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Patient Care Guidelines:

PULMONARY AGENTS

1. CLINICAL FINDINGS

a. Respiratory:

- Chlorine gas – being water soluble, is primarily absorbed by the upper airway. Exposure to low concentrations (1-10ppm) may cause eye and nasal irritation, sore throat and cough. Inhalation of higher concentrations (>15 ppm) can very rapidly lead to respiratory distress. This can occur almost immediately with initial symptoms of stridor, followed shortly by wheezing, rales, hemoptysis, and subsequent pulmonary edema.
- Phosgene – being only slightly soluble in water it is primarily absorbed by the lower airway. Inhaling low concentrations may cause no signs or symptoms initially or symptoms that are secondary to mild irritation of the airway. After an asymptomatic period for 30 minutes to 48 hours, in those developing severe pulmonary damage a progressive pulmonary edema ensues which can produce up to 1 liter of fluid per hour.

b. Cardiovascular:

- Chlorine – Initial tachycardia and hypertension followed by hypotension may occur.
- Phosgene – circulatory collapse secondary to severe pulmonary edema. Destruction of RBCs in the pulmonary circulation can result in right sided heart failure.

c. Acidosis – may result from hypoxia. Following a massive chlorine inhalation an excessive amount of chloride ions can end up in the blood. Because of their higher metabolic rate children are more vulnerable to toxicants interfering with their metabolism.

d. Dermal – Chlorine and Phosgene cause skin irritation and with sufficient concentration can cause, burning pain, inflammation, and blisters. Liquefied chlorine and phosgene can cause frost-bite injury.

e. Ocular:

- Chlorine – Low vapor concentrations can cause burning, redness, conjunctivitis, and tearing. Higher concentrations may result in corneal burns.
- Phosgene – High vapor concentration can cause tearing and blood in the eye. Contact with liquid phosgene may result in clouding of the cornea and delayed perforation.

f. Hematological – In severe cases of phosgene exposure hemolysis can occur with resultant plugging of pulmonary capillaries.

g. Hepatic – Phosgene may be directly cytotoxic to the liver.

h. Renal – Phosgene may also cause cytotoxicity to the kidneys with resultant loss of function.

i. Gastrointestinal – Nausea and vomiting may occur following exposure to phosgene.

Potential Sequelae:

- Chlorine – After an acute exposure pulmonary function usually returns to baseline in 7 – 14 days. Although a complete recovery usually occurs prolonged pulmonary impairment may persist. Chlorine exposure can result in a chemical irritant – induced type of asthma (reactive airways dysfunction syndrome –RADS).
- Phosgene – If the patient survives 48 hours recovery is likely. Persistent airway hyperactivity, pulmonary tissue destruction and scarring may lead to dilatation of the bronchi, lobar emphysema, atelectasis. As with chlorine exposure RADS has been reported.

2. DIFFERENTIAL DIAGNOSIS

- Phosgene is distinguished by its smell in high concentrations and delayed onset of pulmonary edema.
- Chlorine has a characteristic even in low concentrations, immediate onset of respiratory distress, bronchospasm, eye, skin, and upper airway irritation.

- Riot agents cause an acute onset of burning sensation in the eyes and upper airway without progression of symptoms.
- Nerve agents induce watery secretions as well as respiratory distress but have a host of other symptoms that can distinguish them from pulmonary agents.
- The respiratory toxicity of vesicants (i.e. Mustard Gas) is usually delayed but affects the central rather than the peripheral airway. Vesicant toxicity severe enough to cause dyspnea typically causes airway necrosis often with upper airway obstruction.

3. MEDICAL MANAGEMENT

a. Triage:

- ABCs – Evaluate and support airway, breathing and circulation.
- Phosgene has a delayed onset of action as opposed to chlorine. Serious pulmonary effects may be delayed up to 48 hours.
- Those patients exposed only to chlorine or phosgene vapor do not need decontamination.

b. Decontamination:

- Healthcare providers are at low risk of secondary contamination from chlorine or phosgene gas.
- Victims covered with liquid phosgene should be decontaminated (ambient temperature is below 47 degrees F). Healthcare personnel can be contaminated through direct contact or off-gassing.
- Remove and double bag contaminated clothing and personal belongings.
- Flush exposed skin and hair with plain water for 2-3 minutes, then wash with mild soap, followed by rinsing (children are more vulnerable to hypothermia).
- Irrigate exposed eyes for at least 15 minutes and remove contacts (if this can be done in a non-traumatic manner)

c. Healthcare Provider Protection:

- If decontamination is necessary SCBA is recommended as well as chemical protective clothing. NIOSH recommends suits made from Responder, Tychem 1000, or Teflin. Use butyl rubber gloves.
- Be aware that the protective equipment may cause fear in children.

d. Supportive Care:

- There are no antidotes for pulmonary agents.
- Stridor – Consider racemic epinephrine aerosol. Dosing - 0.25-0.75 ml of 2.2% racemic epinephrine solution in 2.5cc of water. This may be repeated every 20 minutes as needed with caution for myocardial variability.
- Bronchospasm - Utilize aerosolized bronchodilators. While chlorine does not cause an increased risk of cardiac arrhythmias when combined with certain bronchodilators be careful following other chemical inhalations.
- Phosgene – Steroids are suggested for intense inflammation or preemptively if the patient experienced a severe exposure. The following other drugs have been recommended for significant pulmonary disease: ibuprofen, aminophylline, terbutaline, and N acetylcystine.
- Diuretics are contraindicated. The pulmonary edema from lung agents is not hypervolemic. These patients tend to hypovolemic and hypotensive. Fluid resuscitation and dopamine... may be necessary as well as CPA.
- Prophylactic antibiotics are not routinely utilized but pneumonia can complicate pulmonary edema.
- Cardiac arrhythmias – Treat in the conventional manner.
- Frostbite – Always handle frostbitten skin and eyes with caution. Place frostbitten skin in warm water (108 degrees). Do not allow the skin to touch the sides of the container. If hot water is not available wrap the affected area gently in warm blankets. Encourage exercise of the affected part while it is being warmed.

- Chemical Burns – Treat as thermal burns. Note that because of their larger surface area:body weight ratio children are more vulnerable to toxicants absorbed through the skin.
- Eye exposure – Chlorine and phosgene exposed eyes should be irrigated for at least 15 minutes. Visual acuity should be tested and the eyes should be examined for potential corneal damage.

e. Lab Testing:

The diagnosis of phosgene or chlorine toxicity is primarily clinical with the support of specific chemical identification equipment.

- Routine labs on all pulmonary agent exposed patients routinely include CBC, glucose, and electrolyte determination.
- Those with significant pulmonary exposure may require pulse oximetry and ABGs as well as a chest x-ray.
- With phosgene evidence of pulmonary edema – hilar enlargement and ill defined central patch infiltrates on chest x-ray is a late finding that may occur 6-8 hours post exposure.
- Massive inhalation of chlorine may also be complicated by hyperchloremic acidosis

4. PATIENT DISPOSITION

- Chlorine – Patients who are symptomatic with complaints of shortness of breath, severe cough, and/or chest tightness should be hospitalized until symptom free. Pulmonary injury may be progressive over several hours.
- Phosgene – After known inhalation and normal repeated exams patients may be DC'd after 48 hours
- Chlorine – Patients who are asymptomatic or have only minor symptoms of burning sensations of the eye, nose, and throat may be released with appropriate follow-up. If new symptoms develop or the old reoccur prompt medical follow-up is necessary.
- Those with corneal injury should be rechecked in 24 hours.

- Follow-up is recommended for all hospitalized patients because of the potential of long term respiratory problems. Chlorine induced reactive airways dysfunction syndrome (RADS) can persist up to 12 years.

5. REFERENCES

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2. U. S. Army Medical Research Institute of Chemical Defense, Medical Management of Chemical Casualties, Third Edition, July 2000
3. Medical Management Guidelines (MMG) for Chlorine from the Agency for Toxic Substances and Disease, revised May 24th, 2004
4. Medical Management Guidelines (MMG) for Phosgene from the Agency for Toxic Substances and Diseases, revised May 24th, 2204
5. Managing Hazardous Materials Incidents, Hospital Emergency Department, Agency for Toxic Substances and Disease Registry, revised 2000
6. 2000 Emergency Response Guidebook, Transport Canada, U.S. Department of Transportation, Secretariat of Transport and Communications of Mexica

6. CONTACT INFORMATION

- Agency for Toxic Substances and Disease Registry - Division of Toxicology 1-888-442-873
- District of Columbia Poison Control Center 202-625-3333
- Centers for Disease Control – emergency response resources website – www.cdc.gov

Patient Care Guidelines:

NERVE AGENTS

1. CLINICAL FINDINGS

Nerve agent's primary means of inducing toxicity is through inhalation and skin/eye contact. Occasionally ingestion can occur (toddler hand to mouth behavior).

The onset of action with inhaled vapor can be almost instantaneous causing local and systemic effects. Liquid which is readily absorbed thru the skin can cause system effects in minutes and up to 18 hours later.

- **Respiratory:** Inhalation of nerve agent vapors causes respiratory tract effects within seconds to minutes. Symptoms include increased, rhinorrhea, and bronchial secretions, chest tightness secondary to bronchial muscle contraction.
- **CNS:** High dose – seizures, loss of consciousness, apnea. Other pathology includes irritability, memory loss, fatigue, memory loss, behavioral and psychological changes.
- **Cardiovascular:** Potentially up to three phases in variable length – transient tachycardia/with or without hypertension (minutes) followed by bradycardia and hypotension. The final phase starts hours to days after exposure with QT prolongation and a tendency toward malignant dysrhythmias. In one Organophosphate toxicity study 42% had cardiac arrhythmias with torsades de pointe occurring in 37% of the cases.
- **Gastrointestinal:** Abdominal pain, N&V, diarrhea are common manifestations of any exposure. It may be the first systemic effects of skin exposure. If GI symptoms occur within one hour of dermal contamination severe intoxication is present.
- **Skeletal Muscles;** Nerve agents stimulate skeletal muscles producing twitching and fasciculations. This leads to fatigue and flaccid paralysis.

