E01: Hypoglycemia and Hyperglycemia

Sheena Osborne

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Reviewed:

Introduction

Diabetes mellitus (DM) is a common disease affecting the endocrine system. DM can be classified into Type 1, Type 2, and gestational diabetes. These diseases produce complications that are commonly encountered in the prehospital environment, including hypoglycemia, hyperglycemia, diabetic ketoacidosis (DKA), and hyperglycemic hyperosmolar state (HHS). Disruptions in blood glucose levels are the hallmark of all diabetic emergencies. A typical blood glucose level is between 4.0 mmol/L and 7.0 mmol/L, and may be slightly higher after meals. A blood glucose measurement below 4.0 mmol/L is considered hypoglycemia, and should be corrected.

The goals of care include early recognition of abnormal blood glucose levels, followed by the immediate correction of hypoglycemia. Paramedics should investigate the underlying cause of hypoglycemia, and treat concurrent illnesses. Patients with hyperglycemia, diabetic ketoacidosis, or hyperglycemia hyperosmolar states require immediate transport and supportive care, often including fluid replacement.

Essentials

- Early recognition of abnormal BG levels and identification of underlying pathologies
- Hypoglycemic patients who are able to swallow and follow commands should be given oral glucose preferentially
- Hypoglycemic patients who are unable to follow commands should receive intravenous dextrose or intramuscular glucagon
- Hyperglycemic patients, and those with suspected diabetic ketoacidosis or hyperglycemic hyperosmolar states should be transported urgently and evaluated for possible fluid replacement

Additional Treatment Information

- Diabetic emergencies often involve an alteration in a patient's level of consciousness. Ensure the airway is patent and manage as required.
- Patients experiencing an episode of hypoglycemia who are able to follow directions can be encouraged to eat long-acting carbohydrates (e.g., a sandwich or fruit) when available. This provides a more sustained correction of blood glucose and may be preferred over other interventions provided paramedics do not suspect any other underlying problems (such as infection).
- Blood glucose levels should be retested to measure the effectiveness of treatment, and to confirm adequate reversal of hypoglycemia.
- During IV administration of dextrose solutions ensure IV is patent, as extravasation causes tissue necrosis.
- Fluid therapy may be necessary during diabetic emergencies. Assess for signs of dehydration and provide IV fluid if required. Patients in hyperglycemic states often become dehydrated, and diabetic ketoacidosis and hypergylcemic hyperosmolar states can cause profound hypotension.
- Paramedics must consider other causes of altered levels of consciousness, particularly in those patients whose blood glucose levels have been corrected but remain obtunded.

Referral Information

Adult patients who experience an explained hypoglycemic episode that is fully resolved may wish to decline transport. This can be supported, in relative safety, under certain circumstances. Paramedics must establish the proximate cause of the hypoglycemic episode, and ensure there is no underlying illness that will require additional care. Patients who elect to not be transported must:

- Not have a concurrent acute illness
- Not have suffered a drug overdose, nor consumed excessive alcohol
- Not be taking oral hypoglycemic medications

- Not have experienced another hypoglycemic episode requiring treatment within the past 24 hours
- Not have any abnormal vital signs, including blood pressure and Glasgow Coma Score
- Not be febrile
- Have fully recovered from their hypoglycemic episode, with a return to normal mentation. Post-recovery blood glucose shall be 4.0 mmol/L or higher.
- Have a clearly identified explanation for the hypoglycemic episode
- Be attended to by a responsible adult who will stay with the patient for at least four hours
- Have completed the appropriate waivers and demonstrated, to the paramedic's satisfaction, that they understand the recommendations for follow-up care

General Information

- Causes of hypoglycemia (< 4.0 mmol/L) include: missed meals, an overdose of insulin or oral hypoglycemic agent, recent changes in medications, higher than normal amounts of physical activity, underlying illess (particularly infections), alcohol consumption, or other physiological stressors.
- Signs and symptoms of hyperglycemia include: thirst and polydipsia, polyphagia, excessive urine production, blurred vision, dehydration, and nausea. Common causes include: infection, medication changes or mismanagement, changes in diet, increased emotional stress, or a reduction in physical activity. Hyperglycemia is sometimes the initial finding prior to a diagnosis of diabetes.
- Diabetic ketoacidosis is a life-threatening emergency primarily affecting Type 1 diabetics. It may represent a first-time presentation of diabetes (25% of patients who present in diabetic ketoacidosis have no prior diagnosis of diabetes).
  - It is typically the result of an insulin deficiency and a surge in counter-regulatory hormones, and can be trigged by a variety of causes. Diabetic ketoacidosis results in hyperglycemia, ketosis from fatty acid breakdown, dehydration, metabolic acidosis, and electrolyte disturbances. Patients commonly present with altered levels of consciousness, nausea and vomiting, an elevated blood glucose level, abdominal pain, and a "fruity" or ketone odor on their breath.
  - The increase in ketone body production causes a metabolic acidosis, which in turn drives a compensatory hyperventilation (Kussmaul's respirations). This ventilatory rate is intended to lower $PaCO_2$ and counteract the decrease in pH.
- Hyperglycemic hyperosmolar states, formerly known as hyperglycemic hyperosmolar nonketoic coma, are a similar to diabetic ketoacidosis, though it is more common in Type 2 diabetics. Patients experience an extreme elevation in blood glucose levels and significant dehydration, but do not experience the same acidosis and ketosis as would be seen in diabetic ketoacidosis.
- Gestational diabetes has a similar pathogensis as Type 2 diabetes, and is the cause of glucose intolerance in pregnancy. It can be managed in the same way as diabetes mellitus, and affects approximately 7% of pregnancies.

Interventions

First Responder

- Position patient in lateral position if unconscious
- Evaluate for stroke signs and symptoms
- Assess and maintain airway patency
  - → B01: Airway Management
- Provide supplemental oxygen therapy as required
  - → A07: Oxygen and Medication Administration
- Correct suspected or confirmed hypoglycemia
  - Apply glucose gel to oral mucosa if altered. Maintain vigilance over the airway.

Emergency Medical Responder – All FR interventions, plus:

- Provide supplemental oxygen therapy in patients with clinical signs of hypoxemia or to maintain $SpO_2 \geq 94\%$.
  - → A07: Oxygen and Medication Administration

- Provide safe and expeditious transport
- Consider higher level of care intercept

Primary Care Paramedic – All FR and EMR interventions, plus:

- Obtain vascular access.
  - → D03: Vascular Access
- Correct confirmed hypoglycemia:
  - 10% dextrose in water (D10W) IV: 10 to 25 g (100-250 mL)
  - Glucagon if unable to obtain IV access
- Correct hypotension. Target systolic blood pressure of 90 mmHg.

