



Medical Emergencies in the Dental Office

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Busy clinicians require information that can be rapidly accessed and put to immediate use, especially when the need is urgent. With this in mind, the fifth edition of **Medical Emergencies in the Office** provides a fresh approach to aid the dentist in the medico-legal responsibility of anticipation, prevention, diagnosis and management of acute medical problems that can present during the day-to-day practice of dentistry. Because these events are infrequent, training and experience are limited. Recall, decision-making and performance are diminished in times of stress and time urgency. The **ONLY** way to effectively manage these situations is to have well-rehearsed **SYSTEMS** in place to help guide you and your staff in the management of emergent situations.

Repeated exposure to this information via continuing education, journal articles and frequent, documented physical rehearsal of written emergency policies is mandatory, including clear role assignment for office staff, whose help during emergent times is invaluable and can be life-saving. The following key duties, listed in no specific order, should be reviewed and assigned so that on any given day, and with any given staff, each member will have a clear understanding of their expected behavior in the event of an emergency:

- Assist with airway, CPR, drug preparation / administration
- Bring drugs, oxygen, airway devices, etc. to site of emergency
- Document all interventions with timetable
- Provide information to accompanying parties
- Vacate or reschedule other patients, as necessary
- Call 911, escort paramedics to site of emergency
- Provide written records to paramedics
- Notify local hospital ER by telephone

Awareness, diligence, anticipation and flawless, repeated task performance – patient histories, vital signs, injection technique – are just a part of the overall relentless attention to detail that is necessary to achieve excellence in the clinical practice of dentistry.

The intent of this document is to provide a sound basis for clinical judgment, followed by a summary of rational, practical and *easily referred to* guidelines for the diagnosis and treatment of medical emergencies (symptoms) in the dental office. A basic kit is suggested. Knowledge and competence in drug/device usage should guide your selection. Drugs should be checked for expiration at least two times per year, and equipment should be kept in working order. All members of the staff should be currently certified in CPR.

Dental practitioners should recognize that each case is different and that this guide is meant as an overview, rather than strict protocol for treatment of all cases. The patient's history, always the most important step, should give the clinician an advantage in determining the cause of the problem. If an anticipated problem occurs, then the emergent situation can be managed in an orderly fashion. It is not an expressed goal to make an accurate diagnosis; rather, the focus is on symptom recognition and emergent treatment of those symptoms, as necessary to save a life, until further help arrives.

History and Focused Physical Examination

The primary goal in the management of medical emergencies is prevention, ideally achieved with a thorough, directed **history**, updated at each visit; and a focused **physical examination**. Although emergencies, such as syncope or first time chest pain can occur in otherwise ostensibly healthy patients, urgent situations are more likely to involve patients with concurrent medical problems, such as asthma, cardiovascular disease, seizure disorders, allergy or diabetes. Therefore, when the respiratory, cardiovascular, neurologic, immunologic or endocrine systems are involved, thorough questioning is necessary – specifically related to triggers, onset, signs, symptoms and relieving or palliative factors. For example, a patient relates that they get chest pain with one flight of stairs that is always relieved by rest and occasionally by one nitroglycerin tablet. If chest pain occurs in the office, the dentist will stop the procedure, check vital signs, provide oxygen and administer a nitroglycerin tablet, as the patient predicted might happen. IF this is unsuccessful, EMS should be contacted immediately, while administering a second nitroglycerin tablet. Note that this event was “outside” the patient’s normal response; a possible indication that something more serious is occurring and that additional measures will be necessary. Similarly, if a patient has an asthmatic attack that does not resolve with one puff of his rescue inhaler (that they previously stated always worked in the past), this also would be an indication to contact EMS and encourage preparation for further treatment options.

Many patients are poor historians; they may not remember or may not understand the nature of their diseases. Current medications relate to the nature of the disease. If a complete history or medication list is unavailable, invasive treatment should be deferred until this information is obtained.

Many patients do not regularly visit their physician, yet they can still have undiagnosed disease. Here, the identification of the following risk factors may be the only clue that trouble might occur. These risk factors include obesity, smoking, sedentary lifestyle, poor dietary choices, regular alcohol consumption, and a positive family history of cardiovascular disease or diabetes.

The following questions should be included in your pre-operative evaluation and documented history, as they relate to the likelihood of medical problems occurring in your office. Your history form should have areas for checking yes *or no*, as it is equally important to document negative findings (medico-legal). The answers to these questions provide a framework for further investigation into your patient's medical conditions that may affect the care that you render.

1. Are you currently under a physician's care? For what?
2. Have you been in the hospital during the past 2 years? For what?
3. List all current medications
4. List all allergies, with specific reference to antibiotics, codeine, aspirin and latex
5. Are you subject to fainting, dizziness or seizures?
6. Do you have asthma or any shortness of breath with normal activity?
7. Are you or could you be pregnant?
8. Have you had any of the following?
 - a. chest pain, heart attack, bypass, angioplasty, pacemaker
 - b. any trouble with heart valves
 - c. high blood pressure
 - d. stroke
 - e. diabetes
9. Are you able to take care of yourself and perform usual household tasks, including the ability to climb 1 – 2 flights of stairs?

Coupling a history with a focused physical exam, to include general observation of the patient, blood pressure, pulse rate and rhythm and auscultation of the lungs (in asthmatic patients to check for wheezing) will usually, but not always, enhance predictability of trouble during a dental appointment. Blood pressures greater than 180/110mmHg, resting pulse rates that are excessively fast (>170bpm), excessively slow (<50bpm) or irregular should invite suspicion and the possible need for additional medical intervention to optimize the patient's health prior to elective or semi-elective dental work.

To review, a history and physical examination involves the identification of systems problems and their current level of control or severity to assess the likelihood that signs or symptoms of decompensating disease might occur during dental treatment. Rapid screening of all systems, noting all current medications and compliance, guides the astute clinician to further focused questioning.

Identifying the “At Risk” Patient

After an accurate medical history is obtained, a decision must be made regarding the ability of the patient to tolerate the planned treatments. Dentistry involves a wide variety of procedures, occasionally uncomfortable, that can lead to emotional and/or physical distress due to or in spite of the use of local anesthesia. The three procedures most likely to cause this stress are local anesthetic injection, dental extraction, and endodontic manipulation. In the past, the identification of patients who can “safely” tolerate these procedures has been difficult, non-specific and subjective.