- **Metabolic:** Sweating
- **Ocular:** Symptoms may occur from local effects secondary to vapor exposure or as a manifestation of systemic absorption. Pinpoint pupils, eye pain, conjunctivitis, and increased tearing are common.

Pediatric Specific Clinical Issues:

- Children may only exhibit CNS effects
 - A child's smaller mass alone reduces the dose of nerve agent required for toxic/lethal effects. Animal studies have shown that the lethal dose of nerve agent in a immature vs. adult animal is 10%.
 - With higher respiratory rates and minute volumes than adults a child will inhale a greater dose of nerve agent.
 - The smaller airway diameter, anatomic subglottic narrowing, omega shaped epiglottic structure, relatively large tongue size, less rigid ribs and trachea make them more vulnerable to nerve agent induces pathology i.e. bronchospasm, copious secretions.
- Nerve Agents may penetrate the blood brain barrier more easily in children than adults. Those children under four years of age with status epilepticus have the highest risk of death.

2. DIFFERENTIAL DIAGNOSIS

- The diagnosis in a severely intoxicated individual is straight forward. The combination of miosis, copious secretions, bronchospasm, generalized muscle fasciculations, and seizures is characteristic.
- A mild vapor exposure may mimic a child having allergic rhinitis/conjunctivitis in combination with an asthmatic episode
- GI symptoms by themselves could be confusing and they could be the only presenting signs.
- Look carefully for miosis (if present will be helpful)
- Opioid abuse can include miosis, apnea, seizures etc.

3. MEDICAL MANAGEMENT

Medical Management for nerve agent includes ventilation, administration of antidotes, decontamination, and supportive therapy (the order is clinically dependent)

a. Triage:

- Attend to infants and children in the immediate and moderate categories first ABCs: Evaluate and support the airway, breathing, and circulation. If the patient is apneic give antidotes immediately. Antidote administration may allow easier ventilation. Tracheal intubation may be required in the hot zone. Large amount of secretions may be encountered. Mouth to mouth is dangerous to the health care provider in nerve agent inhalation (off gassing). In severe nerve agent exposure mechanical ventilation has been required for up to three hours.

Initiate antidotes (atropine and 2-PAM CI) as soon as possible (including in hot zone). 2-PAM CI must be given within minutes to a few hours to be effective.

- Patients with possible exposure to vapor only and appear well by the time they reach the ED may be discharged
- Patients exposed to liquid even if they are doing well need to be observed for at least 18 hours
- Patients exposed to vapor who have miosis and rhinorrhea will require no care unless they have eye or head pain or nausea and vomiting .
- Severity of miosis can not be used as a indicator of amount of exposure. Check vision

b. Decontamination:

- The eyes should be decontaminated within minutes of liquid nerve agent exposure. Flush with water for 5-10 minutes. There is no need to flush eyes following vapor exposure. Do not cover eyes with bandages
- If exposed to liquid, cut and remover all clothing and wash skin/hair immediately with soap and water. If water supplies are limited use 0.5% hypochlorite or absorbent powders such as flour, talcum powder, or Fullers earth. If exposure is to vapor only, remove outer clothing, and wash exposed ski with soap and water or 0.5% hypochlorite.

Category (Priority)	Effects	Clinical Signs
Immediate (1)	Unconscious, talking but not walking, or moderate to severe effects in two or more systems (e.g. CNS, GI)	Seizing or postictal, severe respiratory distress, recent cardiac arrest
Delayed (2)	Recovering from agent exposure or antidote	Diminished secretions improving respirations
Minimal (3)	Walking and talking	Miosis, rhinorrhea, mild to moderate dyspnea
Expectant (4)	Unconscious	Cardiac/respiratory arrest of long duration

- Ingestion - Do not induce emesis (aspiration may cause arrest, seizure etc).
- Remove and double bag contaminated clothing and personal items (separate personal items from clothing).

c. Health Care Provider Protection:

- Nerve agent vapor is readily absorbed by inhalation and ocular contact. Liquid is readily absorbed thru the skin and will gradually change to vapor.
- Self – Contained Breathing Apparatus is recommended in response situations that involve exposure to a vapor or liquid nerve agent (that potentially will off gas vapor).
- Skin protection; Chemical protective suits and butyl rubber gloves are required to prevent the absorption of liquid nerve agent through the skin

d. Antidote Dosing:

Mild effects:

- Miosis alone – No antidotes. However, if eye/head pain or N&V (in the absence of other systemic signs suggesting a liquid exposure) are severe use atropine ophthalmic drops
- Miosis and severe rhinorrhea – Atropine only

Infant (0-2 yrs)	0.05mg/kg IM
Child (2-10 yrs)	1 mg IM
Adolescent/Adult	2 mg IM

Mild/Moderate effects – Initial Dosing

These include localized swelling, muscle fasciculations, nausea and vomiting, weakness, shortness of breath.

	Atropine	2-PAM CI
Infant (0-2 yrs)	0.05mg/kg IM 0.02 mg/kg IV	15 mg/kg IM or IV over 20-30 minutes
Child (2-10 yrs)	1 mg IM	15 mg/kg IM or IV over 20-30 minutes
Adolescent (>10 yrs)	2 mg IM	15 mg/kg IM or IV over 20-30 minutes
Adult	2 to 4mg IM	600 mg IM or 15mg/kg (1gm) IV over 20-30minute

- Repeat atropine every 5-10 minutes (similar dosing) until dyspnea, resistance to ventilation, and secretions are minimized. Treat vomiting and diarrhea from a liquid exposure in a similar way.

Severe Effects – Initial Dosing

These include unconsciousness, convulsions, apnea, and flaccid paralysis

	Atropine	2-PAM CI
Infant (0-2 yrs)	0.1 mg/kg IM or 0.02 mg/kg IV	15 mg/kg IV over 20-30 minutes, or 25 mg/kg IM
Child (2-10 yrs)	2 mg IM	15 mg/kg IV over 20-30 minutes, or 25 mg/kg IM
Adolescent (>10 yrs)	4 mg IM	15 mg/kg IV over 20-30 minutes, or 25mg/kg IM
Adult	6 mg IM	1800 mg IM or 15 mg/kg (1 gram) over 20-30 minutes

- Repeat atropine 2mg IM or 1 mg IM (infants) at 5-10 minute intervals until secretions have diminished, breathing is comfortable, and airway resistance has returned to normal.
- 2 PAM CI should be repeated hourly for a total of three doses (use IV infusions at above doses for at least the second and third doses)
- Atropine should not be given IV in a hypoxic patient. IV Atropine has regularly produced ventricular fibrillation in test animals in these clinical situations. (give at least the initial dose IM)
- Diazepam, lorazepam or midazolam should be given to all patients having seizure activity, unconsciousness, diffuse muscle twitching, and if > 1 organ is involved. The military gives diazepam as part of initial therapy for any seriously ill NA exposed patients. Utilized early, atropine may function as a anticonvulsant. The benzodiazepines are the most effective seizure medication for nerve agent toxicity. Israel will be utilizing midazolam as their nation's first line NA anticonvulsant.

- Ingestion – do not induce emesis – aspiration may result in respiratory arrest, seizures etc. If the patient is evaluated within thirty minutes of ingestion, consider gastric lavage. The gastric contents should be considered contaminated and quickly isolated.

e. Lab Testing:

- Routine laboratory studies recommended for all admitted patients include: CBC, glucose, electrolytes. Chest X-Ray, pulse ox, ABG prn for more severe exposures.
- Red Blood Cell AChE levels can be done to confirm exposure. Severe symptoms of exposure are usually present when more than 70% of the RBC cholinesterase is inhibited. There is, however, a wide variation in levels based on age, ethnicity and reproductive status.

f. Supportive Care:

- Respiratory - bronchospasm - clinically appears like status asthmaticus, pulmonary edema – utilize oxygen, bronchodilators (watch for increased vulnerability to arrhythmias) ventilator etc.
- Cardiac – monitor for arrhythmias
- Fluids, electrolytes, nutrition – children have lower reserves of fluid and are more vulnerable to GI losses, correct acidosis, nursing mothers should pump and discard breast milk until cleared medically.
- Eye care – treat eye pain, miosis (atropine will not reverse miosis)
- Treat complicating injuries/infections
- Follow – up chronic neuropsychiatric sequelae

4. REFERENCES

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7. Managing Hazardous Material Incidents, Hospital Emergency Department, Agency for Toxic Substances and Disease Registry, revised 2000

5. CONTACT INFORMATION

Agency for Toxic Substances and Disease Registry
 Division of Toxicology 1-888-422-8737
 District of Columbia Poison Control Center
 202 – 625-3333 CDC – web site

Patient Care Guidelines:

BLISTER AGENTS

1. CLINICAL FINDINGS

The primary means of inducing toxicity for blister agents is through inhalation and skin/eye contact. Rarely, ingestion may occur.

The onset of action with inhaled vapor is slow and intensifies over several days. Both local and systemic effects may develop. Liquid agent may be absorbed through the eyes, skin and mucous membranes. Clinical effects often do not occur until hours after exposure.

- Eye: Effects of exposure to blister agents may not appear for an hour or more. Exposure may cause intense eye pain, swelling, lacrimation, and photophobia. High concentrations may cause corneal edema, perforation, blindness and later scarring.
- Skin: Direct skin exposure to liquid often causes no immediate pain but erythema and blistering may develop. Pruritic rashes occur within 4 to 8

hours followed by blistering 2 to 18 hours later. Moist skin (axilla, groin) is most susceptible to blistering. Exposure to vapor is usually less severe. Vapor contact may result in first and second degree burns while liquid exposure causes second and third degree burns.

