eyes deviate to one side, speech impairment	Avoid unnecessary movements, keep warm, oxygen until hospitalized
11. Angina pectoris	Substernal and precordial pain radiating to arm, rapid pulse	Oxygen, sublingual nitroglycerin tablet, repeat 3 minutes (× 3), hospitalization
12. Myocardial infarction	Severe, persistent substernal pain radiating to left arm, possible cyanosis, cold clammy skin, no relief with nitroglycerin	Oxygen, supportive therapy, keep warm until hospitalized
13. Cardiac arrest	20–30 seconds of gasping respirations, respiratory arrest, no pulse, cyanosis, pupils dilated, centric, and fixed	Place patient on floor, CPR until hospitalization
14. Adrenal crisis	Past history of episodes, weakness, pallor, perspiration, weak and rapid pulse	Oxygen and supportive therapy until hospitalized. Decadron i.v. or i.m. 1–4 mg, (child) and 4–6 mg (adult)

inspections.^{5, 6, 14, 15} Having the proper training, emergency equipment, and drugs will be of limited value in an emergency situation if the office staff are unfamiliar with the emergency procedures, and confusion prevails. Practice sessions on emergency procedures are imperative so that each person is responsible for a designated procedure and knows when it is to be performed.

For medicolegal purposes when an emergency arises, someone should be responsible for keeping a written record of the following: (1) the time of onset; (2) vital signs during the emergency; (3) time, dose, and route of drug administration; (4) the effects of drugs and therapy provided; and (5) time of initiation of any therapy, e.g., CPR. Following the emergency episode, the pedodontist should immediately record a summary of events and patient reactions to drugs and therapy.

The best form of emergency therapy is prevention. Thorough medical histories and follow-up consultations for underlying disease states can be invaluable in avoiding potential medical emergencies. There can be no argument against practicing defensively. A valuable adjunct toward preventing medical emergencies is a good rapport and proper consultation with the local medical personnel.

It is important to have a manual on the treatment of potential medical emergencies which includes the duties required of the various members of the office staff available for periodic review. In addition, a quick reference on emergency therapy should be readily available.

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