RISK OF A CARDIAC EVENT DURING DENTAL TREATMENT

In 2007, the American College of Cardiology and American Heart Association updated recommendations to identify patients who may be unable to safely tolerate non-cardiac surgical procedures. Specifically, *the document focuses on the estimation of risk of a cardiac event during non-cardiac surgery, in an operating room, under general anesthesia*. These concepts do apply to dental manipulation, which is considered *minor, low risk surgery*, having an arbitrary upper limit of prolonged, single visit multi-quadrant extractions or reconstruction.

Patients with the following active cardiac conditions may be unable to tolerate invasive dental procedures. Medical consultation / referral is advised prior to treatment.

- 1. unstable coronary syndromes**
 - a. recent myocardial infarction (within 1 month)
 - b. unstable angina (non-provoked chest pain)
- 2. decompensated heart failure**
 - a. patients with congestive heart failure who have excessive swelling around the ankles, who easily become short of breath, or who cannot sleep supine (among many other findings)
 - b. any shortness of breath not associated with physical exertion
- 3. severe cardiac valvular disease or arrhythmias**
 - a. always provoking symptoms of dizziness or light-headedness
- 4. recent pacemaker or implanted cardiac defibrillator**
- 5. orthostatic intolerance – inability to stand without getting dizzy**

RISK OF A NON-CARDIAC EVENT DURING DENTAL TREATMENT

The document above does not address risk for non-cardiac issues such as syncope, asthma attack, stroke, seizure, hypoglycemia or allergy, among others. These issues will be covered in the following sections.

General Concepts Regarding Common “Emergencies”

“Fight or Flight”

Some patients may not be “mentally prepared” or able to tolerate needle penetration, extraction or other perceived threats. Exaggerated anticipation or mild discomfort can trigger various somatic responses. Usually, these reactions will reveal as an increase in sympathetic tone leading to what is classically described as the “fight or flight” response. As expected, signs and symptoms include a rapid heartbeat, rapid breathing (hyperventilation), agitation, “feelings of panic or loss of control,” elevated blood pressure and inappropriate sweating (in the absence of exercise or ambient heat).

It is important to realize that other challenges to the patient will also, at least initially, result in this hyper-adrenergic response. Allergy, local anesthetic toxicity, heightened response to exogenous vasoconstrictors (also seen with frank overdose or intravascular injection), breathing difficulty, hypoglycemia and early syncope can all demonstrate the same initial presentation. Because of these similarities, an accurate and thorough medical history becomes paramount in aiding treatment decisions.

Chest pain can also, at least initially, be a trigger of the fight or flight response. A complaint of new onset chest pain should never be taken lightly.

Psychogenic reactions

Psychogenic reactions are, by far, the most common cause of patient difficulty in the dental office. Apprehension and fear are among the most potent mental stressors that a patient may endure. These situations herald a variety of responses, including inappropriate and unrestrained behavior, hyperventilation, syncope or near-syncope, all with attendant changes in heart rate, respiratory rate and blood pressure. Nausea and vomiting are also possible. Occasionally, patients may demonstrate a red “blush” over the lower face, anterior neck and upper chest when challenged by a stressful situation. This is in direct contradistinction to the raised, pruritic (itching) hive that may be seen with cutaneous allergy, after antigenic challenge. These events can be minimized in severity and frequency by practitioner empathy, limit-setting, and by taking the necessary time to establish rapport with each patient prior to treatment. Fortunately, most isolated psychogenic reactions are short-lived and often resolve with appropriate practitioner intervention.

Recognizing the emergent situation

Medical emergencies vary in presentation, duration and severity depending on a host of factors. In general, any deviation from “normal”, whether that refers to physical status or appropriate interaction with one’s environment, should be considered a harbinger for trouble. It is common for the practitioner to “deny” that bad things are happening. Unfortunately, this often leads to a delay in appropriate treatment that can have devastating consequences.

Emergencies will present as:

- Loss of consciousness
- Respiratory distress
- Altered patient status
 - “Feels sick”
 - Increased anxiety
 - Pain
 - Pallor
 - Inappropriate sweating
 - Tremors
 - Rash
 - Headache
 - Confusion

General Treatment Protocol for Medical Emergencies:

1. **MAINTAIN THE AIRWAY!** – chin lift, jaw thrust
2. **TERMINATE the procedure** - remove any hardware or loose objects from the mouth
3. **REPOSITION the patient** – supine, on a firm, flat surface
 - With cardiac or respiratory distress in a conscious patient, semi-recumbent positioning may be preferred
 - If the patient is in the late stages of pregnancy and is conscious, semi-recumbent positioning with knees flexed is preferred. If pregnant and unconscious, supine with right hip elevation is necessary.
4. **ACTIVATE THE EMERGENCY MEDICAL SYSTEM (EMS)** at any time when you do not “feel comfortable” with a circumstance AND with any patient who is unconscious or is losing consciousness (except in cases of uncomplicated vaso-vagal syncope)
5. **Assess and monitor AIRWAY and BREATHING**
6. **Assess CIRCULATION**, take vital signs
7. **ADMINISTER OXYGEN**

Activating Emergency Medical Systems

The “call for help”

When you take the time to think about this, the 911 call is a frightful and stressful experience. When the office is unprepared, it becomes chaotic - your patient is not doing well, and you are coming to the realization that you are unable to improve the situation and will need help right away. Concern about blame and guilt can surface, usually inappropriately.

There are many reasons why the call for help is necessary. As an example, assume a 55 year-old male has started to complain about chest pain, and then becomes pulseless. His wife and two other patients are in the waiting room, one hygiene chair is filled, and another patient is waiting for local anesthesia to take effect. Who will call 911? Who will help you with CPR? Who will bring oxygen to the room? Do you have an AED? Is there a face mask readily available, or will you do unprotected mouth-to-mouth rescue breathing? Who will document the event? Who will direct the paramedics to the appropriate area? How will his wife react when she sees paramedics entering your office? Should you say something to her in advance, and if so, what should be said and who will say it? Will you follow the patient to the hospital? How will you handle the other patients in the midst of treatment? The answers to these questions should be determined in advance. The specific roles and assigned duties will depend on the nature of the practice, layout of the office and number of staff members present on any given day. A partial list of tasks, which should be pre-assigned include

- Team leader tasks
 - establish the diagnosis, direct the call for 911
 - maintain the airway
 - CPR as necessary
 - administer necessary drugs
- Assistant tasks
 - bring drugs and equipment to the patient
 - assist with CPR
 - draw up drugs
 - administer medication as needed, under the supervision of the team leader
 - record events
 - call to 911
 - manage other patients in the office
 - manage family or accompanying parties to the patient

Each office is unique and may have a rotating staff, such that some members will change from day to day. Writing out "task cards" and distributing them each day will be guide the coordinated performance of duties. The most important caveat is to avoid panic and remain as calm as possible to promote clarity of thought and optimal performance of intended actions.