Advanced Care Paramedic – All FR, EMR, and PCP interventions, plus:

- In suspected DKA/HHS:
  - Obtain and interpret 12-lead ECG
    - → PR16: 12 Lead ECG
- Perform continuous cardiac monitoring en route to hospital. Electrolyte disturbances may produce arrhythmia.
- Exercise caution in diabetic ketoacidosis when performing advanced airway procedures: tachypnea is the main compensatory mechanism to control acidosis. If intubation is required, select a higher than normal ventilatory rate (use patient's intrinsic rate as a guide).

Evidence Based Practice

Hypoglycemia

Hyperglycemia

References

1. Alberta Health Services. AHS Medical Control Protocols. 2020. [Link]
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E02: Adrenal Crisis

Richard Armour and Chris Millar

Updated: December 11, 2020
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Introduction

Acute adrenal insufficiency, or adrenal crisis, is a life-threatening endocrine emergency caused by a lack of cortisol (the most common glucocorticoid). Primary adrenal insufficiency is caused by a loss of function of the adrenal gland, while secondary adrenal insufficiency is a result of compromised adrenal function, due to a lack of adrenocorticotropic hormone. Patients who are unwell, with a past medical history of Addison's disease (the incidence of which varies from 1 to 6 out of ever 100,000 individuals) should be routinely evaluated for signs of an adrenal crisis; these individuals may carry their own hydrocortisone injections.

Paramedic treatment for adrenal insufficiency includes the maintenance of airway patency, supporting oxygenation and ventilation, providing adequate fluid resuscitation, the correction of hypoglycaemia, as well as early recognition of these crises and the timely administration of hydrocortisone.

Essentials

- In undifferentiated, critically ill patients, routinely assess for a history of Addison's disease, or a pre-existing prescription for hydrocortisone injection.
- The administration of a single dose of hydrocortisone to patients with adrenal insufficiency is never harmful. The failure to recognize and treat an adrenal crisis may rapidly result in death.
- In patients with suspected adrenal crisis, hydrocortisone should be administered prior to movement, as some patients may lack a sufficient adrenal reserve to allow for a safe transfer to a stretcher.
- Intravenous administration of hydrocortisone is preferred over the intramuscular route. However, IM administration should be provided early when IV access is delayed or unobtainable.
- Patients on long-term (> 3 weeks) glucocorticoid therapy are at risk for secondary adrenal insufficiency.

Any source of stress (illness, trauma, mental health crisis) in patients with chronic adrenal insufficiency may be sufficient to provoke a crisis.

Additional Treatment Information

- Hydrocortisone should be administered to patients with suspected adrenal crisis, regardless of whether the patient received hydrocortisone prior to paramedic arrival.
- Adrenal insufficiency may commonly co-occur with diabetes mellitus. Ensure blood glucose is assessed in all patients with suspected adrenal crisis and treat accordingly.
- Patients with suspected adrenal crisis should never be ambulated to the ambulance.
- In a rare circumstance where a patient with known or suspected adrenal insufficiency also presents with anaphylaxis, administer EPINEPHrine before hydrocortisone.

General Information

- Glucocorticoids are used in many chronic medical conditions such as autoimmune disorders, asthma, inflammatory bowel disease and cancer. In patients with prolonged use of glucocorticoids (3 weeks or more) this may cause suppression of ACTH release and place the patient at risk of secondary adrenal insufficiency.
- Common glucocorticoids include prednisone, prednisolone, dexamethasone, betamethasone or hydrocortisone.
- Previous adrenal crisis places the patient at greater risk for future adrenal crisis.
- Signs and symptoms of an adrenal crisis are general and should be correlated with clinical history:
  - Nausea and vomiting
  - Hypoglycemia
  - Hypotension
  - Weakness

- Dizziness
- Confusion or altered levels of consciousness

- Evaluate the patient's medical history for any of:
  - 3 weeks of glucocorticoid use
  - Non-compliance or cessation of chronic glucocorticoid therapy (including difficulties with compliance because of nausea/vomiting or prolonged illness)
  - Addison's disease
  - Pituitary insufficiency

Interventions

First Responder

- Position supine to improve blood pressure and do not walk the patient
- Provide supplemental oxygen to maintain $SpO_2 \geq 94\%$
- → A07: Oxygen and Medication Administration

Emergency Medical Responder – All FR interventions, plus:

- May assist patient in administering own hydrocortisone injection, if available
- Obtain capillary blood glucose sample. If hypoglycemic:
  - → E01: Hypoglycemia and Hyperglycemia

Primary Care Paramedic – All FR and EMR interventions, plus:

- Consider vascular access for drug administration. Do not delay hydrocortisone in cases of failed or difficult vascular access.
- → D03: Vascular Access
  - Normal saline to correct hypoperfusion or hypotension
  - Dextrose to normalize blood glucose
    - → E01: Hypoglycemia and Hyperglycemia

References

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E03: Hyperkalemia

Andrew Mills

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Introduction

Although there are many potential electrolyte disturbances, hyperkalemia is arguably the most serious. In addition, it may be reasonably identified and treated in the pre-hospital environment based on clinical features. The strict laboratory testing diagnosis of hyperkalemia is a serum potassium level over 5.5 mmol/L.

In rare cases with signs of hemodynamic compromise and potentially life-threatening arrhythmias, a clinical suspicion of hyperkalemia may be sufficient for initiating treatment.

Essentials

- The lethality of hyperkalemia is directly related to the rapidity with which the condition has developed, in addition to the absolute level of serum potassium.
- Correlation of specific ECG changes with specific serum levels has not been adequately demonstrated.
- Clinical suspicion of hyperkalemia alone is not cause for treatment in the prehospital setting.
- Treatment of life-threatening hyperkalemia aims at preventing or resolving lethal arrhythmias and restoring hemodynamic stability; this can be accomplished by stabilizing the myocardium, shifting potassium back into the intracellular space, and removing excess potassium from the body. The majority of these interventions are only available in hospital.

Additional Treatment Information

- Bradyarrhythmias with bizarre morphologies should prompt a strong consideration of hyperkalemia.
- To warrant prehospital intervention, patients must present with significant hemodynamic or arrhythmogenic instability, alongside a suspicion of hyperkalemia as the likely cause.

General Information

- Classic causes of hyperkalemia:
  - Increased intake, either through potassium supplementation or diet
  - Increased production, as occurs in hemolysis, rhabdomyolysis, extensive burns, or as a result of intense physical activity or trauma (particularly crush injuries and tissue ischemia)
  - Decreased excretion, caused by acute or end-stage chronic renal failure, or by some drugs (such as nonsteroidal anti-inflammatory drugs, cyclosporine, potassium-sparing diuretics, and ACE inhibitors)
  - Shifts from intracellular to extracellular fluid as a result of acidosis (either metabolic or respiratory), insulin deficiency, or some drugs (particularly succinylcholine in certain populations, beta blockers, and digoxin)
- Clinical features of hyperkalemia are often non-specific:
  - Generalised muscle weakness, paresthesia and/or absent deep tendon reflexes. In rare cases, muscular paralysis and hypoventilation may be observed.
  - Mental status change including confusion, fatigue and lethargy
  - Signs of renal failure, such as edema, skin changes, and dialysis sites, may be present
- The ECG is one of the most important diagnostic tools in detecting hyperkalemia. ECG changes associated with Hyperkalemia include:
  - Tall tented T-waves
  - Flattened or absent P waves
  - Prolonged PR Interval
  - Wide QRS
  - Bradycardia
- These changes may progress to bizarre QRS complexes, sine waves, or asystole.