- **Respiratory:** Burning nasal pain, epistaxis, sinus pain, laryngitis, loss of taste and smell, cough, wheezing, and dyspnea may occur. Necrosis of respiratory epithelium may cause pseudomembrane formation and airway obstruction. Dose-dependent inflammatory reactions in the upper and lower airway begin to develop several hours after exposure and progress over several days.
- **Gastrointestinal:** Ingestion may cause chemical burns of the GI tract. Nausea and vomiting may occur after ingestion or inhalation.
- **CNS:** High doses may cause hyperexcitability, convulsions and insomnia.
- **Hematopoietic:** Systemic absorption may induce bone marrow suppression and an increased risk for fatal complicating infection, hemorrhage and anemia.

Pediatric Specific Clinical Issues:

- Children exposed to nitrogen mustards are likely to experience the same effects seen in exposed adults.
- Children may differ from adults in their susceptibility to nitrogen mustards.
- Exposure may be greater due to the higher number of respirations per minute in children.
- The high vapor density of gases places their highest concentration close to the ground which is in the lower breathing zone of children.
- The more permeable skin of newborns and children in conjunction with a larger surface-to-mass ratio may also result in increased exposure.

- Vesicants and corrosives produce greater injury to children because of poor keratinization of their skin
- Children, because of their relatively larger body surface area, lose heat quickly when showered. Consequently, decontamination may result in hypothermia unless heating lamps and other warming equipment are used.
- Having less fluid reserve increases the child's risk of rapid dehydration or shock after vomiting and diarrhea.
- Infants, toddlers, and young children do not have the motor skills to escape from the site of an incident.
- All children are at risk of psychological injury such as posttraumatic stress disorder from experiencing or living under the threat of terrorism

2. DIFFERENTIAL DIAGNOSIS

- The delay between exposure and the development of symptoms may present a diagnostic challenge, particularly if the exposure was undetected and the symptoms are mild.
- A mild exposure affecting the eyes may appear similar to allergic or infectious conjunctivitis or mild eye trauma such as a corneal abrasion.
- A respiratory vapor exposure may initially mimic a child having allergic rhinitis or an asthmatic episode.
- Skin exposures may present as burns, which may be attributed to other etiologies, including a scald, or an infectious rash such as staphylococcal scalded skin syndrome.
- GI symptoms may be limited to nausea and vomiting which may be consistent with a mild gastroenteritis.

Category (Priority)	Time of Onset	Clinical signs
Immediate (1)	< 4 up to 12 hours post exposure	Lower respiratory signs (dyspnea)
Delayed (2)	> 4 hours (eye and skin); or > 12 hours (respiratory) post exposure	Eye lesions with impaired vision; skin lesion covering 2 to 50% of body surface area for liquid exposure or any body surface burn for vapor exposure; lower respiratory symptoms (cough with sputum production, dyspnea)
Minimal (3)	> 4 hours post exposure	Minor eye lesion with no vision impairment; skin lesion < 2% of body surface area in noncritical areas; minor upper respiratory symptoms (cough, sore throat)
Expectant (4)	< 4 hours post exposure	Lower respiratory signs (dyspnea); skin lesion covering 50% or more of body surface area from liquid exposure

3. MEDICAL MANAGEMENT

Medical Management for blister agent exposure includes decontamination and supportive therapy (the order is clinically dependent).

There is no antidote for sulfur mustard toxicity. Decontamination within 1 to 2 minutes of exposure is the only effective means of decreasing tissue damage.

a. Triage:

- Attend to infants and children in the immediate delayed categories first.
- ABCs: Evaluate and support the airway, breathing, and circulation.
- Prepare to decontaminate if it has not been done prior to arrival. By the time a patient arrives in the emergency department, decontamination can only prevent secondary exposure to the medical staff; it does not limit the patient's injury. Victims whose skin or clothing is contaminated with sulfur mustard can contaminate rescuers by direct contact or through off-gassing vapors.
- Remember, patients arriving directly from the scene of potential exposure (within 30 to 60 minutes) will rarely have symptoms.

- The sooner after exposure that symptoms occur, the more likely they are to progress and become severe.

b. Decontamination:

- The eyes should be decontaminated within minutes of liquid blister agent exposure. Flush with water for 5-10 minutes. There is no need to flush eyes following vapor exposure. Do not cover eyes with bandages
- If exposed to liquid, cut and remove all clothing and wash skin/hair immediately with soap and water. If water supplies are limited use 0.5% hypochlorite or absorbent powders such as flour, talcum powder, or Fullers earth. If exposure is to vapor only, remove outer clothing, and wash exposed skin with soap and water or 0.5% hypochlorite.
- Ingestion - Do not induce emesis.
- Remove and double bag contaminated clothing and personal items (separate personal items from clothing).

c. Health Care Provider Protection:

- By the time a patient arrives in the emergency department, decontamination can only prevent

secondary exposure to the medical staff; it does not limit the patient's injury. Victims whose skin or clothing is contaminated with sulfur mustard can contaminate rescuers by direct contact or through off-gassing vapors.

- If victims have been decontaminated properly, personnel do not require specialized protective gear.
- Pressure-demand, self-contained breathing apparatus (SCBA), personal protection equipment (PPE) including chemical protective suits, and butyl rubber chemical-protective gloves are recommended if exposure to the agent is involved.

d. Supportive Care and Management:

• Eye exposure

Early symptoms: Conjunctivitis occurring within 12 hours of exposure or more significant findings such as lid swelling/inflammation indicate a need for inpatient care and observation.

Later symptoms: Mild conjunctivitis beginning more than 12 hours after exposure is unlikely to progress to a severe lesion. A thorough eye examination, including assessment of visual acuity, should be done. The patient should be treated with a soothing eye solution, such as Visine or Murine, sent home, and instructed to return if the symptoms worsen.

• Skin exposure

Early or significant symptoms: Erythema beginning less than 12 hours after exposure, with or without blistering, should be admitted for further evaluation. A patient with significant erythema or blistering should be treated in the same manner.

Later symptoms: A small area of erythema beginning later than 12 hours after exposure is unlikely to progress to a significant lesion. The patient should be examined, treated with a soothing lotion, sent home and instructed to return if progression occurs.

• Airway exposure

Significant symptoms: Patients with severe effects (laryngitis, shortness of breath, productive cough) seen any time postexposure should be admitted directly to critical care unit after decontamination. Those with less severe effects should be admitted to a routine care ward.

Later or mild symptoms: Patients with a mild cough, irritation of the nose and sinuses, and/or sore throat beginning later than 12 hours after exposure should be told to use a cool steam vaporizer, cough drops, and lozenges, sent home and instructed to return if symptoms worsen.

• Ingestion exposure

Do not induce emesis.

If large dose has been ingestion and the patient is being evaluated within 30 minutes of the event, cautious orogastric lavage may remove ingested material. (The risk of potential bleeding and perforation must be considered.)

If the ingestion is small and the patient is alert and able to swallow, give 4 to 8 ounces of milk or water to drink.

There is no evidence that activated charcoal is beneficial.

e. Lab Testing:

- Routine lab studies should be obtained on all patients requiring admission: CBC, glucose and serum electrolytes.
- Chest xray and pulse oximetry (or ABG measurements) are recommended for inhalation exposures.
- A test for urine thiodiglycol, a metabolite of mustard, can be performed at specialized laboratories, but is not a routine laboratory measure.

f. Other Aspects of Supportive Care:

- Bronchodilator therapy may be useful in treatment of respiratory distress
- Provide fluid and nutritional support and resuscitation

- Ensure adequate pain control
- Treat complicating injuries/infections
- Provide psychosocial support
- Promote family reunification

4. REFERENCES

1. Committee on Environmental Health and Committee on Infectious Diseases. Chemical-Biological Terrorism and Its Impact on Children: A Subject Review. *Pediatr* 2000; 105: 662-670.
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7. Medical Management Guidelines (MMG) Nerve Agents, from the Agency for Toxic Substances and Disease Registry, revised May 24, 2004

5. CONTACT INFORMATION

Agency for Toxic Substances and Disease Registry
Division of Toxicology
1-888-422-8737

District of Columbia Poison Control Center
202-625-3333
1-800-222-1222 (universal number)

Centers for Disease Control Emergency response resources website
<http://www.cdc.gov>

American Academy of Pediatrics terrorism website
<http://www.aap.org/terrorism>

Patient Care Guidelines:

CYANIDE AGENTS

1. CLINICAL FINDINGS

Cyanide agent's primary means of inducing toxicity is through inhalation and skin/eye contact. Occasionally ingestion can occur (toddler hand to mouth behavior). The clinical signs of poisoning following significant vapor inhalation begin in seconds to minutes after exposure. Liquid agent, which is readily absorbed through the skin, can produce symptoms immediately or be delayed up to 1 hour.

- CNS – Initial signs and symptoms especially with lower dose exposures are nonspecific and include excitement, dizziness, nausea and vomiting, headache and weakness. Progression of symptoms (pending exposure levels) can include increased lethargy, tetany, convulsions, and loss of consciousness.
- Cardiovascular – Arrhythmias can occur in cases of severe poisoning. Bradycardia, hypotension followed by death can occur. Transient hypertension and tachycardia may be early findings.
- Respiratory – Initial patient findings may include shortness of breath, chest tightness, and increased respiratory rate. With progression of poisoning, respirations become slow and gasping. Central cyanosis may or may not occur. Pulmonary edema may occur.
- Metabolic – Acidosis occurs secondary to increased anerobic respiration.
- Dermal – Systemic absorption can occur. High ambient temperate, relative humidity results in increased absorption.
- Ocular – Direct contact to liquid cyanide can result in eye irritation and swelling.

Pediatric Specific Issues:

- Children exposed to the same level of cyanide agents as adults will usually receive higher doses because they have greater lung surface area: body weight ratios and increased minute volume: weight ratios.
- Young children especially under the age of four are more prone to develop seizure disorders secondary to hypoxia or other CNS insult.

- Children are more vulnerable to these toxicants being absorbed through the skin because their skin is thinner, contains more moisture, and they have a larger surface area to weight ratio than adults.
- In animal studies it has been documented that sodium thiosulfate does not cross the placenta when utilized to treat cyanide toxicity but by treating the mother the cyanide levels in the fetus were lowered.