OFFICE EMERGENCY KIT (minimum)

1. oxygen source and delivery mask
2. sugar source (glucose paste, orange juice, Glutose™)
3. diphenhydramine elixir (Benadryl™)
4. epinephrine 1:1000, 1mg/cc (Epipen™, TwinJect™, syringe and ampule) – more than one dose should be available
5. albuterol inhaler (Proventil™, Ventolin™)
6. nitroglycerin (.4mg tablets or sublingual spray)
7. aspirin tablet

DRUG	NAME	INDICATION	HOW SUPPLIED	DOSE/ROUTE
Sympathomimetic amine	Epinephrine (Adrenalin™)	Allergy Asthma	1:1000 Ampule, pre-filled syringe	.1 - .3cc subQ injection
β ₂ agonist	Albuterol inhaler (Ventolin™, Proventil™)	Allergy Asthma	Inhaler	Metered puff
Antihistamine	Diphenhydramine (Benadryl™)	Allergy	Elixir	25 – 50mg orally
Vasodilator	Nitroglycerin	Chest Pain	Tablet / sublingual spray	.4mg subL, dissolve in mouth
Sugar	Glutose™, Orange juice, etc	Hypoglycemia	Tube	Oral
Oxygen		All	Tank	Mouth / nose
Aspirin		Chest Pain	325mg tablet	Chew, dissolve in mouth

SYNCOPE

Disease:

Syncope is a transient, abrupt loss of consciousness and postural tone secondary to inadequate cerebral blood perfusion. Vasovagal syncope is the most frequent cause of unconsciousness in the dental office, and is usually triggered by anxiety, pain, sight of blood, etc. The term vasovagal describes two pathophysiologic parameters that often occur simultaneously. “Vaso” refers to vasodepressor – causing a decrease in vascular tone and blood pressure; “vagal” refers to a heightened cardio-inhibitory vagal response causing a decrease in heart rate.

Classic vasovagal syncope occurs in susceptible patients in the following manner. A perceived threat – sight of blood, needle, anticipation of discomfort, etc. triggers a fight or flight sympathetic response where the heart rate is increased and blood is diverted to the larger muscle groups (legs) in anticipation of activity. The patient, however, sits still in the chair, which diminishes venous return to the heart, because of the lack of lower extremity muscular activity pumping blood back to central circulation. The result is a rapidly beating heart with no blood to pump. Cardiac output falls, leading to diminished blood flow to the brain. In susceptible patients, a heightened vagal response causes the heart to slow excessively, further decreasing cardiac output. If the brain is deprived of enough oxygen, the patient will lose consciousness and control of their airway. In some cases, resolution is spontaneous, while others may proceed to a short salvo of seizure activity. This muscular activity augments venous return sufficiently to restore cerebral perfusion and consciousness.

When “passing out” is more serious than “vasovagal syncope”

Deviation from any of the following “classic” features of vasovagal syncope should invite suspicion of more serious etiology:

CLASSIC SYNCOPE

- quick onset, temporary, limited duration, quick recovery
- brief prodromal warning symptoms – sweating, anxious, feeling of warmth
- usually young, otherwise healthy, fearful patients
- patients look “pale”, not blue
- incontinence is rare
- seizure activity, if it occurs, is brief in duration

WARNING SIGNS

- chest pain before passing out
- gradual loss of consciousness – deterioration over several minutes
- very sudden drops or falls (no prodrome or warning) , frequently causing injury, may be assumed to be a sign of significant cardiac or neurologic trouble until proven otherwise
- incontinence of bladder, but especially bowel
- prolonged seizure activity and/or prolonged recovery
- geriatric patients who “pass out”
- any loss of consciousness with cyanosis (blue coloration)

History:

Question the patient concerning prior history of syncope, nature of provoking factors, occurrence of seizure activity, prior medical work-up, etc. The more frequent the episodes, the more likely the problem may present.

Diagnosis:

Clinical syncope (or near syncope, where the patient feels bad, but never quite loses consciousness) occurs as follows. A prodromal feeling of warmth, sweating, pallor (skin turns pale, esp. face, lips and oral mucosa) and patient awareness of a rapid heartbeat (palpitations) will manifest. As the event progresses, the patient becomes cold and clammy. In some cases and occasionally regardless of appropriate treatment, a loss of consciousness, with a loss of airway and spontaneous respirations can occur, oftentimes followed by to 2 – 3 myoclonic (jerking) movements. In other cases, a full progression to unconsciousness will not occur; the patient will instead feel bad for ten or more minutes.

When syncope leads to seizure activity, one must entertain a diagnosis of neurologic seizures. The seizure activity associated with syncope is of short duration, rarely involves injury, usually is not accompanied by incontinence and ends with a quick return to normalcy. The seizure of neurologic origin usually occurs without warning, is of longer duration, can involve injury and incontinence and is followed by significant post-ictal depression.

The patient experiencing syncope will turn pale, but not cyanotic (blue), which might be an indication of serious cardiac or pulmonary trouble.

Treatment:

1. maintain airway, supplemental oxygen
2. terminate procedure, remove loose objects from mouth
3. trendelenburg positioning – patient supine with legs higher than heart.
If semi-conscious, encourage repetitive leg movement to augment venous return.
4. prevent injury if convulsant

If there is no improvement with this protocol, activate EMS and consider other possible etiologies, such as primary seizure disorder, stroke, allergy, hypoglycemia or myocardial infarction.

CHEST PAIN – MYOCARDIAL INFARCTION

Disease:

Chest Pain: Angina pectoris is typically a transient, substernal, squeezing or pressure type pain that can spread across the chest and may radiate to any area above the diaphragm. It is important to realize that myocardial embarrassment without chest pain is possible and that patients may present with “anginal variants” such as nausea, vomiting, dizziness, palpitations or shortness of breath. Angina is due to an imbalance between myocardial oxygen demand and oxygen supply. Events that increase oxygen demand, such as exertion, stress or anxiety can precipitate angina, while rest, oxygen or vasodilators relieve angina by improving oxygen supply. The most frequent cause of stable angina is narrowing of the coronary vessels by atherosclerotic plaques. Unstable angina occurs without warning or worsens rapidly (crescendo) and may not respond to vasodilator therapy. Unstable angina is presumed to be caused by a blood clot lodging in and obstructing a coronary vessel. This scenario requires immediate medical attention.