Interventions

First Responder

- Keep patient at rest in a position of comfort.
- Oxygen as required to maintain SpO2 ≥ 94%
- → A07: Oxygen and Medication Administration
- Rapid transport
- Consider ACP intercept

Advanced Care Paramedic – All FR, EMR, and PCP interventions, plus:

- Obtain vascular access.
- → D03: Vascular Access
- In patients with significant hemodynamic instability or dysrhythmia, and a suspicion of hyperkalemia:
  - REQUIRES CLINICALL CONSULTATION (1-833-829-4099)
  - Stabilize cellular action potential:
    - Calcium chloride. May repeat after 5 minutes if ECG changes persist or recur.
  - Shift potassium intracellularly:
    - Sodium bicarbonate
    - Salbutamol

Critical Care Paramedic – All FR, EMR, PCP, and ACP interventions, plus:

- Stabilize cellular action potential:
  - Calcium gluconate IV: 1.0 g slow push over 2-3 minutes. May repeat once after 5 minutes if ECG changes persist or recur.
- Shift potassium intracellularly:
  - D10W with 10-20 U insulin R mixed: give 500 mL intravenously over 60 minutes, or:
  - Insulin R 10 units IV followed by glucose 25 g IV.
  - Sodium bicarbonate IV: 150 mEq in 1 L D5W over 2-4 hours depending on volume status.
- Eliminate potassium:
  - Furosemide IV: 40 mg every 12 hours

References

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E04: Dialysis Emergencies

Michelle Haig and Rebecca Kroeker

Updated: December 07, 2020
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Introduction

Patients who suffer from an acute or chronic injury or illnesses to their kidneys are at risk of developing kidney failure. Treatment options depend upon the patient's clinical condition and comorbidities, and range from conservative treatment with medication and fluids, to peritoneal dialysis or hemodialysis, to kidney transplantation.

Essentials

- Patients requiring renal dialysis often have numerous other medical problems, including hypertension, diabetes, and cardiovascular disease. Paramedics should be alert to the possibility of concurrent clinical issues.
- Do not attempt to take blood pressures, or start an intravenous, in an extremity that has a dialysis shunt or fistula in place.
- Always consider the possibility of hyperkalemia in patients on dialysis or with renal failure.
- Dialysis patients should be transported preferentially to a facility capable of providing dialysis services. If the patient is critically ill, transport the patient to the nearest facility. Contact CliniCall for assistance with destination choices.

Referral Information

It may be reasonable to bypass the emergency department in favor of transport to the patient's dialysis clinic. Consult with CliniCall is encouraged.

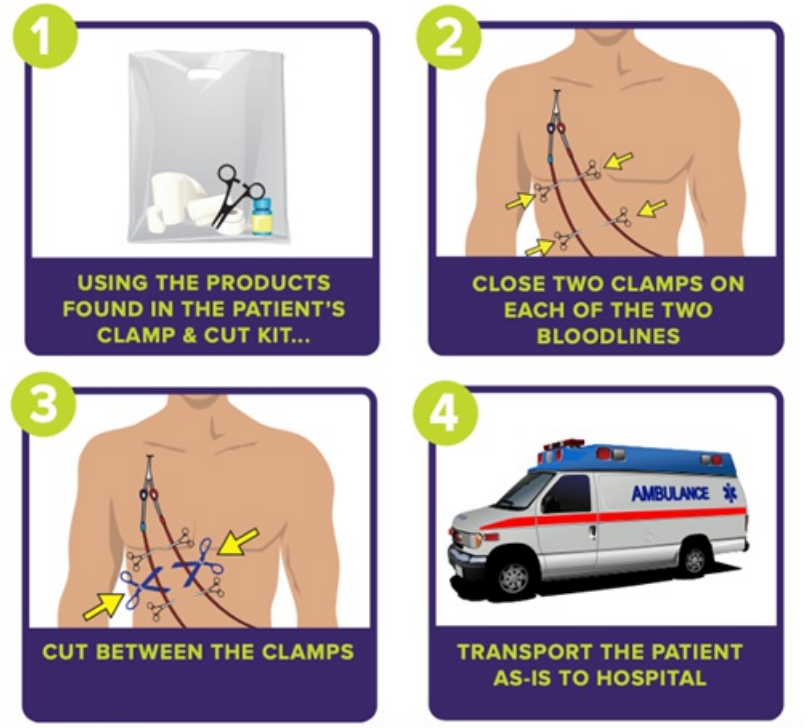
General Information

- Peritoneal dialysis uses the peritoneal membrane in the body itself as a filter. This membrane is a fine layer of tissue lining the peritoneal cavity. The peritoneal cavity's rich vascular supply makes the peritoneal membrane ideal for filtering metabolic wastes and excess fluid from the blood. Dialysis solution is instilled into the abdominal cavity via a surgically inserted Tenckhoff Catheter. Metabolic waste products then pass from the bloodstream, across the peritoneal membranes, and into the dialysis solution. After a period of dwelling time, the solution is drained from the peritoneal space and replaced with a fresh solution.
- In hemodialysis, blood is pumped from the body through special tubing into a dialysis machine from a surgically inserted catheter or arterio-venous (AV) fistula. This typically occurs 3 or 4 days per week at a dialysis center, but can also be performed daily at home. The hemodialysis machine removes waste products and excess fluid from the blood and, as such, acts as a type of artificial kidney. The blood passes through a dialyser (filter), which also assists in balancing fluids and electrolytes in the blood. The machine then returns the filtered and cleansed blood to the body at the same rate at which it is removed.
- Patients undergoing hemodialysis will have a long-term catheter or shunt placed for this procedure. Catheters are typically placed in the upper chest groin, and shunts are typically placed in the arms or forearms. The shunt is created by anastomosing a vein and an artery; a thrill can be felt on the shunt when it is palpated, and a bruit can be heard when it is functioning properly.
- Common complications of dialysis treatment include:
  - Infection at the shunt or catheter site, or systemically
  - Direct fingertip pressure with gauze should be performed at the site of the bleeding
  - Disequilibrium syndrome develops when a shift of metabolic waste and electrolytes occurs, causing weakness, dizziness, nausea and / or vomiting and seizures
  - Hypotension can cause altered LOC, angina, seizures, or arrhythmia, and typically responds to small fluid bolus of 250 mL normal saline
  - Occlusion or disruption of the Tenckhoff catheter
  - Some medications are filtered out by the dialyser, limiting their therapeutic effect

