



MSSNY

Medical Society of the
State of New York

BIOLOGICAL, CHEMICAL, AND RADIOLOGICAL TERRORISM: An Overview of Indicators and Response

INTRODUCTION

This guide provides physicians and other healthcare providers with basic information to help identify and respond to patients affected by biological, chemical, or nuclear/radiological agents. Healthcare workers should be alert to illness patterns and reports of biological, chemical, or radiological exposure that might signal an act of terrorism. This guide is intended to provide an overview of some of those potential threats.

RECOGNIZING A TERRORISM-RELATED EVENT

Biological Agents

- Unusual numbers of sick or dying people and/or animals, especially over a short period
- Severe disease in previously healthy people
- Out-of-season or region disease outbreaks
- Outbreak of previously rare disease
- Unscheduled and unusual aerial spraying
- Abandoned spray devices

Chemical Agents

- Mass casualties
- Definite pattern of casualties and physical syndromes
- Illness associated within a confined geographic area
- Dead insects/animals/birds/fish
- Vegetation dies out of season
- Unusual liquid droplets
- Unexplained odors
- Unexplained low-lying clouds
- Unusual metal debris, especially if wet and no rain

Radiological Events

- Acute radiation sickness unfolds over days or weeks
- Within 2-3 weeks, cluster of people presenting with nausea, vomiting, skin redness (in the absence of a known heat source), tendency to bleed, and/or hair loss

INFECTION CONTROL

Standard Precautions

For procedures likely to generate splash or contact w/ blood or body fluids/secretions/excretions: gowns, masks, protective eyewear, gloves, hand washing after gloves are removed

Contact Precautions

Standard precautions; plus gown if clothing will contact patient or if patient has diarrhea, ileostomy, colostomy, or uncontained wound drainage; gloves when entering patient room; medicated handwashing agent

Droplet Precautions

Standard precautions; plus mask for those entering room of patient, surgical mask on patient during transport

Airborne Precautions

Standard precautions; plus N95 mask or respirator for those entering room of patient, surgical mask on patient during transport

REPORTING

Report suspected or confirmed cases of any of the biological, chemical, or nuclear agents listed in this brochure immediately to your local or state department of health.

New York State Department of Health, Office of the Commissioner: **518-474-2011**

New York City Department of Health, Office of Communicable Diseases: **212-788-9830**

If not in New York City, locate your local health department in New York.

New York State Association of County Health Officials: **518-456-7905**

www.nysacho.org/Directory/directory.html

RESOURCES

New York State Department of Health (NYS-DOH)

www.health.state.ny.us/home.html

Bureau of Environmental Radiation Protection: **518-402-7550**

Bureau of Toxic Substance Assessment: **518-402-7870**

Communicable Disease Control: **518-473-4436**

Wadsworth Center Laboratories: **518-474-4177**

After hours NYSDOH Duty Officer: **518-465-9720**

After hours State Emergency Management Office (SEMO) State Warning Point: **518-457-2200**

New York City Department of Health (NYC-DOH)

www.nyc.gov/html/doh/home.html

Bureau of Radiological Health: **212-676-1572**
(After hrs 212-764-7667)

NYC Public Health Laboratories: **212-447-2864**

Poison Control Center: **212-764-7667**

Medical Society of the State of New York (MSSNY)

www.mssny.org

Phone: **518-465-8085** (Albany)

Phone: **516-488-6100** (Lake Success)

Armed Forces Institute of Pathology (AFIP)

www.afip.org

Information Desk: **202-782-2100**

Centers for Disease Control and Prevention (CDC)

www.cdc.gov, www.bt.cdc.gov

Bioterrorism Preparedness and Response Program

Hotline: **770-488-7100**

National Immunization Hotline: **800-232-2522**

Federal Bureau of Investigation (FBI) Operations Center

www.fbi.gov/terrorinfo/terrorism.htm

Phone: **202-324-6700**

Federal Emergency Management Agency (FEMA)

www.fema.gov

Phones: **800-480-2520**, **202-646-4600**

FEMA Operations Center: **800-634-7084**,

540-665-6100, **703-771-6100**

FEMA National Preparedness Office: **202-324-9025**

AppleCare Foundation

www.applecarefoundation.org/research2.html

Poison Control Centers

Hotline: **1-800-222-1222**

State public-health locator for officials, agencies, and public hotlines

www.statepublichealth.org,

www.cdc.gov/other.htm#states

Strategic National Stockpile (SNS)

www.bt.cdc.gov/stockpile

Phone: **404-639-0459**

U.S. Army Medical Research Institute of Chemical Defense (USAMRICD)

ccc.apgea.army.mil

Phone: **410-436-2230**

U.S. Army Medical Research Institute of Infectious Diseases (USAMRIID)

www.usamriid.army.mil

Response Line: **888-USA-RIID (888-872-7443)**

U.S. Department of Health and Human Services

www.hhs.gov

Phone: **202-619-0257**

U.S. Department of Homeland Security

www.whitehouse.gov/homeland

Homeland Security state contact list:

www.whitehouse.gov/homeland/contactmap.html

U.S. Food and Drug Administration (FDA)

www.fda.gov,

www.fda.gov/oc/opacom/hottopics/bioterrorism.html

Phone: **1-888-INFO-FDA (1-888-463-6332)**

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Anthrax

Biological Agent

The bacteria *Bacillus anthracis*

Indications of Terrorist Release

The sudden appearance in a region of a large number of patients with flulike illness (particularly off flu season), respiratory symptoms, and a high fatality rate, with nearly 1/2 of all deaths occurring w/in 24-48 hrs from time that symptoms begin, would suggest a release of inhalation anthrax as a biological weapon.