Myocardial Infarction: Heart attack is usually, but not always, preceded by angina and is indicative of death of those heart muscle cells supplied by the obstructed coronary vessel. A small or minor heart attack may go unnoticed by the patient and may not cause significant pump or conductive tissue problems, while a major heart attack can be heralded by severe chest pain, electrical instability (rhythm abnormalities), and even death, as the heart fails to be an effective pump. For purposes of this monograph, the usual symptom of a heart attack is chest pain that persists for longer than 2 minutes in a patient with a negative cardiac history, or chest pain that is refractory to 3 challenges of sublingual NTG over a 15 minute period, in a person who normally depends on NTG to relieve chest pain.

History:

A thorough cardiac history is necessary. Consultation with the patient’s physician should be obtained prior to treating any patient with a history of an attack within the last 6 months. In patients with ongoing anginal problems, document frequency of attacks, precipitating events and response to NTG. This will be your “road map” to manage chest pain, should it occur during dental treatment.

Diagnosis:

Substernal pressure, pain, squeezing, fullness, tightness and heaviness with or without radiation are typical “hard” symptoms of myocardial ischemia. “Soft” anginal variants include nausea, vomiting, sweating, shortness of breath, dizziness, disorientation and lethargy. Loss of consciousness, loss of pulse and death are ultimate sequelae.

Treatment:

1. terminate the procedure, remove any loose dental hardware
2. reposition the patient
 - a. if conscious, semi-recumbent or as the patient prefers
 - b. if unconscious, supine on a flat, firm surface, ready to perform external cardiac compressions if pulselessness occurs
3. administer 100% O₂
4. obtain and continuously monitor airway and vital signs
5. if conscious, administer one aspirin (160-325mg) to be chewed and absorbed in the mouth (not swallowed). Quick release aspirin crystals are now available for this purpose.
6. for NTG-dependent patients with a prior anginal history, and if the systolic BP is > 90mmHg, give one NTG (.4mg) tablet and allow to dissolve sublingually. If chest pain persists, administer a 2nd and 3rd tablet, if necessary, at 5 minute intervals. If chest pain still persists after 3 doses of NTG over a 15 minute period, assume MI, activate EMS, and monitor pulse and respiration, being prepared to commence CPR if necessary, in a pulseless, breathless patient.
7. for patients without a cardiac history, when chest pain persists longer than 2 minutes, assume MI, activate EMS and monitor vital signs
8. any change in location, severity or duration of chest pain constitutes unstable or “pre-infarction” angina; EMS should be summoned immediately

BREATHING DISORDERS

ASTHMA

Disease:

Asthma is a recurrent, reversible hyper-responsiveness of the tracheo-bronchial smooth muscle to various stimuli, with overlying acute and chronic inflammation of the airway mucosa. It is considered an obstructive disease because air flow is hindered when the diameter of the conducting bronchi and bronchioles is reduced by smooth muscle spasm, edematous mucosa and excessive secretions/mucus plugging. As would be expected, the obstruction to air movement occurs primarily with active expiration when lungs AND airways are squeezed and narrowed by the diaphragm and intercostal muscles. Inspiration, on the other hand, tends to dilate the airways as the chest volume is increased and connective tissues tug on the airways, increasing their diameter. It is easy to appreciate that an asthma attack is characterized by a dynamic hyperinflation of the lungs – each breath becomes more difficult to take as the lungs expand further and air is trapped. The patient panics as he/she feels the need for more air, but cannot breathe it in! This results in the inability to move oxygen from the atmosphere to the alveolar-capillary membrane, resulting in suffocation and tissue hypoxia as its most severe expression.

The prevalence of asthma is increasing, with a predilection for patients <18 years; however, all ages are affected. Usual triggers include environmental irritants (tobacco smoke), strong odors, emotional upset, cold air and exercise, to name a few.

History:

The disease is classified according to the frequency and severity of symptoms. Mild intermittent disease can often be controlled with a “rescue” β_2 agonist inhaler (albuterol) that relaxes bronchiolar smooth muscle and dilates the airways. If this fails to control the disease, classification is advanced to mild or severe *persistent*, now requiring other medications, including inhaled or systemic steroids and leukotriene inhibitors (e.g., montelukast – Singulair™.) Airway hyperreactivity tends to last for several weeks after a recent attack, increasing its likelihood for recurrence during this period. The following are considered risk factors that can increase the likelihood of an asthmatic attack occurring in your office. Be vigilant – “out of the blue” attacks are also possible.

WARNING SIGNS

1. recent attack
2. need for 2 or more different medications
3. non-compliance with medications
4. poorly controlled and/or longstanding disease
5. active wheezing
6. upper respiratory infection in asthmatic patients
7. prior history of sudden, severe exacerbations
8. more than 2 hospitalizations or 3 ER visits within the last year for asthma

Diagnosis:

- patient in distress – leaning forward
- chest tightness
- wheezing
- cough
- shortness of breath – gasping for air

Treatment:

1. terminate the procedure
2. administer 1 – 2 puffs of a β_2 agonist (albuterol) - EARLY
3. administer supplemental oxygen
4. activate EMS if situation fails to improve
5. with deteriorating condition, failure of multiple puffs of inhaler and help not immediately available administer .3cc (.3mg) of 1:1000 epinephrine sub Q and be prepared to re-administer a 2nd dose in 5 minutes should this be necessary. Dose can be reduced to .1cc in small patients. Refer to section – [The subcutaneous epinephrine injection.](#)

BREATHING DISORDERS

HYPERVENTILATION

Disease:

Hyperventilation is respiration in excess of current metabolic demand. It is usually psychogenic in origin, secondary to anxiety or fear. Hyperventilation expresses as an increase in tidal volume and/or increase in respiratory rate. Too much oxygen is not a clinical problem; rather it is the over-elimination of CO₂ that leads to difficulties. Hypocarbica is associated with respiratory alkalosis that causes a decrease in serum ionized Ca⁺⁺ levels. Hypocalcemia lowers threshold potentials, leading to neuromuscular irritability and tetany as its most severe expression.

History:

Hyperventilation usually appears in apprehensive patients who initially attempt to hide their fear. It can be associated with “panic attacks.” Many patients may not be willing to volunteer this information, even with direct questioning.