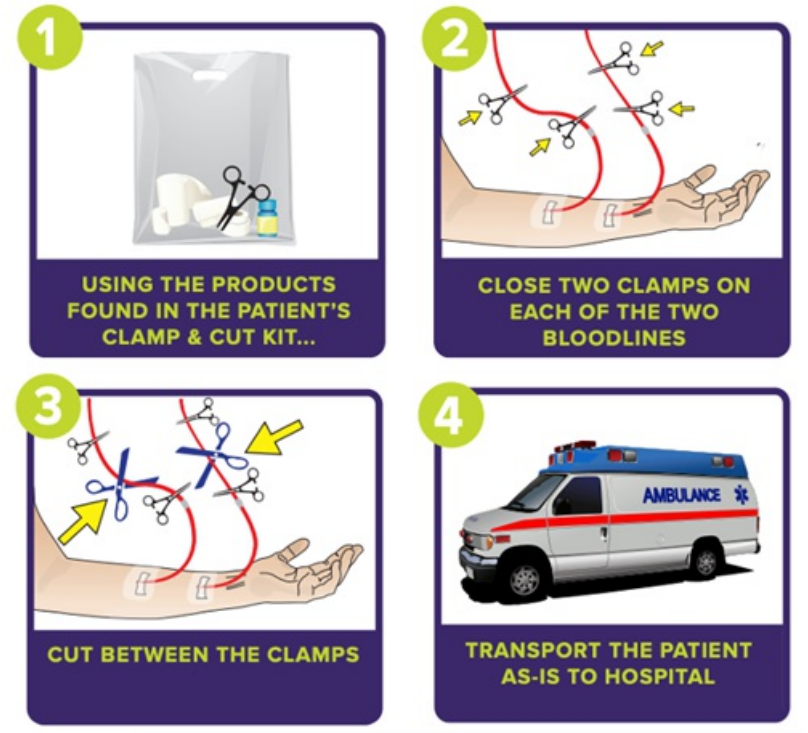
- Air embolism
- Shunt bleeding typically following a hemodialysis session, and will occur in 1 to 4 tiny holes made by needles. Apply direct pressure to control. When the bleeding stops tape over the gauze, but do not remove the gauze to check for control as this will usually cause more bleeding. Circumferential dressings, if used, should not be used as this can occlude the shunt and cause clotting. The tape should, at a maximum, envelope about 180 degrees of the extremity.

Emergency Disconnect Instructions

For dialysis patients with a central catheter:



For patients with a fistula or graft:



Interventions

First Responder

- Keep patient at rest
- Control bleeding as required
- Position patient based on comfort and prevent heat loss

Emergency Medical Responder – All FR interventions, plus:

- Transport in position of comfort
- Perform emergency disconnect from home dialysis machine if patient is critically ill

Primary Care Paramedic – All FR and EMR interventions, plus:

- Obtain vascular access.
  - → D03: Vascular Access
  - Normal saline if systolic blood pressure is < 90 mmHg, or if signs of end-organ hypoperfusion exist.
- Correct hypoglycemia:
  - → E01: Hypoglycemia and Hyperglycemia

Advanced Care Paramedic – All FR, EMR, and PCP interventions, plus:

- In patients with significant hemodynamic instability or dysrhythmia, and a suspicion of hyperkalemia:
  - → E03: Hyperkalemia

References

1. Mount DB. Treatment and prevention of hyperkalemia in adults. In UpToDate. 2019. [Link]
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E05: Abdominal Pain

Sheena Osborne

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Introduction

Abdominal pain is one of the most common prehospital complaints, and features a broad and varied list of potential causes ranging from benign to life threatening. In the absence of laboratory testing and diagnostic imaging, it can be extremely difficult to differentiate between causes of abdominal pain.

Common origins for abdominal pain can include biliary tract diseases, appendicitis, peptic ulcers, diverticulitis, acute gastroenteritis, renal colic, urinary tract infections, GERD, constipation, bowel obstruction, and many others. When examining a patient with abdominal pain, paramedics must be aware that the pain may be originating from outside of the gastrointestinal system. Consider cardiac, urinary, reproductive, respiratory, and toxicological origins in these cases.

The prehospital care of abdominal pain centers on the early identification of life-threatening causes, the management of symptoms and physiological dysfunction, and improving patient comfort.

Essentials

- Identify and communicate potentially life-threatening causes of abdominal pain
- Identify and correct hypovolemia
- Provide symptom relief

Additional Treatment Information

- Fluid replacement should be considered if clinical signs of dehydration or hypovolemia are present. These can include dry mouth or tongue, poor skin turgor (i.e., tenting), and a history of diminished oral intake or fluid loss (vomiting, diarrhea).
- Manage nausea and vomiting. Paramedics should be particularly alert to the presence of blood or "coffee ground" emesis. Maintain patient dignity and comfort during episodes of nausea and vomiting.
- Consider assessing blood glucose levels in cases of prolonged vomiting, anorexia, or limited oral intake.
- Practitioners should ensure that acute abdominal pain is managed adequately with analgesic medications. Strong evidence supports the use of narcotic analgesics in this patient population. Use of analgesia does not affect the accuracy of in-hospital assessment or diagnosis.

General Information

- Use appropriate personal protective equipment. Contact precautions may be warranted in patients who exhibit signs and symptoms consistent with infectious causes of abdominal pain. Fever, nausea and vomiting, loose stools or diarrhea, myalgia, and headache may be the result of norovirus infection. Refer to BCEHS Infection Control and Prevention material for additional guidance on the selection and use of personal protective equipment.
- Potentially life-threatening causes of abdominal pain or discomfort include:
  - *Aortic aneurysm or dissection* is sometimes accompanied by a known history of aneurysm, or pain characterized as ripping or tearing, with radiation to the back. It may correspond to a syncopal event. Pain from an aortic dissection is generally above the diaphragm, and may manifest itself as chest or back pain. Leaking or disrupted abdominal aortic aneurysms produce pain below the diaphragm.
    - → C05: Acute Aortic Dissection
  - *Acute coronary syndromes* can manifest as pain above the umbilicus, and should be considered in all patients over the age of 35.
    - → C01: Acute Coronary Syndrome
  - A *perforated abdominal viscus* is often associated with a history of peptic ulcer disease or diverticulitis. It is characterized by the rapid onset of abdominal pain accompanied by abdominal rigidity, guarding, and rebound

tenderness. Patients are commonly febrile and nauseated.