2. DIFFERENTIAL DIAGNOSIS

- In mass casualty events cyanide or nerve agents can both present with sudden loss of consciousness followed by convulsions and apnea. Nerve agents typically have miosis, copious oral and nasal secretions, and muscle fasciculations. Cyanide has normal or dilated pupils, few secretions and muscular twitching.
- One would have to have a high index of suspicion to focus on cyanide as the etiology of an individual presenting with loss of consciousness followed by convulsions and apnea as this chain of events is common in routine pediatric care.

3. MEDICAL MANAGEMENT

Medical treatment for cyanide agents includes aggressive supportive therapy including 100% oxygen, decontamination, and administration of antidotes (the order is clinically dependent).

a. Triage:

- Evaluate and support the airway, breathing, and circulation.
- If victims are symptomatic provide specific antidotes and supportive care simultaneously with decontamination (include 100 oxygen).

b. Decontamination:

- Remove contaminated clothing, flush exposed skin and hair with plain water for 2 –3 minutes, wash twice with mild soap, and rinse thoroughly with water. Double – bag contaminated personal belongings and clothing.
- Children are particularly vulnerable to hypothermia
- Keep children with parents if at all possible
- ED staff should examine their mouths because of the high frequency of hand to mouth behavior.

c. Health Care Provider protection:

- Cyanide is a highly toxic substance that is absorbed through inhalation as well as the skin. Therefore, if one is dealing with patients that are exposed to liquid contaminants one should be utilizing self – contained breathing apparatus (SCBA) as well as chemical protective clothing (staff should wear butyl rubber gloves – hydrogen cyanide penetrates most rubbers and barrier fabrics). Hydrogen cyanide will also penetrate butyl rubber gloves after a short while.

d. Antidote Dosing and Sequencing:

- Amyl nitrite perles should be broken onto a gauze pad and held under the nose, placed under the lip of a facemask, or over the Ambu-valve intake. The patient should inhale for 30 seconds/minute and a new perle should be utilized every three minutes.
- As soon as IV access has been achieved in a symptomatic patient DC the perles and initiate IV sodium nitrite (ASAP).
- The usual adult dose is 10 ml of a 3% solution (300).
- The pediatric dose is .12 to .33 ml/kg.
- It should be infused over no less than 5 minutes (monitor BP – slow rate if hypotension develops).
- Follow – up immediately with IV sodium thiosulfate.
- The adult dose is 50 ml of a 25% solution (12.5 grams infused over 10 – 20 minutes.
- The pediatric dose is 1.65mL/kg of a 25% solution.
- Repeat ? of the initial dose in 30 minutes if there is an adequate clinical response.
- IV sodium nitrite removes cyanide from the cells and is subsequently binds with hemoglobin forming methemoglobin (which cuts down on the blood's ability to carry oxygen to the tissues). If the methemoglobin level is dangerously high (see below), one can give 1% methylene blue IV, which sends the cyanide back to the cells.

e. Lab Testing:

- Routine labs include CBC, blood glucose, and electrolyte determinations. Additional studies include ECG monitoring. Pulse oximetry, ABG (VBG – with cyanide poisoning - oxygen level in

venous blood may be abnormally high because of lack of cellular oxygen utilization), serum lactate levels, cyanide level.

- In patients who are not clinically responding you can measure the methemoglobin level (however this testing may seriously underestimate the levels of inactive hemoglobin) and utilize them as a therapeutic guide. The methemoglobin level should not exceed 20% - 30% in children and 40% in adults (see above).

f. Supportive Care:

- Treat apnea, seizures, cardiac arrhythmias, shock, and pulmonary edema in the traditional way.
- Continuously monitor cardiac rhythm
- If the patient's pH is < than 7 or the patient is having significant dysrhythmias (which may be secondary to serious acidosis) consider giving 1mEq/kg of IV sodium bicarbonate.
- In cases of ingestion, do not induce emesis. If activated charcoal has not been given and the patient is alert with a present gag reflex give slurry of activated charcoal. Consider lavage if the patient is conscious and ingestion was recent. Isolate gastric washings and vomitus because of potential off gassing of hydrogen cyanide.
- Treat complicating injuries or infections.
- Patients with histories of significant exposure should be hospitalized.
- Patients utilizing infusions from the cyanide kit should be admitted to the ICU.
- Patients who are asymptomatic 6 hours after exposure may be DC'd with instructions to follow-up immediately if symptoms develop.

g. Follow-Up:

- Survivors of a serious exposure need to be further evaluated and followed for the sequelae of potential ischemic damage to the heart and brain. CNS sequelae may include Parkinsonian – like symptoms.

4. REFERENCES

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5. The Lack of Transplacental Movement of Cyanide Antidote Thiosulfate in Gravid Ewes, Fred LaVeechio DO, Tedd Banks BS, Anesthesia, 1999, 89:1448

5. CONTACT INFORMATION

Agency for toxic Substance and Disease Registry
Division of Toxicology
1-888-442-8737

District of Columbia poison Control Center –
202-625-3333

CDC web site for emergency preparedness and response – www.cdc.gov

Patient Care Guidelines:

ISOLATION PROCEDURES

Priorities for management of children with exposure to/illness from biological weapons:

- Decontamination, if immediately to hospital from site of exposure
- Use of personal protective equipment (PPE) as appropriate
- Evaluation of history/physical exam for signs & symptoms of syndromes of infection by biological weapons
- Notification of hospital infection control/epidemiology officer, and of local department of health (city, county)
- Assignment to appropriate isolation category for further emergency department/inpatient treatment

Standard precautions always apply to patient care, and consist of:

- careful hand washing before and after contact with each patient;
- barrier precautions (impermeable gloves) for handling of blood or blood-tinged secretions, urine, feces, respiratory secretions;
- eye protection if splashing of body fluids is anticipated;
- proper disposal of materials contaminated with such fluids.

Transmission-Based Precautions:

- **Airborne** — airborne droplet nuclei; patient in private room, door closed, room at negative pressure relative to ward, use N95 respirator or powered air-purifying respirator (PAPR) when in patient's room; surgical mask for patient if needs to be moved from room.
- **Droplet** — large droplets containing organisms; suspended for only short distances; mask for contact within three feet of patient and during cough/respiratory-aerosol-producing procedures
- **Contact** — private room, gown and gloves for all contact with patient, in addition to standard precautions.

Bacterial bioweapons:

Standard precautions for most pathogens in this group (after initial decontamination).

EXCEPTION: droplet isolation and private room for PNEUMONIC PLAGUE.

Viral bioweapons:

- **Smallpox:** private room, negative pressure, airborne and contact precautions, biohazard disposal of all contaminated items
- **Viral hemorrhagic fevers:** private room at negative pressure, airborne precautions, impermeable gown, double gloves, eye protection, shoe and leg covers, biohazard disposal of all contaminated items

Patient Care Guidelines:

ANTHRAX

1. DIFFERENTIAL DIAGNOSIS

a. Cutaneous Anthrax

- **Weaponized:** Ulceroglandular tularemia
- **Natural Disease:** Staphylococcal infection, Erysipelas, Herpes Simplex Virus Infection, Brown Recluse Spider Bite, Ecthyma gangrenosum, Ulceroglandular tularemia

b. Inhalational Anthrax

- **Weaponized:** Brucellosis, tularemia, plague, Ricin, Staphylococcal Enterotoxin B (SEB), Chlorine Gas, Phosgene Gas, organophosphate poisoning
- **Natural Disease:** Viral respiratory infection, Bacterial pneumonia, Tuberculosis, Tularemia

c. Gastrointestinal Anthrax

- **Weaponized:** Brucellosis, Salmonella, Plague, Staphylococcal Enterotoxin B (SEB)
- **Natural Disease:** Viral gastroenteritis, Bacterial gastroenteritis, sepsis

2. MEDICINE MANAGEMENT

a. Isolation

Standard precautions

b. Decontamination

Rarely necessary to decontaminate. Bathing and laundering with soap and water is prudent after direct contact with a suspicious substance believed to be anthrax.

c. Staff Precautions

Person to person transmission unlikely. Healthcare workers should use standard precautions. Postexposure prophylaxis after confirmed or suspected exposure to anthrax spores.

d. Postexposure Prophylaxis for Children:

Ciprofloxacin 10 to 15 mg/kg/dose orally every 12 hours (maximum 500 mg/dose) or

Doxycycline 2.2 mg/kg orally every 12 hours (maximum dose 100 mg every 12 hours) for 60 days.

Amoxicillin 80 mg/kg/day in 3 divided doses (maximum 500 mg/dose), **if organisms is susceptible to penicillin**, is an option for children.

Postexposure Prophylaxis for Adults:

Ciprofloxacin 500 mg orally twice a day or

Doxycycline 100 mg orally twice a day.
Amoxicillin 80 mg/kg/day in 3 divided doses (maximum 500 mg/dose), **if organism is susceptible to penicillin**, is an option for pregnant or lactating women.

Ciprofloxacin and tetracyclines (including doxycycline) are usually considered to be acceptable for **breastfeeding mothers**, however the effects of long term use are not known; mothers may elect to express and discard their breastmilk until antimicrobial prophylaxis is completed if they are taking ciprofloxacin or doxycycline.

Duration of Postexposure Prophylaxis:

Three options for duration: 1) 60 days or 2) 100 days or 3) 100 days combined with 3 doses of anthrax vaccine administered over 4 weeks at time 0, 2 weeks, 4 weeks. Anthrax vaccine is licensed for individuals 18-65 years of age and should be administered with informed consent.