Diagnosis:

Diagnosis is relatively straightforward; the increase in rate or volume of ventilation is easily noticed and heard. If allowed to persist, hypocarbica and alkalosis will result, causing a constriction of cerebral blood vessels leading to lightheadedness and impairment of consciousness. Neuromuscular irritability leads to complaints of numbness or tingling of the extremities, muscle pain, cramps, spasms, trismus and generalized stiffness.

Treatment:

1. terminate the procedure
2. verbally calm the patient – may have to be firm
3. have the patient breathe into a paper bag in order to rebreathe and accumulate CO₂ to bring these levels back to normal

BREATHING DISORDERS

EMPHYSEMA

Disease:

Emphysema is a pulmonary response to chronic exposure to noxious stimuli, characterized by abnormal permanent enlargement (coalescence) of distal air spaces and loss of elasticity in the lung parenchyma. This causes premature airway collapse prior to alveolar emptying on necessarily active expiration, resulting in air trapping and an inability to exhale. The end result is an inability to move air with subsequent decreased oxygenation of tissues.

History:

Usually, the patient is aware of this diagnosis. It occurs in susceptible patients secondary to chronic exposure to noxious stimuli.

Diagnosis:

The emphysematous patient is usually thin, barrel-chested, and prefers to exhale through “pursed-lips” – necessary to keep the airways open. Typically, these patients prefer to lean forward to help with their breathing. When severe, the patient quietly gasps for air, speaks in short phrases, and is intolerant to any but the mildest physical activity when the disease is severe. Often times, supplemental oxygen is necessary, usually administered through nasal prongs. It is possible for these patients to decompensate and become very short of breath during dental appointments.

Treatment:

1. recognition of signs and symptoms
2. allow the patient to breathe as he/she requires – they may not be able to tolerate prolonged periods with a wide open mouth
3. supplemental oxygen – 2-3 liters per minute
4. β_2 agonist inhaler (albuterol) as necessary

HYPOGLYCEMIA

Disease:

HYPOGLYCEMIA can readily present as an emergent situation in the dental office. It can occur in diabetic patients who have taken hypoglycemic agents (oral pills or insulin) and have not supplied sufficient calories. In this instance, basal levels of blood glucose are excessively decreased, leading to signs and symptoms of low blood sugar. It is important to note that there are some patients who are not diabetic who can experience with episodic hypoglycemia (e.g., after eating). Treatment considerations are the same, however. The brain has a continual need for glucose and, in the acute situation, is unable to utilize any other metabolic substrate. When glucose levels fall, signs and symptoms relating to a compromised nervous system will appear.

Diabetes mellitus is a progressive disease of glucose dysregulation and carbohydrate intolerance. In this disease, insulin is either lacking or ineffective in escorting blood glucose intracellularly, where it is broken down to create energy for cellular metabolism. The resultant excess blood sugar (chronic HYPERGLYCEMIA) is toxic to all cells and promotes osmotic diuresis. Type I diabetics have an absolute insulin deficiency and always require exogenous insulin. Type II diabetics have impaired “insulin functioning” – not enough, ineffective, or insulin receptor resistance and may require insulin in addition to oral medication to keep blood sugar levels in an appropriate range.

History:

Currently, many patients have undiagnosed diabetes – this will lead to hyperglycemia, which rarely presents as an office emergency. Diabetic patients who may be prone to hypoglycemia will have already been diagnosed, and will be currently taking insulin or oral agents to control their blood sugar. SPECIFICALLY,

- They took insulin, but didn't eat or eat enough
- They took insulin, but are in a hypermetabolic state (fever, exercise, stress)

DRUGS CAPABLE OF LOWERING BLOOD SUGAR

ORAL HYPOGLYCEMIC AGENTS

- Diabinese™ (chlorpropamide)
- Micronase™, Diabeta™ (glyburide)
- Glucotrol™ (glipizide)
- Glucophage™ (metformin)
- Glucovance™ (metformin + glyburide)

INSULINS

Duration	Insulin Preparation	Onset	Peak	Duration
<i>Rapid acting</i>	Lispro (Humalog™) Aspart (Novolog™)	5 – 15 min	30 – 90 min	4 - 6 hours
<i>Short acting</i>	Insulin (Regular)	30 – 60 min	2 – 4 hours	5 – 10 hours
<i>Intermediate acting</i>	Isophane (NPH, Humulin N, Novolin N)	2 – 4 hours	4 – 10 hours	10 – 18 hours
	Insulin Zinc (Lente, Humulin L, Novolin L)	2 – 4 hours	4 – 12 hours	12-20 hours
<i>Long acting</i>	Extended Insulin Zinc Ultralente	6 – 10 hours	10 – 16 hours	18-24 hours
	Glargine (Lantus)	2 – 4 hours	Continuous	24 hours
<i>Premixed insulins</i>				
<i>Humulin 70/30</i>	70% NPH + 30% regular	30 – 60 min	Dual	10 – 16 hours
<i>Humulin 50/50</i>	50% NPH + 50% regular	30 – 60 min	Dual	10 – 16 hours
<i>Humalog 75/25</i>	75% NPL* + 25% lispro	5 – 15 min	Dual	10 – 16 hours
<i>Novalog 70/30</i>	70% NPL* + 30% aspart	5 – 15 min	Dual	10 – 16 hours

*NPL = neutral protamine lispro, functionally identical to NPH (neutral protamine hagedorn)

Diagnosis:

Hypoglycemia affects both the autonomic nervous system and the central nervous system.

Signs and symptoms of ANS dysfunction can appear with mild hypoglycemia (50-70mg/dl) and can include:

- Weakness
- Hunger
- Anxiety
- Hypotension
- ↑ sympathetic discharge (fight or flight)
 - Inappropriate sweating
 - Tachycardia – palpitations (being aware of one’s heartbeat)
 - Trembling
 - Peripheral vasoconstriction (cold, clammy hands)
 - Nausea and vomiting
 - Piloerection

Signs and symptoms of CNS dysfunction usually appear with moderate to severe hypoglycemia (20 – 50mg/dl) and can include:

- Decreased spontaneity
- Mood alteration
 - Inability to concentrate
 - Mood alteration
 - Belligerence
- Dizziness, confusion, lethargy
- Headache
- Slurred speech
- Loss of consciousness
- Seizures

The loss of consciousness that is seen with severe hypoglycemia is usually slow in onset, heralded by a gradual decline in cerebral functioning. In contrast, the loss of consciousness that is seen with vasovagal syncope is usually sudden, although patients experiencing vasovagal syncope may experience some warning – sweating, palpitations, etc.