- Although uncommon, *ectopic pregnancies* should be considered in any woman of childbearing age with lower abdominal quadrant pain. A syncopal event, associated with abdominal pain in this population, is suggestive of a ruptured ectopic pregnancy.
- *Mesenteric ischemia* should be suspected in patients who have a sudden onset of severe pain, which can be disproportionate to the physical findings. Atrial fibrillation and prior cardiovascular disease are risk factors. The mortality rate can be as high as 70%.
- Constant pain in the epigastrum radiating to the back should prompt a consideration of *pancreatitis*. Risk factors include alcohol abuse and biliary tract disease. Consider the possibility of diabetic ketoacidosis in Type 1 diabetics.
- Abdominal pain associated with dark, tarry stools, frank blood in the stool or emesis is suggestive of a *gastrointestinal hemorrhage*. Significant quantities of blood can be lost through gastrointestinal bleeding: watch for signs of hypotension.
- *Anaphylaxis* can provoke abdominal pain, cramping, nausea, vomiting, and diarrhea,
  - → E09: Anaphylaxis
- Abdominal pain can be associated with *sepsis*.
  - → K02: Sepsis

Interventions

First Responder

- Place patient in position of comfort where possible
- Prevent heat loss
- Provide supplemental oxygen as required
  - → A07: Oxygen and Medication Administration

Emergency Medical Responder – All FR interventions, plus:

- Provide supplemental oxygen to maintain $SpO_2 \geq 94\%$
  - → A07: Oxygen and Medication Administration
- Consider analgesia:
  - → E08: Pain Management
  - Nitrous oxide (self-administered) to effect
  - Nitrous oxide should be used with caution in abdominal pain – the gas has a tendency to diffuse into air-filled spaces. Its use is contraindicated in patients with gross abdominal distension.

Primary Care Paramedic – All FR and EMR interventions, plus:

- Obtain vascular access
  - → D03: Vascular Access
  - Consider volume replacement to correct hypotension. Target systolic blood pressure of 90 mmHg.
- Consider symptom relief for ongoing nausea or active vomiting:
  - → E07: Nausea and Vomiting
    - DimenhyDRINATE

Advanced Care Paramedic – All FR, EMR, and PCP interventions, plus:

- Obtain and interpret 12-lead ECG in patients over 35 and pain above the umbilicus
  - → PR16: 12 Lead ECG
  - → C01: Acute Coronary Syndrome
- Consider symptom relief for ongoing nausea or active vomiting:
  - → E07: Nausea and Vomiting
- Consider analgesia:
  - FentaNYL

Evidence Based Practice

Abdominal Pain

References

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E06: Non-Traumatic Back Pain

Christiana Gregory and Marc Gessaroli

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Reviewed:

Introduction

Approximately 84% of adults will experience back pain at some point in their lives. Episodes of non-traumatic back pain are mostly self-limited, and are most often not indicative of a serious medical condition. Acute non-traumatic back pain, as defined by an episode of pain less than four weeks in length, can generally be managed in the primary care setting. However, a small percentage of patients will have serious, potentially life-threatening causes of back pain; careful history taking and physical examination are required to identify conditions such as cauda equina syndrome, abdominal aortic aneurysmal leak, vertebral infections, and spinal fractures.

Essentials

- Paramedics must rule out life-threatening causes of back pain. Foremost among these is cauda equina syndrome, but conditions that can produce back pain as a symptom must be considered as well, particularly leaking aortic aneurysms and peritoneal bleeding.
- Patients should receive analgesia wherever possible.

Additional Treatment Information

- Acetaminophen is considered safe and effective pain management. Nitrous oxide, methoxyflurane, fentaNYL, and ketAMINE may facilitate transport in cases of severe pain and discomfort.

Referral Information

Patients who are ambulatory, and who, in judgment of paramedics, have non-acute causes of their back pain may be referred to a physiotherapist or general practitioner for further assessment or treatment. Non-ambulatory patients will require transport.

General Information

- The most serious cause of back pain is *cauda equina syndrome*. This is a condition where the nerve roots in the lower spinal cord become compressed. Cauda equina syndrome can develop quickly; it can also come on more slowly. Signs and symptoms of cauda equina include:
  - "Saddle" anesthesia (an altered sensation around the groin and inner thigh, as would be in contact with a saddle while riding a horse).
  - Leg weakness or numbness (can affect either leg or both).
  - Bowel and bladder incontinence (considered a late finding).
- Infections of the vertebrae should be considered if the patient has a history of fever or recent infection, is immunocompromised, or has used intravenous drugs.

Interventions

Primary Care Paramedic – All FR and EMR interventions, plus:

- Provide appropriate analgesia:
  - → E08: Pain Management

Evidence Based Practice

Mechanical Back Pain

References

1. Alberta Health Services. AHS Medical Control Protocols. 2020. [Link]
2. Ambulance Victoria. Clinical Practice Guidelines: Ambulance and MICA Paramedics. 2018. [Link]

E07: Nausea and Vomiting

Marc Gessaroli and Christina Gregory

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Introduction

Nausea is the unpleasant, disabling, and painless urge to vomit. It can exist on its own, or be accompanied by vomiting. The potential causes for nausea and vomiting are extensive; nausea and vomiting are not considered diseases in themselves but rather symptoms of other conditions. In caring for individuals with nausea and/or vomiting, paramedics should work towards two goals: identification of the underlying cause to determine appropriate treatment, and the management of symptoms to improve patient comfort.

Essentials

- An attempt at identifying acute etiologies for nausea and vomiting must be made
- Provide therapies to alleviate symptoms
- Facilitate appropriate transportation
- Consider referral to primary care services when no acute etiologies are suspected

Additional Treatment Information

- Intramuscular (IM) dimenhydrinate is a safe and effective anti-emetic. It should only be used for nausea that is actually present – it should not be considered for prophylaxis.
- Ondansetron is an effective anti-emetic for nausea and vomiting secondary to radiation, chemotherapy, surgery, and gastroenteritis. It provides little relief from motion sickness.
- Dimenhydrinate must be used with caution with head injuries, as it may cause further CNS dysfunction. Ondansetron is preferred in these patients; control of vomiting is important to limit the increase in intracranial pressure.
- Look for the following signs of dehydration: postural perfusion changes including tachycardia, hypotension or dizziness, decreased sweating and urination, poor skin turgor, dry mouth, dry tongue, fatigue and altered consciousness, and evidence of poor fluid intake compared to fluid loss. Dehydrated patients are candidates for volume replacement.

General Information

- A complete physical and neurological assessment should be completed for all patients. Acute etiologies may include but are not limited to:
  - Myocardial infarction
    - → C01: Acute Coronary Syndrome
  - Cerebrovascular accident
    - → F03: Stroke
  - Sepsis
    - → K02: Sepsis
  - Gastrointestinal bleeding
  - Meningitis
  - Ischemic bowel
  - Diabetic ketoacidosis
    - → E01: Hypoglycemia and Hyperglycemia
  - Overdose or drug toxicity (consider adverse drug reactions)
  - Carbon monoxide poisoning
    - → J02: Carbon Monoxide
- Common causes of nausea and vomiting include:

- Vertigo: One of the most common causes of pre-hospital nausea/vomiting, this is the perceived sensation of motion often described as spinning or whirling. Sweating, pallor, nausea, vomiting, and balance disturbances often accompany vertigo. Vertigo is caused by many different factors including:
  - Impaired visual input, inner ear function, or peripheral sensory input
  - Central nervous system impairments: e.g. alcohol, prescription drugs
  - Disease (e.g. Meniere's disease)
- Migraines: these headaches can last from minutes to days and are characterized by intense throbbing pain, photosensitivity, nausea and vomiting, and sweating. Patients may be prescribed metoclopramide as it treats both the pain and nausea associated with suspected migraines.
- Opioid-induced: due to the low incidence of opioid-induced nausea, the lack of efficacy of prophylactic therapy and the possibility of additional side effects, opioids should not be accompanied by an antiemetic agent. Antiemetic therapy is only indicated if the patient develops nausea or vomiting after opioid use.
- Alcohol withdrawal: patients experiencing alcohol withdrawal are at higher risk of developing electrolyte abnormalities, which can affect QT intervals. Dimenhydrinate is the antiemetic of choice in these cases, as it does not cause QT interval elongation.
- Upper gastrointestinal bleeding: blood in the stomach is often a cause of extreme nausea. Metoclopramide can be useful in these cases, as it improve gastric emptying in addition to treating nausea.
- Pregnancy: nausea can be a common issue during pregnancy, especially in the first trimester and in the morning. Dimenhydrinate is considered to be the first-line medication for nausea and vomiting that is safe and effective during pregnancy. Women should be reassured as to dimenhydrinate's safety and low risk of toxicity for the fetus.

Interventions

First Responder

- Keep the patient at rest in a position of comfort
- Transport in the position of comfort consistent with the need to protect the patient's airway
  - → B01: Airway Management

Primary Care Paramedic – All FR and EMR interventions, plus:

- Consider vascular access.
  - → D03: Vascular Access
- Consider dimenhyDRINATE:
  - IM/IV: 25-50 mg; 12.5 mg in frail or elderly patient
- Treat hypotension from volume loss:
  - Normal saline: 500 mL bolus to maximum of 2 L. Reassess after every bolus. Target systolic blood pressure of 90 mmHg.

Evidence Based Practice

Nausea and Vomiting

References

1. Ambulance Victoria. Clinical Practice Guidelines: Ambulance and MICA Paramedics. 2018. [Link]
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E08: Pain Management

Richard Armour and Chris Millar

Updated: December 07, 2020
Reviewed:

Introduction

The relief of pain is one of the most significant and meaningful interventions paramedics perform in the prehospital setting. It is expected that paramedics will provide timely and effective pain management to all patients in their care. Controlling pain can calm patients and assist in assessment and management of other clinical problems. The demeanor and language used by paramedics can dramatically influence the efficacy of any analgesic strategy: even narcotic analgesia will not work if patients do not trust their providers.

Essentials

- Use a step-wise approach to controlling pain, moving from the simplest to more invasive. Never neglecting the basics in favour of more complicated approaches.
- Typical measures should always include reassurance, gentle handling, control of temperature, positioning of the patient or limbs and splinting of injured limbs.
- As interventions are applied, continue to assess and record their effects.
- An inability to report or rate pain should not preclude analgesia. Where discomfort is evident in the setting of possible painful stimuli, consider options for analgesia.

Additional Treatment Information

- When combined with positive reinforcement, nitrous oxide (Entonox) is an effective analgesic. It is the agent of choice in many countries for use in childbirth. The contraindications to the use of nitrous oxide are the result of the pathophysiology of gas exchange and absorption (primarily the trapping of gas and development of hypoxia).
- Nitrous oxide can cause rebound hypoxemia due to the displacement of oxygen from the alveoli as it diffuses out of the blood stream. Supplemental oxygen following the use of nitrous oxide will prevent the development of this hypoxemia, and should be provided to all patients.
- Fentanyl is an opioid analgesic. It is generally less prone to causing hypotension than morphine, though a drop in blood pressure is likely once adequate analgesia is achieved due to a reduction in overall sympathetic stimulation. Fentanyl does not provide a greater degree of analgesia than morphine.
- Ketamine provides excellent analgesia, sedation, and dissociation depending on dose. As an analgesic, ketamine has significant advantages in the prehospital setting: it allows the patient to breathe spontaneously, maintain many of their own protective airway reflexes, and tends to elevate blood pressure through the release of catecholamines. Ketamine has an extensive record of use in austere environments and military medicine, and its effectiveness has been recently demonstrated within BCEHS.

General Information

- Approach each call with a view to assessing a patient’s pain, and exploring ways to help alleviate it.
- Every intervention and medication has important side effects. Some of these may actually worsen a patient’s pain or experience. Use those predicted to help.
- As interventions are applied, continue to assess and document the effects of the interventions by measuring the patient’s pain. In cases where patients are unable to describe their pain effectively (because of language barriers, altered levels of consciousness, age, or dementia), other signs of pain must be monitored. Consider the use of facial expressions, the guarding of limbs, tears or crying, moaning, restlessness, heart rate, and blood pressure – all may provide clues and allow paramedics to manage pain more effectively.
- In special populations, specific pain assessment tools may be useful. Consider the FLACC scale in children, or the Abbey scale in adults with dementia.

Interventions

First Responder

- Keep the patient at rest and in position of comfort
- Splint/support any injured extremity

Emergency Medical Responder – All FR interventions, plus:

- Nitrous Oxide (Entonox):
  - Patient self-administered – inhaled to effect

Primary Care Paramedic – All FR and EMR interventions, plus:

- Acetaminophen (Tylenol)
- Ibuprofen (Advil)
- KetAMINE (restricted to PCPs trained and approved)

Advanced Care Paramedic – All FR, EMR, and PCP interventions, plus:

- FentaNYL
- KetAMINE
- MORPHine is reserved for the management of pain in patients receiving palliative care.
- Nausea associated with the administration of fentaNYL and ketAMINE is rare, and there is no need to administer anti-emetics prior to analgesia. They may be considered if nausea develops after administration:
  - DimenhyDRINATE

Evidence Based Practice

Analgesia

E09: Anaphylaxis

Joe Acker

Updated: December 07, 2020
Reviewed:

Introduction

Allergic reactions range from localized urticaria to life-threatening anaphylaxis. Anaphylaxis is the most severe form of an immediate hypersensitivity reaction, and encompasses both IgE-mediated reactions and anaphylactoid reactions; the latter do not require previous sensitizing exposures. Paramedic management of anaphylaxis includes maintenance of the airway, breathing and circulation with epinephrine the primary therapeutic intervention.

Essentials

- Intramuscular administration of EPINEPHrine is indicated for initial care of a patient with systemic signs of anaphylaxis. The anterolateral mid-thigh is the preferred site due to improved absorption.
- Intravenous EPINEPHrine should be reserved for the patient who is extremely poorly perfused or facing impending cardiac arrest.
- Intravenous EPINEPHrine should only be considered after intramuscular EPINEPHrine.
- A patient's own EPINEPHrine auto-injector is an appropriate treatment for anaphylaxis and EMRs can administer a patient's EPINEPHrine autoinjector when associated with signs and symptoms of anaphylaxis.
- Deaths from anaphylaxis are far more likely to be associated with delay in management rather than an inadvertent administration of EPINEPHrine.