3. SIGNS AND SYMPTOMS

a. Cutaneous Anthrax: Incubation period is 1-7 days. Raised lesion resembling a mosquito bite develops 2-5 days after exposure. Papular lesion progresses to a blister or vesicle then forms a black-scabbed lesion. Patients may have fever, malaise, lymphadenopathy.

b. Inhalational Anthrax: Incubation period is 1-60 days. Prodromal flu-like illness with fever, myalgia, cough, chest pain 2-5 days after exposure, followed by dyspnea, diaphoresis and cyanosis. On examination cough, tachypnea, hypoxia and rales. Potentially septic appearance with meningeal signs. Initial chest x-ray may appear normal or show characteristic widened mediastinum or patchy lung infiltrates and pleural effusion.

c. Gastrointestinal Anthrax: Incubation period is 1-7 days. Decreased appetite, nausea, vomiting, diarrhea, oropharyngeal lesions. Abdominal bloating, diarrhea, constipation, blood tinged vomitus or stool. May appear septic. Oropharyngeal lesions, cervical adenopathy or dysphagia may be present, as well as decreased breath sounds, abdominal distention, abdominal tenderness.

4. RELEVANT LABORATORY TESTING

Bacillus anthracis is a Gram positive bacillus with a “string of boxcars” appearance on Gram stain. Can be grown from cultures of blood, cerebrospinal fluid, skin lesions and stool. Nonhemolytic nonmotile organism. Diagnosis of anthrax in the acute setting is made on the basis of microbiology test results. Serology for anthrax may be sent to the state health department laboratory. Rapid screening tests are currently investigational and are not part of the standard of care.

Cutaneous Anthrax: Send swab culture of fluid from vesicle or from below the eschar and send blood culture for anthrax.

Inhalational Anthrax: Obtain a chest x-ray. Send blood culture for anthrax and cerebrospinal fluid in patients with meningitis and pleural fluid from patients who undergo pleural drainage. Send blood to the state laboratory for anthrax polymerase chain reaction testing or serology.

Gastrointestinal Anthrax: Obtain a chest x-ray, blood and stool cultures or rectal swab cultures for anthrax. Send blood to the state laboratory for anthrax polymerase chain reaction testing or serology.

5. TREATMENT GUIDELINES

Children with Cutaneous Anthrax

Ciprofloxacin: 10-15 mg/kg orally every 12 hours (maximum dose 500 mg every 12 hours) for 60 days or

Doxycycline: 2.2 mg/kg orally every 12 hours (maximum dose 100 mg every 12 hours)

Amoxicillin 80 mg/kg/day orally divided every 8 hours (maximum dose 500 mg orally three times daily) after clinical improvement and if the organism is susceptible to penicillin to complete 60 days of total antibiotic therapy

Use intravenous antibiotics as outlined under the section on treatment of systemic or inhalational anthrax if there are signs of systemic involvement or there are lesions on the head or neck or there is extensive edema or the patient is 2 years of age or younger

Adults with Cutaneous Anthrax:

Ciprofloxacin 500 mg orally twice daily for 60 days or

Doxycycline 100 mg orally twice daily for 60 days or **Amoxicillin** 500 mg orally three times daily for 60 days if the isolate is demonstrated to be susceptible to penicillin

Use intravenous antibiotics as outlined under the section on treatment of systemic or inhalational anthrax if: there are signs of systemic involvement or there are lesions on the head or neck or there is extensive edema.

Children with Inhalational, Oropharyngeal, Gastrointestinal or Systemic Anthrax

Ciprofloxacin* 10-15 mg/kg IV every 12 hours (maximum dose 500 mg every 12 hours) or

Doxycycline*: 2.2 mg/kg IV every 12 hours (maximum dose 100 mg every 12 hours)

*** plus 1-2 additional agents** (i.e. rifampin, vancomycin, penicillin, ampicillin, chloramphenicol, imipenem, clindamycin or clarithromycin based on in vitro susceptibility testing of isolates in 2001 anthrax attack)

- **If meningitis is suspected, ciprofloxacin may be preferable to doxycycline due to better CNS penetration**
- **Transition to oral antibiotic therapy when clinically improved to complete a total course of 60 days therapy**

Adults with Inhalational, Oropharyngeal, Gastrointestinal or Systemic Anthrax:

Ciprofloxacin* 500 mg IV every 12 hours or

Doxycycline* 100 mg IV every 12 hours

***plus 1-2 additional agents** (i.e. rifampin, vancomycin, penicillin, ampicillin, chloramphenicol, imipenem, clindamycin or clarithromycin based on in vitro susceptibility testing of isolates in 2001 anthrax attack)

- If meningitis is suspected, ciprofloxacin may be preferable to doxycycline due to better CNS penetration
- When the patient has improved may transition to Ciprofloxacin 500 mg orally twice a day or Doxycycline 100 mg orally twice a day to complete a total IV plus oral course of 60 days

6. LONG-TERM SEQUELAE

The mortality rate for cutaneous anthrax is 20% for gastrointestinal anthrax 40% and for inhalational anthrax 80%, however the mortality rate for cases of inhalational anthrax resulting from the Bioterrorism attack in 2001 was 40%

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6. Patt H, Feigin R. Diagnosis and Management of Suspected Cases of Bioterrorism: A Pediatric Perspective. *Pediatr* 2002; 109:685-692.

8. CONTACT INFORMATION

Notify the Infectious Disease Division, the Infection Control Division and the Director of the hospital's Clinical Microbiology Laboratory and the Chief Medical Officer of the institution, as well as the local and state health department of suspected cases of anthrax.

Patient Care Guidelines:

SMALLPOX

1. PRIORITIES FOR MANAGEMENT OF CHILDREN WITH EXPOSURE TO/ILLNESS FROM BIOLOGICAL WEAPONS

- Recognition
- Isolation
- Use of personal protective equipment (PPE) as appropriate
- Assignment to appropriate isolation category for further emergency department/inpatient treatment

- **Notification of hospital infection control/epidemiology officer, and of local department of health (city, county)—SMALLPOX IS AN INTERNATIONAL HEALTH EMERGENCY**

2. TREATMENT

- No specific treatment available; cidofovir may be available as investigational new drug (IND), but carries risk of renal toxicity; efficacy not known
- Vaccination is the primary management tool
- Some protective efficacy, significant decreased mortality if given within 4 days of exposure
- In event of identified smallpox case, all contacts are vaccinated, regardless of immune status

3. DISTINCTION FROM OTHER SYNDROMES

- Lesions appear after febrile prodrome with prostration, significant myalgia
- Lesions are deeper-set, intradermal, compared with superficial vesicles of varicella
- Flat, or malignant, smallpox presents with less distinct rash
- Smallpox lesions all progress together; varicella lesions come in crops and may not all be at same stage of development on the same patient

4. TRANSMISSION-BASED PRECAUTIONS

- **Airborne**-airborne droplet nuclei; patient in private room, door closed, room at negative pressure relative to ward, use N95 respirator or powered air-purifying respirator (PAPR) when in patient's room; surgical mask for patient if needs to be moved from room.
- **Contact**-private room, gown and gloves for all contact with patient, in addition to standard precautions.

Smallpox: private room, negative pressure, airborne and contact precautions, biohazard disposal of all contaminated items, for those patients requiring inpatient management.

Quarantine at home is preferred for patients stable enough for home management.

Separate **smallpox hospitals** may be established in large-scale outbreaks

Patient Care Guidelines:

VIRAL HEMORRHAGIC FEVERS

1. PRIORITIES FOR MANAGEMENT OF CHILDREN WITH EXPOSURE TO/ILLNESS FROM BIOLOGICAL WEAPONS

- Recognition
- Isolation
- Use of personal protective equipment (PPE) as appropriate
- Notification of hospital infection control/epidemiology officer, and of local department of health (city, county)

2. TREATMENT

- No specific treatment available; ribavirin may be useful for Arenaviridae & Bunyaviridae, no known effect of ribavirin on Filoviridae or Flaviviridae
- **Ribavirin for empiric therapy** of possible VHF cases:
 - Loading dose 30 mg/kg IV (max 2 grams), then
 - 16 mg/kg (max 1 gram) every 6 hr x 4 days
 - 8 mg/kg (max 500 mg) every 8 hr x 6 days
- **Ribavirin for oral empiric therapy** of possible VHF cases in **mass casualty setting**:
 - Loading dose 30 mg/kg PO (max 2 grams), then
 - 15 mg/kg (max 1 gram) divided BID x 10 days for children;
 - for adults >75 kg, 1200 mg divided BID x 10 days
 - for adults <75 kg, 1000 mg div. BID (400 mg AM/600 mg PM) x 10 days

a. Post-Exposure Prophylaxis:

- None licensed or proven; oral ribavirin for 7 days is recommended
- Isolation and observation of contacts for 21 days for asymptomatic contacts:
 - "High-risk" contact = mucous membrane
 - "Close" contact = cohabitation, hand-shake/hug, clinical care, lab spec.

- Ribavirin for contacts with T > 38.3oC/101oF within 21 days of contact

b. Transmission-Based Precautions:

Aerosol transmission of hemorrhagic fever viruses not proven (except for some arenaviruses aerosolized naturally from rodent feces, urine)

- **Airborne** - patient in private room, door closed, room at negative pressure relative to ward, use N95 respirator or powered air-purifying respirator (PAPR) when in patient's room; surgical mask for patient if needs to be moved from room.
- **Contact** - private room, gown and gloves for all contact with patient, in addition to standard precautions.
- **Additional precautions** of shoe/leg covers for VHF
- **Degree of precautions** for VHF indicated because of high morbidity and mortality, lack of effective treatments, uncertainty about modes of transmission for various VHF, and impossibility of initially distinguishing etiology of VHF

3. VACCINATION

- No effective, licensed vaccines for any VHF except yellow fever
- Appearance of neutralizing antibodies to yellow fever take longer to develop than the incubation period of yellow fever, so the vaccine not useful for post-exposure prophylaxis

4. DISTINCTION FROM OTHER SYNDROMES

- Febrile prodrome with headache, myalgia, arthralgia, vomiting and diarrhea
- Development of mucous membrane bleeding, DIC
- Cluster of severe cases, high severity, and simultaneous occurrence

Patient Care Guidelines

BRUCELLOSIS

1. DIFFERENTIAL DIAGNOSIS

Weaponized: Q fever, Tularemia, Salmonella

Natural Disease: Q fever, Tularemia, Tuberculosis, Syphilis, Viral infection, Salmonella, Chronic Fatigue Syndrome