Treatment:

1. Any diabetic patient demonstrating slow, bizarre behavior should be assumed to be hypoglycemic and managed as such until proven otherwise.
2. The treatment of suspected hypoglycemia is to give sugar orally if the patient is conscious – orange juice, candy bar, glucose syrup, etc. Putting food or liquid in the mouth on an unconscious patient can lead to airway embarrassment
3. If the patient is unconscious, contact EMS, maintain airway, ensure breathing and circulation. Protect patient from harm in the event of seizure activity.

ALLERGY

Disease:

A hypersensitive immunologic state acquired by exposure to a particular antigen; subsequent re-exposure produces a heightened capacity to react. Allergic reactions have variable clinical manifestations ranging from MILD, DELAYED ONSET to IMMEDIATE, ACUTE ONSET and LIFE THREATENING. The severity and time from exposure to symptom appearance vary with the degree of antigenicity, route of exposure, dose of antigen, as well as host factors. This discussion will focus on TYPE I (immediate hypersensitivity) reactions, where an antigen cross-links pre-existing IgE antibodies on mast cells and basophils, stimulating the release of histamine (causing increased capillary permeability and vasodilation) and SRS-A (causing bronchiolar constriction), among a veritable plethora of other mediators, all producing similar effects.

History:

Direct questioning concerning allergy to frequently used drugs in the dental office should include reactions to *penicillin*, *codeine*, *iodine (surface disinfectants)* and *latex*. These should be noted in the chart. The question of local anesthetic allergy occasionally surfaces. Allergic reactions to amide type anesthetics are extremely rare, while allergy to esters (such as Hurracaine™ or Cetacaine™) is more common, as these drugs are metabolized to the notoriously allergenic PABA (para-amino benzoic acid.) Direct questioning about the occurrence of rash, itching and rhinitis should all but eliminate the possibility of local anesthetic allergy. If in doubt, it is not wise to challenge your patient with a “test dose”, as even minute amounts of allergen can trigger full blown anaphylaxis in susceptible patients.

Diagnosis:

Diagnostic features of allergy can involve any or all of the following systems noted in the next section. Milder reactions usually involve only one or two systems, with cutaneous manifestations common as an initial presentation. When multiple systems are involved, with severe and rapid escalation, the patient may report a feeling of “impending doom”, and generalized anaphylaxis may be approaching. Any combination of symptoms can occur within 5 – 30 minutes, or several days after exposure to an antigen. True, life-threatening anaphylaxis is quite rare, especially in the dental office; however, case reports occasionally surface involving the administration of penicillin derivatives to penicillin allergic patients for antibiotic prophylaxis. As stated above, the patient may report a feeling of intense itching, flushing, giant hives, piloerection, cramping, nausea, vomiting and wheezing.

Signs and symptoms of allergy

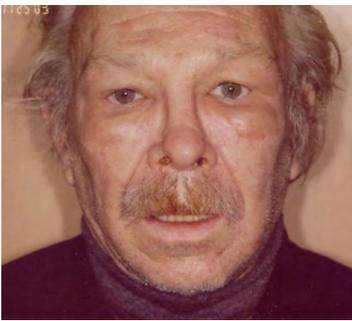
- **Cutaneous**
 - Urticaria (hive)
 - Angioedema (asymmetrical swelling in loose tissues)
 - Pruritis (itching)
 - Erythema (rash)
 - Wheal formation
 - Warm, red skin
 - Periorbital swelling
- **Exocrine**
 - Watery eyes
 - Running nose
- **Respiratory**
 - Difficulty in breathing
 - Bronchoconstriction – wheezing, shortness of breath
 - Laryngeal edema (change in tone or pitch of voice)
- **Cardiovascular**
 - Hypotension
 - Tachycardia - palpitations
 - Generalized **collapse and loss of consciousness**
- **Gastrointestinal**
 - Cramping
 - Nausea / vomiting
 - Incontinence

Many of these reactions may be confused with other diagnoses, all having several symptoms in common. Bronchoconstriction also occurs in the asthmatic patient – in many instances, asthmatic patients have multiple allergies. Differentiation of the various possible etiologies is secondary and should not delay palliative treatment of signs or symptoms. Tachycardia and palpitations are seen in most reactions – these are classic fight or flight signs. Early syncope can mask as early allergy – however, one would not expect rash formation with syncope, and the skin in syncope or hypoglycemia is moist and cold, while the skin in anaphylaxis is warm and dry.

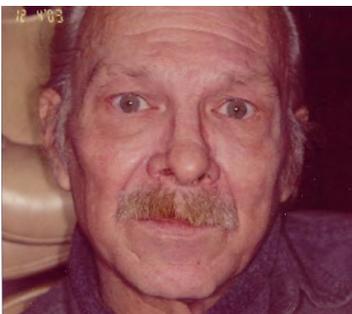
Visual manifestations of allergy



Note raised, itching **hive** on right lateral chest and abdominal wall, representing a reaction to penicillin.



Note **periorbital swelling, watery eyes, rhinitis “runny nose”**. This patient “looks bad.” This particular case represents a reaction to clindamycin.



This is the same patient as above, three days after allergic reaction resolved, and now appears **normal**.



This is a clinical example of **angioedema of the lower lip**. Note asymmetric contortion secondary to fluid accumulation in loose tissue layers. Angioedema can also occur in the soft laryngeal tissues, leading to upper airway obstruction.

Treatment:

Mild:

Treatment should be tailored to the severity and rapidity of symptom onset. Mild, cutaneous or exocrine reactions can often be managed by **eliminating the allergen** (if possible) and taking **oral diphenhydramine (Benadryl™) 25-50mg QID** for several days as needed to control signs and symptoms. Consultation with the patient's physician or an emergency room is recommended.

Severe:

The appearance of any other signs or symptoms, and especially with rapid onset, including wheezing, change in voice, difficulty in breathing, tachycardia, or hypotension should prompt immediate contact with EMS. While waiting for their arrival, the **airway is maintained, oxygen and β_2 agonist bronchodilators should be administered (inhaled albuterol) and when urgency dictates, .3mg of 1:1000 epinephrine solution should be injected subcutaneously, every 5 minutes as necessary until help arrives.** Epinephrine is life-saving in anaphylaxis, but its effect is short-lived. Refer to section – [The subcutaneous epinephrine injection.](#)

SEIZURES

Disease:

A seizure is an abnormal, paroxysmal neuronal discharge in the brain, characterized by an attack involving changes in the state of consciousness, motor activity, and/or sensory phenomena. Usually, the attack is *sudden* in onset and brief in duration. Etiology includes genetic predisposition, brain lesions, trauma, infection or *non-compliance with anti-seizure medication*. There is no identifiable cause in a majority of cases.