Additional Treatment Information

- DiphenhyDRAMINE is not effective in life-threatening anaphylaxis. It must not be administered instead of EPINEPHrine. Antihistamine use is intended for controlling urticarial to improve patient comfort.
- Some patients, particularly those taking beta-blocking medications, will be unresponsive to EPINPEHrine. In consultation with CliniCall, paramedics may elect to give glucagon 1-2 IU IM or IV. Glucagon administration must not delay additional EPINEPHrine.
- Some patients will present with predominant respiratory symptoms with dyspnea and wheezing. Treating with salbutamol for bronchodilation is acceptable if EPINEPHRine has been ineffective. It should only be used after EPINEPHrine use, and not as a first line treatment.
- Patients who are persistently hypoxic and whose condition does not improve following repeated epinephrine doses may require assisted ventilation and advanced airway management. These procedures may be extremely difficult, due to distortion of the airway, primarily due to angioedema. Slow, low pressure bag-valve mask ventilation, with sufficient time for exhalation (similar to ventilation in asthma) will improve air flow through bronchioles. Ventilation rates and tidal volumes typically used in patients with respiratory failure can cause serious complications in anaphylaxis: gastric distension, vomiting, pneumothorax and worsening hypotension can result from high lung pressures.
- Nebulized EPINEPHrine has been used in cases where there is significant airway edema compromising management in addition to IM EPINEPHrine, but there is little data to support its routine use. Nebulized EPINEPHrine must never delay, or substitute for, IM EPINEPHrine.
- The benefit of corticosteroids in anaphylaxis is unproven. Nonetheless, it is common practice to prescribe a 2-day course of oral steroids (e.g. oral prednisolone 1 mg/kg, maximum 50 mg daily) to hopefully reduce the risk of symptom recurrence after a severe reaction or a reaction with marked or persistent wheeze.
- ***Cardiac arrest considerations:***
  - Cardiac arrest may result from angioedema and upper and lower airway obstruction. Immediate cricothyrotomy may be necessary.
    - → PR22: Surgical Airways
  - Severe anaphylaxis may produce profound vasodilation requiring significant volume replacement.

Referral Information

All patients with suspected anaphylaxis must be advised that they should be transported to hospital regardless of the severity of their presentation or response to management. International guidelines recommend at least 4 hours of observation following treatment.

General Information

- The patient's history can include exposure to an allergen such as food, bites/stings, medications or the allergen may be unknown.
- Exposure to an allergen results in the release of inflammatory mediators from mast cells and basophils, which cause the signs and symptoms of anaphylaxis. While there are a number of mediators, histamine is the most widely recognized.
- Anaphylaxis is a rapid onset, multiple-organ, generalized hypersensitivity (allergic) syndrome. It is usually characterized by exposure to a known or suspected allergen with a sudden onset of symptoms and at least 1 of the following R.A.S.H. signs/symptoms:
  - **R**espiratory distress (dyspnea, wheeze, cough, stridor)
  - **A**bdominal symptoms (nausea, vomiting, diarrhea, abdominal pain/cramps)
  - **S**kin/mucosal symptoms (hives, welts, itch, flushing, angioedema, swollen lips/tongue)
  - **H**ypotension (or hypoperfusion or altered conscious state)
- In rare circumstances, anaphylaxis can occur with symptoms in an isolated body system. If a patient has hypotension following exposure to a known allergen, consider treating as anaphylaxis.
- Allergic reactions may range in severity from mild, with only a rash, to life threatening. The degree of severity depends on the body's response to the allergen. The tendency is for reactions to increase in severity over time as the body becomes increasingly sensitive and primed to the allergen.

Interventions

First Responder

- Position supine to improve blood pressure and do not walk the patient
- Remove allergen (i.e. scrape off any stinger(s) / stop drug administration)
- Provide supplemental oxygen and airway management as required
  - → A07: Oxygen and Drug Administration
  - → B01: Airway Management

Primary Care Paramedic – All FR and EMR interventions, plus:

- Prevent progression to life-threatening manifestations:
  - EPINEPHrine
- Treat bronchospasm after EPINEPHrine has been administered:
  - Salbutamol
  - Ipratropium bromide
- Consider vascular access and fluid administration if patients remain hypotensive or hypoperfused:
  - → D03: Vascular Access

Advanced Care Paramedic – All FR, EMR, and PCP interventions, plus:

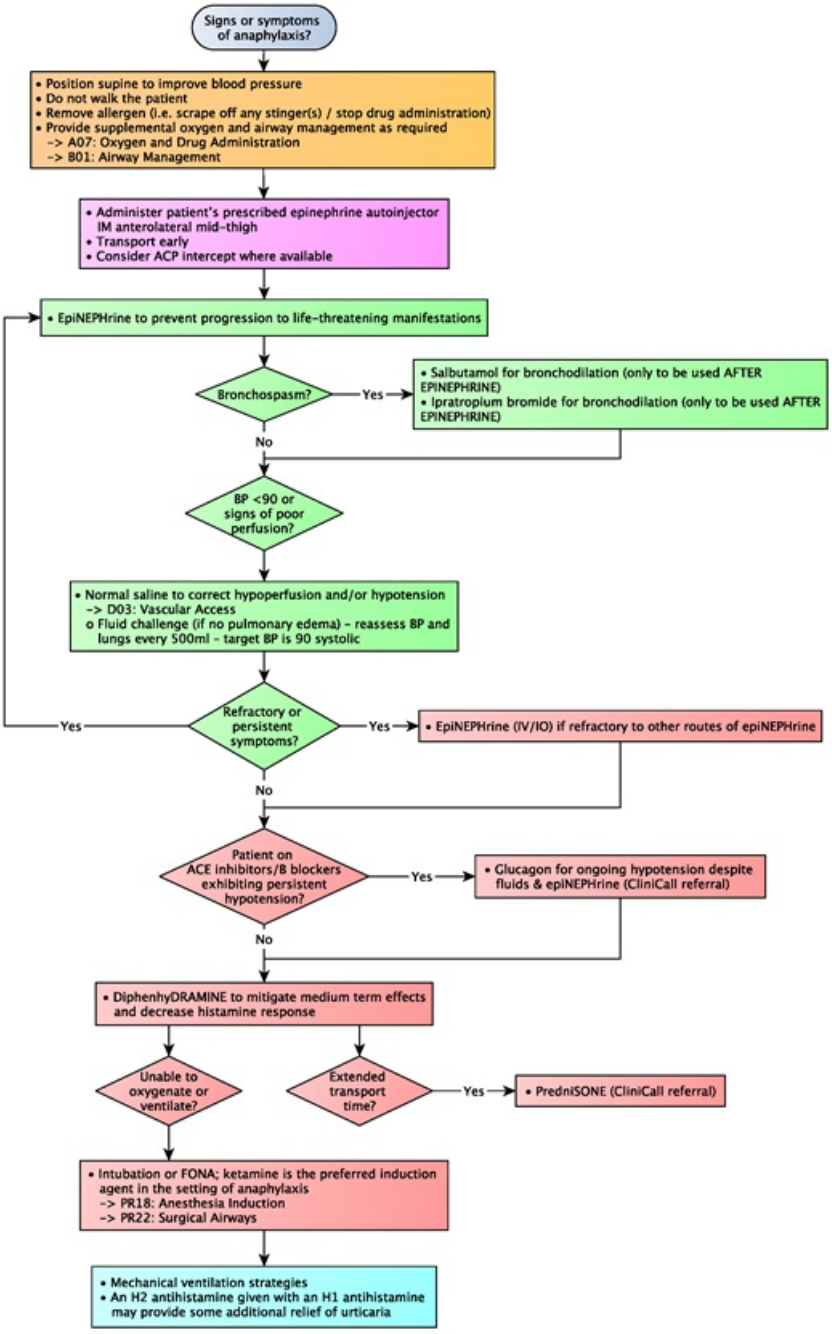
- EPINEPHrine IV/IO if refractory to other routes of EPINEPHrine
- Consider glucagon for persistent hypotension despite fluids and EPINEPHrine in patients taking ACE inhibitors or beta blockers (requires CliniCall consultation (1-833-829-4099)).
- Consider diphenhyDRAMINE to mitigate medium-term effects and limit histamine response
- Consider predniSONE for extended transport time (requires CliniCall consultation (1-833-829-4099))
- Intubation or FONA if unable to oxygenate and ventilate. KetAMINE is the preferred induction agent in anaphylaxis.
  - → PR18: Anesthesia Induction