2. ISOLATION

- Aerosol (respiratory) precautions with secretions
- Contact isolation for draining wounds
- Biosafety Level 3 precautions in the laboratory

3. DECONTAMINATION

- Decontaminate open wounds
- Brucella is susceptible to disinfectants and heat

4. STAFF SAFETY ISSUES

Isolation

- Person to person transmission occurs rarely
- Standard precautions should be used
- Respiratory precautions should be used with secretions
- Contact isolation should be initiated for draining wounds
- Biosafety Level 3 precautions should be instituted in the laboratory

Propylaxis

Child: Doxycycline 2.2 mg/kg twice daily (max. 100 mg orally twice daily) for 3 weeks or Ciprofloxacin 15-20 mg/kg twice daily (max. 500 mg orally twice daily) for 3 weeks

Adult: Doxycycline 100 mg orally twice daily for 3 weeks and rifampin 600 mg orally daily for 3 weeks

Vaccine No vaccine is available

5. SIGNS AND SYMPTOMS

- Incubation period is 3 days to 2 months
- Flu-like symptoms including fever, anorexia, weight loss, depression first 2 months
- Fever, lymphadenopathy, hepatosplenomegaly
- Meningitis and endocarditis rare

- Bone and joint disease frequent complication. Sacroiliac joint most commonly affected. Also, hips, knees, ankles.
- Abdominal pain, ileitis, colitis, peritonitis rare
- Chest x-ray shows hilar adenopathy, pulmonary nodules, pleural effusion
- White blood cell count normal or low with anemia, thrombocytopenia

6. RELEVANT LABORATORY TESTING

Acute Phase (First 8 weeks)

- Culture Brucella from blood, pleural fluid, bone marrow aspirate, cerebrospinal fluid
- Serum agglutination test (SAT) for Brucella: *B. melitensis* test will identify *B. melitensis*, *B. abortus*, *B. suis*. *B. canis* must be ordered to identify *B. canis*

Chronic Phase

- Serum agglutination test for Brucella, Elisa for Brucella

7. TREATMENT

Treatment of Children

- Oral doxycycline (2-4 mg/kg/day max 200 mg/day in 2 divided doses) for 4-6 weeks or
- **Oral trimethoprim-sulfamethoxazole (tmp 10 mg/kg/day max 480 mg/day and smz 50 mg/kg/day max 2400 mg/day in two divided doses) for patients younger than 8 years plus**
- **Rifampin 15-20 mg/kg/day, maximum 600-900 mg per day in 1 or 2 divided doses may be used with either of the above drugs to minimize the chance of relapse**
Alternate regimen for serious infection or for complications of endocarditis, meningitis, osteomyelitis
- **Streptomycin 15 mg/kg IM twice daily (maximum 1 gram/day) or Gentamicin (2.5 mg/kg every 8 hours) for the first 7-14 days plus**
- A tetracycline or trimethoprim-sulfamethoxazole for 6 weeks
- Rifampin can be used with the above agents to minimize the chance of relapse

- **Therapy should be continued for several months if central nervous system disease or endocarditis is present.**

Treatment of Adults

- Doxycycline 100 mg orally twice daily for 3-6 weeks with streptomycin 15 mg/kg/day IV or IM (maximum 1 gram/day IM) for 2-3 weeks to 6 weeks or gentamicin (5-6 mg/kg/day) IV or IM daily for 7 days

Alternate regimen:

- Doxycycline 100 mg orally twice daily with rifampin 600-900 mg daily for 6 weeks

Complicated infections:

- For joint, endocarditis or central nervous system disease use doxycycline, rifampin and an aminoglycoside for a prolonged course of therapy (6-9 months)

Pregnant or lactating women:

- Rifampin 600-900 mg orally daily for 6 weeks

8. LONG TERM SEQUELAE

Deaths are rare and usually secondary to endocarditis which is present in less than 2% of patients
Chronic symptoms do occur and can lead to long term disability

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5. Young E. An Overview of Human Brucellosis. Clin Infect Dis. 1995; 21:283-290.

10. CONTACT INFORMATION

Notify the Infectious Disease Division, the Infection Control Division and the Director of the hospital's Clinical Microbiology Laboratory and the Chief Medical Officer of the institution, as well as the local and state health department of suspected cases of Brucellosis.

Patient Care Guidelines:

GLANDERS AND MELIOIDOSIS

Causative agents:

Burkholderia mallei and pseudomallei

1. DIFFERENTIAL DIAGNOSIS

Weaponized: Streptococcal pneumoniae, Tuberculosis, Bacillus anthracis

Natural Disease: Tularemia, Tuberculosis, Histoplasmosis, Typhoid fever, Coccidioidomycosis, Viral infection

2. ISOLATION

- Aerosol (respiratory) precautions with secretions
- Contact isolation for draining wounds
- Biosafety Level 3 precautions in the laboratory

3. DECONTAMINATION

- Decontaminate open wounds

4. STAFF SAFETY ISSUES

Isolation

- Person to person transmission occurs rarely
- Standard precautions should be used
- Respiratory precautions should be used with secretions
- Contact isolation should be initiated for draining wounds
- Biosafety Level 3 precautions should be instituted in the laboratory

Prophylaxis – no current evidence to support prophylaxis

Child or Adult: Trimethoprim (TMP) 4 mg/kg/day

divided two times daily for seven days and Sulfamethoxazole (SMX) 20mg/kg/day divided two times daily for 7 days

Vaccine No vaccine is available

5. SIGNS AND SYMPTOMS

- Incubation period is 10-14 days

Localized infection:

- Papular eruption followed by localized suppurative abscesses
- Fever and regional lymphadenopathy

Pulmonary form:

- Flu-like symptoms including fever, chills, anorexia, weight loss
- Fever, lymphadenopathy
- Cough, dyspnea, and hypoxia in pulmonary form
- Chest x-ray shows bilateral bronchopneumonia, pleural effusions, and apical cavitary lesions

Septicemic illness:

- High fever, pneumonia, multiorgan dissemination, hypotension
- White blood cell count mildly elevated with mild left shift

6. RELEVANT LABORATORY TESTING

- Culture *Burkholderia mallei* or *pseudomallei* from blood, pleural fluid, urine, or wound for definitive diagnosis
- Indirect hemagglutination test (IHA) is most widely used
- IHA titer of greater than 1:40 is diagnostic
- A large proportion of persons living in endemic areas have IHA titers from 1:40 to 1:160
- IFA titers 1:640 is highly suggestive of active melioidosis

7. TREATMENT

Sepsis or pulmonary involvement:

First line: Imipenem

- >3 years: 15mg/kg IV 4 times daily, up to 2g maximum dose
- >40 kg: use adult dose, 50mg/kg/day, up to 1g IV 4 times daily
- 3 months – 3 years: 15-25 mg/kg IV given 4 times daily

Contraindications: Stop breastfeeding when possible, but give to pregnant women given the seriousness of the condition.

Duration: 2-3 weeks for initial treatment

Alternative to Imipenem: Meropenem

- > 3 months: 10-20 mg/kg IV three times daily
- Adult dose for >50 kg
- Adults: 500mg –1g IV three times daily

Second line: Ceftazidime

- >2 months: 100 mg/kg/day divided in three doses, maximum dose 6g
- <2 months: 60 mg/kg/day in 2 divided doses
- Adults: 2g IV three times daily

- Combination therapy for severe cases: First line: Imipenem, meropenem, or ceftazidime plus doxycycline
- >8 years and >45 kg: adult dose: 100 mg IV twice daily
- <45 kg: 2.2 mg/kg IV twice daily (maximum 200 mg/day if < 8 years)

Local infections:

- Augmentin is bactericidal at 60mg/kg/day by mouth divided three times daily and is usually safe in pregnant women
- Tetracycline is bacteriostatic at 40mg/kg/day by mouth divided three times daily but should not be used in children under 8 years, also UNSAFE in pregnancy, interacts with many medications
- TMP-SMX can be given in children older than 2 months at 4 mg TMP/KG/day and 20 mg SMX/kg/day by mouth divided three times daily

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9. CONTACT INFORMATION

Notify the Infectious Disease Division, the Infection Control Division and the Director of the hospital's Clinical Microbiology Laboratory and the Chief Medical Officer of the institution, as well as the local and state health department of suspected cases of Glanders or Melioidosis if the disease has not occurred in animal workers or those who have traveled or lived in an endemic area.

Patient Care Guidelines:

RICIN

1. CLINICAL FINDINGS

The major symptoms of ricin poisoning depend on the route of exposure and the dose received, though many organs may be affected in severe cases. Initial symptoms of ricin poisoning by inhalation may occur within 8 hours of exposure. Following ingestion of ricin, initial symptoms typically occur in less than 6 hours.

Ingestion: If someone swallows a significant amount of ricin, he or she would develop vomiting and diarrhea (may be bloody). Severe dehydration and shock may occur. Altered mental status, seizures, and hematuria have also been reported. Within 3-5 days hepatic and renal failure or multiple organ failure can occur and lead to death.

Inhalation: Within a few hours of inhaling significant amounts of ricin, the likely symptoms would be respiratory distress, fever, cough, nausea, and tightness in the chest. Diaphoresis pulmonary edema may occur. Hypotension and respiratory failure may occur, leading to death within 3-5 days.

Parenteral: A minute amount of ricin injected parentally can lead to: Immediate pain at site generalized weakness within 5 hours, fever, vomiting, shock, multi-organ failure and Death within 3 days
Skin and eye exposure: Ricin in the powder or mist form can cause redness and pain of the skin and the eyes.

Pediatric Specific Clinical Issues:

- Children may be more affected because of relatively small size and consequent larger dose/weight.
- Children are more susceptible to fluid losses and thus may progress to shock more rapidly.
- With higher respiratory rates and minute volumes than adults a child may inhale a greater dose of aerosolized ricin
- The smaller airway diameter, anatomic subglottic narrowing, omega shaped epiglottic structure, relatively large tongue size, less rigid ribs and trachea make them more vulnerable to respiratory failure.
- Case reports exist of small children and toddlers ingesting castor beans and because the beans are attractive.