Classification is wide and varied with signs and symptoms ranging from simple, episodic short-lived absence seizures (spell); complex seizures involving a loss of consciousness and/or involuntary motor or autonomic discharge; or the frightening display of tonic (sustained muscular contraction) – clonic (twitching) contortions of the trunk and extremities, usually lasting between 2 – 5 minutes, followed by post-ictal depression that can last for several hours. Some patients may be able to anticipate their seizure activity, while in others the occurrence is without warning.

Common medications include phenytoin (Dilantin™) and barbiturates, among several others.

History:

Question the patient concerning the type, frequency, duration, sequelae, warning signs and instigating factors of the seizure. The patient should be able to describe what may happen, the likelihood that it will happen and what you should do about it if it happens. Non-compliance with medication and limited effectiveness of current medication are importance issues that should increase anticipation of a seizure. Usually, seizure patients who are allowed to drive a car are considered to be adequately controlled.

Diagnosis:

Diagnosis is straightforward and requires only visual detection. The patient may demonstrate a blank stare or absence spell, facial muscle twitching, loss of consciousness, nausea, vomiting, possible airway obstruction and/or incontinence.

Differential Diagnosis:

Seizure activity can also occur with syncope and severe hypoglycemia. Seizure activity that can occur during syncope is much shorter duration, usually consisting of 1 – 2 clonic jerks with a rapid recovery to normalcy. Seizure activity associated with hypoglycemia occurs with gradual onset in a patient who has already lost consciousness.

Treatment: (grand mal)

1. terminate the procedure
2. remove all dental hardware (clamps, bands, etc.) with the appearance of prodromal signs
3. protect the patient from injury – you cannot and should not restrain the patient during a seizure – rather, remove objects that may be in the way of his motion to avoid cuts or punctures.
4. maintain the airway – this is easy to say and hard to do during the seizure – if the patient loses his airway during the seizure, it may be impossible to extend the neck and protrude the jaw. The use of hard objects to forcefully pry the jaws apart is not recommended. If possible, suction should be nearby in the event of hemorrhage as a result of tongue or cheek biting.
5. continue to support the airway in the lethargic, post-ictal stage
6. contact EMS with prolonged or unusual seizure activity (something different than what patients report as their ‘normal seizure’).
7. the use of benzodiazepines to control seizure activity in the office by those unfamiliar with their parenteral usage is not recommended and may exacerbate post-ictal depression.

STROKE

Disease:

A stroke is a sudden disruption in the flow of blood to a region of the brain. Deprived of oxygen, the affected area of the brain can be either injured or succumb to cell death. There are two types of stroke:

1. ischemic (80%) – caused by stationary (thrombotic) or moving (embolic) blood clots. More common in older patients.
2. hemorrhagic (20%) – occurs when a blood vessel in the brain leaks or ruptures, secondary to an inherent vascular weakness or severe hypertension. More common in middle age patients.

History:

Strokes are usually sudden and unexpected in onset; therefore, history may not be helpful, except in cases where the patient has risk factors and has suffered strokes in the past. Risk factors include, but are not limited to, male gender, advanced age, sedentary lifestyle, cigarette smoking, obesity and hypercholesterolemia.

Diagnosis:

Signs and Symptoms of Stroke

1. **sudden, severe headache with no known or apparent cause**
2. **sudden weakness / loss of sensation on one side of the face or unilateral extremity**
3. **sudden dimness or loss of vision, especially unilateral**
4. **loss of coherent speech or trouble talking or understanding speech**
5. **unexplained dizziness, unsteadiness or sudden falls, especially with any of the other signs above**

TIA – A Transient Ischemic Attack is a focal, temporary loss of neurologic function, secondary to ischemia. The TIA is abrupt in onset, LESS than 24 hours in duration and resolves without residual signs. A TIA is an important warning sign for stroke. Since the initial presentation of a TIA is identical to stroke, it should be managed in similar emergent fashion.

Treatment:

If a stroke is due to an occlusive clot (as diagnosed on CT scan) AND these patients are treated with thrombolytic agents within 3 hours of symptom onset – there is a 30% less likely chance of irreversible brain injury. As such, signs and symptoms of stroke should be considered an emergent situation, requiring **immediate activation of the EMS**. Your role will be recognitive, supportive and intermediary. Supplemental oxygen and supine posturing can be considered, but both can worsen a cerebral bleed.

DISORDERS OF BLOOD PRESSURE

Baseline blood pressures should be measured on all dental patients. Otherwise normotensive patients presenting with low blood pressure can be at increased risk of syncope (80/50mmHg); while patients with sustained high blood pressure can be at risk of myocardial ischemia or cerebral hemorrhage (230/120mmHg) as well as damage to the eyes, kidneys and other organ systems.

Defer elective treatment for patients with blood pressures greater than 180/110mmHg; while immediate consultation with the patient's physician or the emergency room is indicated with pressures > 220/120mmHg. These numbers are approximate values; each case should be managed on an individual basis, with consideration of other risk factors, such as type and urgency of surgery, general health of the patient, and consultation with the patient's treating physician.

Should a patient develop headache, confusion or nausea during an appointment CONCOMITANT with a significant rise in blood pressure over baseline, treatment should be stopped, and immediate medical consultation obtained. Reassure your patient, and consider oxygen. There is no indication for the parenteral use of anti-hypertensive agents (or vasopressors) in the general dental office to treat abnormalities of blood pressure by those practitioners unfamiliar with their usage.

MANAGEMENT OF FOREIGN BODIES **DISPLACED BEYOND THE OROPHARYNX**

Prevention:

The introduction of small objects into the mouth invites the possibility of their displacement beyond the throat. An oropharyngeal drape (rubber dam, 4x4 gauze) should be used to reduce the possibility of accidental aspiration or ingestion. If this is not possible (e.g., patients prone to gagging,) instruments should be tethered to suture or floss to aid in their retrieval. A numeric inventory of small parts on the operative tray should be maintained.

Diagnosis:

USUALLY, but not always, aspirated objects will produce a coughing reflex, while ingested objects will produce no response or possibly a gag response if the ingested object is large.