- → PR22: Surgical Airways

Critical Care Paramedic – All FR, EMR, PCP, and ACP interventions, plus:

- Mechanical ventilation strategies
- An H2 antihistamine given with an H1 antihistamine may provide some additional relief of urticaria

Algorithm



Evidence Based Practice

Anaphylaxis

References

1. Alberta Health Services. AHS Medical Control Protocols. 2020. [Link]
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E10: Minor Allergy

Laurence Darlington and Kristen Steary

Updated: December 07, 2020
Reviewed:

Introduction

Allergic reactions are a hypersensitivity response by the immune system to an allergen, and can range from localized urticaria to life-threatening anaphylaxis. Minor allergic reactions are typically localized to the integumentary system, and are not systemic reactions (as observed in anaphylaxis). Minor allergies present with urticaria and pruritus, and can be managed by antihistamine administration in the pre-hospital environment for patient comfort. Refer to the E09: Anaphylaxis for patients with suspected allergic reaction presenting with concurrent respiratory, cardiovascular, or gastrointestinal complaints.

Essentials

- Minor allergic reactions involve the integumentary system with the presence of urticaria and occasionally mild localized edema. Minor reactions do not involve any other system (e.g. cardiovascular, respiratory, or gastrointestinal systems).
- Urticaria consists of transient wheals on the skin (raised areas of various sizes, with or without erythema) with pruritus and/or burning sensations. If a patient presents with dermatologic symptoms plus any of hypotension/hypoperfusion, angioedema, respiratory distress, and/or gastrointestinal upset, more aggressive intervention is required.
  - → E09: Anaphylaxis
- Minor allergic reactions are typically managed by removal of the allergen (e.g. removing a stinger, or washing a topical lotion from the skin using soap and water) and antihistamine administration (e.g. diphenhydrAMINE).
- EpiNEPHrine should not be administered in a minor allergic reaction that involves only the integumentary system.

Additional Treatment Information

- Oral antihistamines are typically sufficient for management of minor allergic reactions. If PO medications cannot be tolerated, diphenhydrAMINE may be administered IM or IV.
- Minor allergies have the potential to exacerbate chronic respiratory illnesses (e.g. asthma or COPD). Patients with a history of respiratory illness should be assessed for worsening of their condition and treated accordingly.
- Patients may have an existing treatment regime utilizing over-the-counter and/or prescribed antihistamines. Additional antihistamines should not be administered if the patient has taken antihistamines prior to paramedic arrival due to the possibility of potentiation.

Referral Information

- While most cases of isolated urticaria are self-limiting and will resolve without treatment, patients with minor allergic reactions have potential to progress to life-threatening anaphylaxis.
- Anaphylaxis onset may be delayed several hours after exposure to an allergen. Therefore, until referral pathways to alternate sub-acute pathways are developed, all patients with minor allergy symptoms should be transported to the emergency department for evaluation.

General Information

- A minor allergic reaction is caused by an exaggerated immune response to an allergen that results in the degranulation of mast cells and basophils. Release of inflammatory mediators (primarily histamine) from cells in the dermal layer of cutaneous tissue may result in urticaria, erythema, and discomfort.
- Many minor allergic reactions are mediated by immunoglobulin E (IgE) in response to environmental allergens (e.g. insect stings, pollen), but acute urticaria may result from release of inflammatory mediators due to infection or spontaneous activation that is not IgE-mediated in approximately 50% of cases. Regardless of the underlying cause, treatment with antihistamines remains effective.

- Four types of histamine receptors (H1, H2, H3, and H4) are present in the body, with H1 and H2 receptors being most relevant to minor allergic reactions. First-generation H1 antagonists (e.g. diphenhydrAMINE) cross the blood-brain barrier more readily and therefore are more likely to have sedative effects. Second-generation H1 antagonists (e.g. loratadine) are equally efficacious to first-generation H1 antagonists. Second-generation H1 antagonists are lipophobic and therefore less able to cross the blood-brain barrier, leading to lesser risk of sedative effects. Caution: first-generation H1 antagonists may cause a decreased level of consciousness with a potential to limit recognition of a progression to anaphylaxis.
- H2 antagonists (e.g. ranitidine) will not independently resolve urticaria, but may potentiate the effect of H1 antagonists and should be considered for urticaria causing severe distress.
- H1 antagonists (e.g. diphenhydrAMINE) are not effective in resolving angioedema, cardiovascular, gastrointestinal, or respiratory symptoms in anaphylaxis, and therefore are considered a second-line therapy at best. ***First-line therapy in anaphylaxis remains the administration of epiNEPHrine.***

Interventions

First Responder

- Monitor patient for signs of deterioration into anaphylaxis
  - → E09: Anaphylaxis
- Remove allergen if practical (e.g. scrape off any stinger(s) / wash off topical allergens with soap and water)

Emergency Medical Responder – All FR interventions, plus:

- The patient's personal oral antihistamines may be taken according to manufacturer instructions
- The patient's prescribed inhalers may be taken as directed for known respiratory allergens, if required

Advanced Care Paramedic – All FR, EMR, and PCP interventions, plus:

- Consider DiphenhyDRAMINE to relieve integumentary symptoms and decrease histamine response

Critical Care Paramedic – All FR, EMR, PCP, and ACP interventions, plus:

- Consider H2 antihistamine for additional relief of urticaria

Evidence Based Practice

Minor Allergic Reaction

References

1. Alberta Health Services. AHS Medical Control Protocols. 2020. [Link]
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