2. DIFFERENTIAL DIAGNOSIS

Depends on the route of exposure:

- Gastrointestinal
 - Enteric pathogens (e.g., salmonella, shigella)
 - Mushrooms**
 - Caustics
 - Iron
 - Arsenic
 - Colchicine
- Inhalational/parenteral
 - Staphylococcal enterotoxin B
 - Exposure to pyrolysis by-products of organofluorines (Teflon, Kevlar)
 - Oxides of nitrogen
 - Phosgene
 - Influenza
 - Anthrax
 - Q-fever**
 - Pneumonic plague

3. MEDICAL MANAGEMENT

- There is no specific antidote or vaccine available
 - Treatment for any type of exposure includes decontamination (if indicated ie dermal or inhalational exposure) and supportive care.
 - Supportive care may involve intravenous fluids and vasopressor administration for shock and respiratory support and ventilation for respiratory failure
 - Activated charcoal may be indicated in a known exposure in which vomiting has not yet occurred.
- a. Decontamination:**
- Decontamination is indicated in inhalational exposure as the particles may become re-aerosolized.
 - If dermal or eye exposure occurs washing or flushing with water is indicated.
 - Remove and double bag contaminated clothing and personal items (separate personal items from clothing).

b. Health Care Provider Protection:

- There is no risk to health care providers from patients who have ingested ricin.
- As noted above in inhalational exposure reaerosolization of particles on the the patients clothing or person is possible.
- Personal protective gear should be used until such patients are thoroughly decontaminated.

4. REFERENCES

1. CDC Ricin Website: www.bt.cdc.gov/agent/ricin
2. Cornell Toxic plant website: www.ansci.cornell.edu/plants/toxicagents/ricin/ricin.
3. Franz DR, Jaax NK. Ricin Toxin. in Medical aspects of chemical and biological warfare. Available at: www.ncbi.nlm.nih.gov/pmc/articles/PMC1456441/
4. Homeland Security: Ricin Information: www.nationalterroralert.com/readyguide/ricin.htm

5. CONTACT INFORMATION

- Agency for Toxic Substances and Disease Registry
Division of Toxicology 1-888-422-8737
- National Poison Control Center Hotline
1-800-222-1222
- Centers for Disease Control and Prevention
Public Response Hotline
English (888) 246-2675
Español (888) 246-2857
TTY (866) 874-2646
- E-mail questions to: ricinquestions@cdc.gov

Patient Care Guidelines:

RADIOLOGICAL INCIDENTS

There are several means of injury associated with radiological incidents: Trauma, which includes blunt, penetrating and burn; radiation; panic. There is also a difference between contamination and exposure. The priorities are trauma, medical management and decontamination and further prevention of contamination. Below are the clinical findings.

1. CLINICAL FINDINGS

a. Ionizing Radiation injures tissues through energy transfer. Outcomes range from cell death; to cell malfunction, the cell lives, but is altered, can't repair itself, and may contribute to tissue and organ malfunction; to delayed effects where the cell's genetic material is altered, and creates the potential for later malignancy.

b. Acute radiation syndrome: A combination of clinical symptoms occurring in stages during a period of hours to weeks after radiation exposure, as injury to various tissues and organs is expressed. Acute radiation syndrome requires high radiation exposure of penetrating ionizing radiation to the entire body (or a large proportion of the body) delivered acutely.

i. Stages of acute syndrome:

1. Initial or prodromal period- classic symptoms of nausea, vomiting and diarrhea (dose dependent); time to onset and severity is dose dependent
2. Latent period- patient returns to relatively normal condition for a few hours to days depending on the dose
3. Manifest illness- symptoms depend on specific syndrome
4. Recovery/death

ii. Hematopoietic syndrome:

1. Pancytopenia occurs at a radiation dose of 100-600 cGy(100-600 rad). The targeted cells are stem cells the precursors for all bone marrow cell lines

2. A Prodromal Period occurs next with symptoms that include nausea, vomiting, anorexia and possible diarrhea. This may last up to 3 days. The onset and degree of severity help define the radiation dose received.
3. Latent period- essentially asymptomatic except for mild weakness.
4. Overt clinical picture - Atrophy of the bone marrow, spleen, and lymph nodes occurs with decline in RBC, WBC, and platelet counts. During the 4th and 5th weeks post exposure victim will be severely ill.

iii. Gastrointestinal syndrome:

1. Occurs at a dose range of 600-3000cGy (600-3000 rad). The targeted cells are the GI stem cells.
2. Pathophysiology – A depletion of epithelial cells lining lumen of small intestine allows intestinal bacteria to gain access to the body. Hemorrhage occurs through the denuded areas. There is a loss of the over-all small intestinal absorptive capacity. If exposure is <1300cGy, the epithelial cell count increases post irradiation. If exposure is >1300cGy, there is poor regeneration of the micro villous, mucosal lining.
3. Prodromal period - occurs usually within 2-6 hours post irradiation. This consists of nausea, vomiting, and watery diarrhea with cramps.
4. Latent period - at a lower dose range the individual may be asymptomatic for 5-7 days.
5. Overt clinical picture – There is a return of severe nausea, vomiting, diarrhea, and fever. There is an eventual progression to bloody diarrhea, shock and death (1-2 weeks).

iv. CNS syndrome:

1. The stages occur rapidly with this syndrome. Edema, increased intracerebral pressure, anorexia, and death occur within 2 days. The dose is >3000 cGy.

2. Prodromal period – an intense burning sensation within minutes, nausea and vomiting within the first hour and early transient incapacity.
3. Latent period – An apparent improvement for several hours
4. Overt clinical picture - watery diarrhea, radiation pulmonitis, cardiac arrhythmias, hyperthermia, confusion and motor function loss. This is followed by severe hypotension; decreased cardiac output and decreased arterial pressure.

2. CLINICAL MANAGEMENT

Medical management for radiological injuries is two-fold. For the Patient: appropriate triage; ABC's; decontamination and prevention of further contamination; potassium iodide.

For the Facility: initiate disaster protocol; "Lock" down the facility; prepare the decontamination area/equipment; prepare the outdoor apparatus; Personal Protective equipment (PPE) and dispose of contaminated material.

- a. Triage: It is imperative to appropriately prioritize patients. Attend to infants and children in most dire need first.
- b. Emergency care (ABC's): Secure airway, breathing, and circulation; establish physiological monitoring; treat major trauma or burns.
- c. Decontaminate / radiological assessment
- d. Treat symptomatically- prevention and management of infection is primary objective. Use fluids, electrolytes and antibiotics to prevent secondary infections. If needed use irradiated blood products.
- e. Record timing and severity of clinical symptoms, particularly nausea, vomiting, diarrhea and itching, reddening or blistering of the skin as this can help determine the amount of exposure.
- f. Potassium Iodide (KI)
 - i. The recommended dose of Potassium Iodide (KI) as a thyroid-blocking agent following exposure to radioisotopes of IODINE with predicted radioactive exposures greater than or equal to 5 centigray (e.g., from a nuclear reactor accident) is:

- a. Children and adolescents over 3 through 18 years: 65 milligrams/day (adolescents approaching adult size (70 kilograms or greater) should receive 130 milligrams/day)
- b. Infants 1 month through 3 years: 32 milligrams/day
- c. Neonates birth through 1 month: 16 milligrams/day
- d. In neonates, repeat dosing should be avoided to minimize the risk of hypothyroidism during the critical phase of brain development. Treated infants should be monitored for hypothyroidism. Saturated potassium iodide solution can be diluted in milk, formula, or water (FDA, 2001).

- ii. Therapy with KI should be started as soon as possible prior to or after possible radiation exposure, preferably within 3 to 4 hours, and should continue until the risk for significant exposure to radioiodines no longer exists (FDA, 2001). The thyroid-blocking effect of a single 130-milligram dose persists for 24 hours; daily therapy beyond 7 to 14 days appears unnecessary in the absence of continued exposure (FDA, 2001; Becker, 1987; Becker et al, 1984; Schleien, 1983).

3. DECONTAMINATION

a. Decontamination Priorities

- a. All persons entering the hospital, especially new patients from the scene; new patients concerned they were exposed; Patients who have been admitted and treated already; all patients and staff exposed to patients and material before the notification of radiological event, who remain contaminated after entry.
- b. Rooms, equipment, trash, etc, exposed to material and patients from the scene.

b. External and Internal Contamination

i. External Decontamination

1. Removal of skin/surface material
2. Usually done by EMS before arrival to Hospital
3. Involves mechanical methods to remove
4. Needs to be done early/emergently in hospital
5. Removal of clothing effects a 90% reduction in patient's contamination
6. Skin and Hair Washing
7. Decontaminate wounds first, starting with highest level of contamination.
8. Cover non-contaminated wounds with waterproof dressings: Prevent Contamination!
9. Irrigate and gently cleanse contaminated wounds with surgical sponge; extend
10. debridement only in extreme cases. Scrubbing introduces particles deeply!
11. Gently rinse contaminated burns and apply dressing, additional contamination will be removed with dressing change. Try not to scrub!
12. Wash intact skin and hair with mild soap - do not scrub; trim hair as needed.
13. Used Decontamination Materials Become Radioactive
14. Wash water, clothing, towels, debris must be contained to minimize contamination.

ii. Internal Decontamination

1. Targets material that has been inhaled, ingested, deposited
2. Requires medical and/or surgical removal
3. Usually done after initial stabilization

iii. Decontamination Priorities

1. If exposed before precautions can be taken:
2. Exposure and Contamination from patients is usually minimal.
3. Standard Precaution
Gowns/Gloves provide very good protection.
4. Radiation Officer surveys and monitors Staff, using. . .
5. Personal dosimeter: helps regulate time of staff exposure
6. Radiological assessment/surveys: before/after patient encounter
7. Control contamination of work area/zones
8. Prevent RE-exposure
9. Shielding may be used in certain circumstances
10. Decontamination after patient care is done is required.

c. Diagnosis

- a. Obtain patient physical and exposure history
- b. Obtain blood for CBC and lymphocyte count ASAP and at 2-3 hour interval to assess lymphocyte depletion
- c. Chromosomal analysis of lymphocytes
- d. Information from first responders regarding exposure history
- e. Estimate dose from patient history, serial lymphocyte count and time to emesis using AFRRI Biological Assessment Tool (BAT)

d. Seek expert help

Radiation Emergency Assistance Center/ Training Site (REAC/TS) at (865)-576-3131 or (865)-576-1005
Medical Radiobiology Advisory Team (MRAT) at (301)-295-0316

Patient Care Guidelines:

ASSESSMENT AND MANAGEMENT OF PSYCHOLOGICAL CONSEQUENCES OF TRAUMA AND TERRORISM

NORMAL REACTIONS

Children, like adults, are resilient, and with appropriate support will cope with the effects of a traumatic event. The following are common, normal reactions to trauma:

Normal Trauma Reactions: Infant (birth to age 2):

Respond to the distress of caregivers and the resulting disruption in the attachment relationship.