Treatment:

When an object is lost to the hypopharyngeal region in an already supine patient, do not allow the patient to sit up. Keep the patient supine or trendelenberg (**HEAD DOWN**), lying on the **RIGHT SIDE**. If the patient is upright, reposition as above, unless the patient is in a coughing paroxysm. The best chance for retrieval occurs with the patient in this position. Right-sided trendelenberg posturing lessens the force of gravity pushing the object in a more caudal direction, and in cases of aspiration may keep the object to the right mainstem bronchus, where it is most often located and from where spontaneous or endoscopic retrieval is easier. If unsure of the location of a foreign body, radiographs should be obtained – PA and lateral chest films to check for aspiration and/or a flat plate of the abdomen (KUB) to localize an ingested item. All lost objects must be retrieved or followed to elimination with x-rays, if radiographically identifiable.

INGESTION OF SMALL, BLUNT OBJECTS – tooth, cotton roll, small implant hardware may be managed by radiographic documentation of passage with the help of high fiber diet. Consultation with a physician may be warranted.

INGESTION OF LARGE, BLUNT OBJECTS or ANY SHARP OBJECT – endodontic file, bur, scalpel blade, suture needle, large implant hardware should be immediately referred to a general surgeon, gastroenterologist or emergency facility.

ASPIRATION OF SMALL, BLUNT OBJECTS will often be accompanied by coughing. Immediately place patient to a right sided trendelenberg, encourage a slow inhale (to minimize deeper aspiration) followed by a forceful cough. Once **CANNOT** assume that an aspirated object has been eliminated simply because a coughing paroxysm has stopped. Referral is necessary in cases of unsuccessful retrieval.

ASPIRATION OF LARGE and/or SHARP OBJECTS should be immediately referred to an emergency facility for management. Maintain vigilance and anticipate airway compromise. **DO NOT** encourage coughing if the lost object is sharp. A Heimlich maneuver should be performed with airway obstruction.

The subcutaneous epinephrine injection

Performing an extraoral epinephrine injection, in order to save the patient's life can be daunting for even the most experienced clinicians. Careful planning and rehearsal are the only two ways to prepare for this procedure. To reiterate, the two indications for parenteral epinephrine in the dental office are asthmatic bronchospasm unresponsive to inhaled β_2 agonists AND severe and worsening allergic reactions.

In the United States, epinephrine is available in three forms: the Epipen™ (Dey Pharmaceuticals), the TwinJect™ (Verus Pharmaceuticals) or in an ampule. The ampule will require a simple maneuver (see next page) to fill a syringe, however, it is the most cost effective.

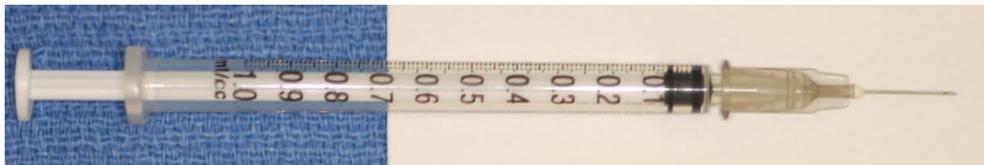
The epinephrine ampule and tuberculin syringe are available at most local pharmacies. The Epipen™ contains 1 injection only, and is available in both adult and pediatric doses. The TwinJect™ contains 2 injections, first as an autoinjector, and a second as a regular pre-filled syringe contained within the apparatus; it is also supplied in both adult and pediatric doses. It is important to note that with true anaphylaxis, one dose of epinephrine may not be sufficient and repeated dosing may be necessary within 5 – 10 minutes.

Instructions for use of these two devices can be viewed at the following websites.

- TwinJect™ - www.twinject.com
- Epipen™ - www.allergic-reactions.com/howtouse.aspx.



1cc ampule of epinephrine; 1:1000, 1mg/cc



**1cc syringe with 27 gauge 1/2" needle
(tuberculin syringe)**

Preparing medication for injection from a glass ampule

1. READ THE LABEL!

- Verify that the ampule contains the drug you wish to administer
- Check expiration date



2. BREAK THE AMPULE

- Flick the upper stem with your fingernail to bring all liquid down to the main portion of the ampule
- Grasp with thumbs and index fingers and briskly snap off top



3. TIP THE AMPULE AND WITHDRAW MEDICATION INTO A TUBERCULIN SYRINGE

- Place tip of needle at the bottom *wall* of the ampule as shown, and withdraw; this minimizes the possibility of aspirating small pieces of broken glass that may have fallen to the bottom of the ampule



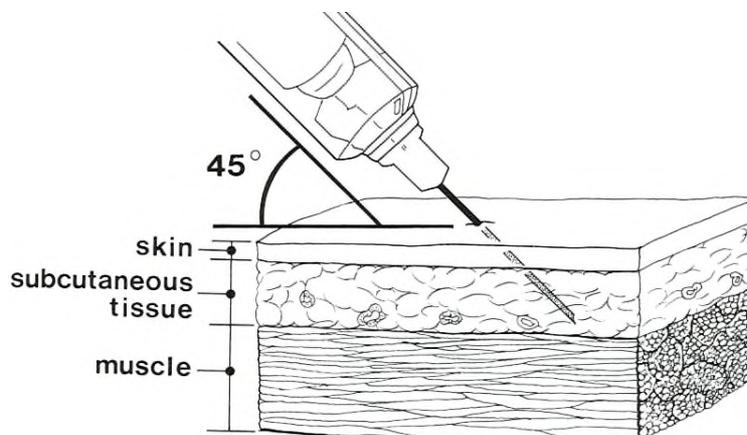
4. EXPRESS ANY AIR BUBBLES FROM THE SYRINGE

- Flick the syringe with the needle up to allow air to come to the top and express the bubbles
- Ready to inject

Where should the epinephrine injection be given?

Epinephrine is rapidly metabolized once it reaches the blood stream; therefore, the 1:1000 (1mg/cc) concentration should be administered in a location where absorption is slower to promote a reasonably sustained effect. Any location with subcutaneous fat is acceptable. IM injections (tongue, floor of mouth) are currently preferred in many emergency settings as absorption will be quicker. In this instance a longer needle is used and is directed at 90 degrees with a direct perpendicular puncture into muscle tissue.

The fat over the back of the upper arm is a readily accessible location when patients are in the dental chair. The needle should be inserted at a 45° angle into the layer of fat that is pinched by the non-dominant hand. Aspiration is not necessary. 0.3cc of a 1:1,000 solution should be administered in an adult, while 0.1cc of a 1:1,000 solution is sufficient in a small child. In many cases, this dose must be repeated every 5 minutes.



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