- Separation issues
- Appear “fussy”
- Regressive behaviors
- Crying
- Feeding and sleeping problems
- Easily startled

Normal Trauma Reactions: Toddler and Pre-school (2-6 years old):

Difficulty understanding other points of view. Inability to understand death as permanent.

- Regressive behaviors
- Sensitivity to loud noises, easily startled
- Trouble falling or staying asleep/nightmares
- Confusion and irritability
- Temper tantrums
- Magical thinking
- Blaming oneself for event
- Increased worries and fears
- Uncontrollable crying
- Running aimlessly
- Excessive clinging to care taker
- Appetite changes
- Fear of going to sleep or leaving the house

Normal Trauma Reactions: School-Age (7-11 years old):

Concrete thinking makes traumatic experiences difficult to comprehend.

- Fear, confusion, and anxiety
- Excessive clinging to care taker
- Competing with siblings for attention
- Regressive behaviors
- School avoidance
- Decrease in concentration
- Argumentative
- Rebellious behaviors
- Withdrawal from peers and/or family
- Focus on concrete details of event
- Sleep and appetite changes

Normal Trauma Reactions: Teenage (12-18 years old):

Can think independently and abstractly. Good sense of cause and effect. Have increased focus on religion, spirituality, morality, and ethics.

- Sadness
- Feelings of hopelessness and helplessness
- Increased worries and fears
- Somatic complaints
- Isolating behavior
- Tend to internalize feelings
- Risk taking behaviors
- Irritability and acting-out behaviors
- Increased defiance, wish for revenge
- Action oriented response to trauma
- Disenchantment
- Apathetic
- Minimization of concerns
- Decrease in concentration

ABNORMAL REACTIONS:

With proper interventions, treatment and support, long-term stress disorders and psychiatric morbidity can be mitigated and possibly prevented.

SEVERITY SPECTRUM FOR TRAUMA-RELATED DISORDERS

	Symptom Severity			
	MILD ←			→ SEVERE
Condition	Bereavement/Stress Reaction (NOT disorders)	Adjustment Disorder	Acute Stress Disorder	Posttraumatic Stress Disorder
Symptoms	Full range of emotional reactions	Depression, anxiety, apathy, sleep/eating changes, withdrawal, suicidality, etc.	Disassociative symptoms and some reexperiencing, avoidance, arousal	Reexperiencing, avoidance, arousal
Treatment	Sometimes (short-term symptomatic relief)	Often	Usually	Almost always
Final Impact	Normally resolves by 2 months to 1 year after traumatic experience	Usually resolves within 6 months of termination of stressor	Resolves within 4 weeks or progresses to PTSD	May last for years and result in inability to function

The following will impact a child's reaction to trauma:

- Amount of destruction seen
- Gruesome nature of the event
- Death and/or injury of loved one
- Direct or indirect involvement in the trauma

Acute Stress Disorder (ASD): Lasting up to 4 weeks.

- Maladaptive and impaired thoughts, feelings, and behaviors in response to traumatic events.

Post-Traumatic Stress Disorder (PTSD): People are “stuck” on the trauma, keep re-living it in thoughts, feelings, images and/or behavior.

- Symptoms lasting more than four weeks. Delayed onset can occur months to years later.

ASD and PTSD Symptoms Overlap:

- **Derealization:** Emotional numbing, dazed, unable to recall the trauma.
- **Intrusive thoughts:** Flashbacks and nightmares of the event.
- **Avoidant behavior:** Avoidance of thoughts, feelings, conversations, activities, places, or people associated with the trauma. Can manifest as school refusal and withdrawal.
- **Hyperarousal:** Exaggerated startle response, explosive anger, restlessness, insomnia, decrease in concentration.

Risk factors for ASD and PTSD:

- Previous psychiatric disorder
- Previous trauma or exposure
- Limited education
- Limited coping skills
- Family history of depression, anxiety, and drug abuse
- Family dysfunction
- Limited social supports

NEURO-PSYCHIATRIC SYMPTOMS OF WMD AGENTS

Differentiate between autonomic arousal and reactions caused by agent or treatment of agent.

General Symptoms of Anxiety and Autonomic Arousal:

- Anorexia
- Diarrhea
- Dry mouth
- Nausea/vomiting
- Chest pain/tightness
- Diaphoresis
- Dyspnea
- Hyperventilation
- Dizziness
- Faintness
- Paresthesias
- Palpitations
- Flushing
- Pallor
- Muscle tension/aches
- Urinary frequency

BIOLOGIC AGENTS

Neuropsychiatric syndromes or symptoms:

Anthrax: Meningitis, advanced stage- encephalitis, hallucinations

Brucellosis: Depression, irritability, headaches

Q fever: Malaise, fatigue, encephalitis, hallucinations

Botulinum toxin: Depression due to lengthy recovery

Viral encephalitis: Mood changes such as depression, long-term cognitive impairment

Viral Hemorrhagic Fevers: Restlessness, confusion, myalgia, and hyperesthesia

All biologic agents: Delirium

CHEMICAL AGENTS

Acute effects of exposure to Organophosphate pesticides (Nerve agents) include:

- Impaired vigilance and concentration
- Memory deficits
- Slowing of information processing
- Psychomotor retardation
- Slowing of speech
- Word finding difficulties
- Depression
- Anxiety
- Irritability

Long-term neuro-psychiatric effects of acute intoxication with organophosphate pesticides (nerve agents) include:

- Drowsiness, fatigue
- Memory impairment
- Depression
- Increased irritability
- Auditory problems
- Visual memory deficit
- Decrease in motor speed
- Decrease in problem solving ability

Blister Agents: (Nitrogen or sulfur mustards):

- Psychological distress over disfigurement
- Sensation of suffocation

Other Chemical Agents: Cyanide:

- Anxiety
- Confusion
- Nausea
- Feeling of weakness
- Giddiness
- Hyperventilation

TREATMENT OF CHEMICAL AGENT EXPOSURE

Treatment of nerve agent exposure using Atropine may cause psychiatric symptoms including:

- Drowsiness
- Hyperactivity
- Hallucinations
- Blurred vision
- Tachycardia

- Dry mouth
- Suppression of sweating
- Urinary retention
- Cognitive impairment
- Psychosis
- Delirium
- Coma

RADIATION

Acute radiation exposure:

- Rapid onset of nausea, vomiting, and malaise.
(This can be confused with psychogenic vomiting that can result from stress/fear reactions.)

Chronic radiation exposure:

- Sleep/appetite disturbances
- Generalized weakness, easily fatigued
- Increased excitability, mood changes
- Impaired memory, loss of concentration

Psychological effects of blast and thermal agents:

- Acute and chronic stress disorders
- Survivor guilt
- Anticipation of lingering death

Recommendations and Guidelines for Assisting Children and Families after a WMD-related Attack:

- Do not over-medicalize normal reactions to an abnormal situation! Understand normal symptoms that will resolve over time with appropriate support.
- Avoid the use of the term “worried well” or similar expressions.
- Provide clear, accurate, and ongoing communication to both children and families.
- Whenever possible, reunite children with families, and facilitate communication.
- Be aware that hoaxes, myths, misunderstanding and unfamiliarity of the events can increase anxiety.
- Be aware that the personal protective equipment, process for decontamination, and isolation may be especially frightening for children.
- Provide reassurance and support
- Even if a person has not been exposed to an agent, psychosomatic symptoms may be present due to the public’s fear of the effects of exposure to agents.

Professional intervention and appropriate treatment may be necessary to reduce potential long-term psychiatry morbidity.

Recommendations for Healthcare Providers:

- Healthcare providers can also feel anxious and have concerns about traumatic events. To provide the best care for patients and families, healthcare providers must take care of their own emotional health as well.
 - Be sure to take breaks and get enough sleep.
 - Maintain regular exercise and proper nutrition.
 - If stress begins to interfere with daily activities and functioning, it is important to seek assistance from a mental health professional, a member of the CISM team, or Employee Assistance Program.

We are all affected by these events!

REFERENCES

1. Center for the Study of Traumatic Stress, Uniformed Services University School of Medicine. “Psychological and Behavioral Issues Healthcare Providers Need to Know When Treating Patients Following A Radiation Event.”
2. DiGiovanni, Cleto. “Domestic Terrorism with Chemical or Biological Agents: Psychiatric Aspects”, *Am J Psychiatry*, 1999; 156:1500-1505.
3. Military Medical Operations Office, Armed Forces Radiobiology Research Institute. *Medical Management of Radiological Casualties Handbook, 1st Edition*. Bethesda, Maryland: AFRRI, 1999.
4. U.S. Army Medical Research Institute of Chemical Defense. *Medical Management of Chemical Casualties Handbook*. Aberdeen Proving Ground, Maryland: USAMRICD, 2000.
5. U.S. Army Medical Research Institute of Infectious Diseases. *USAMRIID’s Medical Management of Biological Casualties Handbook*. Fort Detrick, Maryland: USAMRIID, 2001.