Possible Means of Exposure

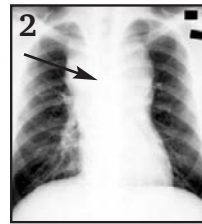
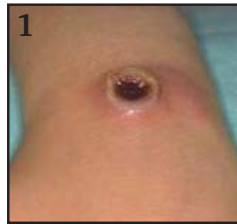
Inhalation, ingestion, and cutaneous

Incubation

Cutaneous: 1-12 days

Gastrointestinal: 3-7 days

Inhalational (most likely in bioterror attack): 1-60 days



(1) Cutaneous anthrax lesion on hand, about 5 days after exposure. (2) Inhalational anthrax; arrows point to the widened mediastinum.

Primary Symptoms of Inhalational Anthrax

Flulike symptoms (e.g., fever, malaise, myalgias, headache, abdominal pain, vomiting, coughing, chest pain) but no nasal congestion; increasingly severe respiratory symptoms, including dyspnea, stridor, and cyanosis, and expansion of the mediastinum seen on chest X-ray.

Diagnostic Tool of Choice

Tissue/blood culture

Treatment

Immediate initiation of IV antibiotics (1st choice = penicillin in non-allergic pts, penicillin-sensitive organisms)

Post-Exposure Prophylaxis

Antibiotic therapy PO. (1st choice = ciprofloxacin)

Vaccine

Available

Infection Control

- Use standard precautions.
- Isolation of patient not indicated.
- Note that anthrax spores are resistant in the environment and decontamination efforts will be difficult.

Botulism

Biological Agent

Botulinum toxin produced by the bacteria *Clostridium botulinum*

Indications of Terrorist Release

In a bioterrorism attack, botulinum toxin would likely be released as an aerosol, hence respiratory symptoms could accompany neurological manifestations (GI symptoms may be present as well).

Possible Means of Exposure

Inhalation, ingestion of contaminated food or untreated water, contamination of an open wound by live bacteria

Incubation

Foodborne: 2 hrs to 8 days

Inhalational: 12-72 hrs

Primary Symptoms/Foodborne Botulism

Begins as acute, afebrile, symmetric, descending paralysis. Effects always begin at the head; prominent findings include ptosis, diplopia, blurred vision, dilated or sluggishly reactive pupils (only <50% of pts), dysarthria, dysphonia, and dysphagia. Mouth may appear dry and pharynx injected. Loss of head control, hypotonia, and generalized weakness become prominent. Dysphagia and loss of protective gag reflex may follow. Deep tendon reflexes may diminish or disappear. If untreated, paralysis will travel symmetrically down body, affecting arms, torso, legs, and respiratory muscles. Other symptoms include fatigue, constipation, urinary retention, dizziness, anorexia, nausea, and vomiting. There are no sensory deficits.

Primary Symptoms/Inhalational Botulism

Symptoms similar to foodborne form but could include chest pain, nonproductive cough, and other respiratory symptoms.

Diagnostic Tool of Choice

Mouse bioassay (must be sent to state health department or CDC)

Treatment

Antitoxin: trivalent (types A, B, E) equine serum

Post-Exposure Prophylaxis

To preserve scarce supplies of antitoxin, asymptomatic exposed persons should delay prophylactic Rx and remain under observation

Vaccine

Under development

Infection Control

- Use standard precautions.
- The toxin is not dermally active and secondary aerosols are not a hazard.

Brucellosis

Biological Agent

Bacteria of the genus, *Brucella*

Indications of Terrorist Release

In a bioterrorism attack, brucellae would likely be released as an aerosol and inhaled; terrorism indicators are a number of brucellosis cases within a short period and without animal contact or other risk factors.

Possible Means of Exposure

Ingestion of/or contact with contaminated animals or animal products, or by inhalation; person-to-person transmission possible but unlikely

Incubation

5-60 days (usually 2-3 wks)

Primary Symptoms

Flulike symptoms including intermittent fevers, myalgias, arthralgias, back pain, generalized weakness, fatigue, cough, pleuritic chest pain; nausea, vomiting, diarrhea, and/or constipation may also be present.

Diagnostic Tools of Choice

Blood or bone marrow culture; serologic testing

Treatment

Doxycycline + gentamycin, streptomycin, or rifampin for 6 wks

Post-Exposure Prophylaxis

Doxycycline (+ rifampin if large exposure suspected)

Vaccine

Not available

Infection Control

- Use standard precautions.
- Rare cases of person-to-person transmission noted but considered insignificant.

Glanders

Biological Agent

The bacteria *Burkholderia mallei*

Indications of Terrorist Release

Occurrence in the absence of animal contact and/or in a human epidemic form is strong evidence of a bioterror attack.

Possible Means of Exposure

Inhalation (most likely in bioterror attack), through mucous membranes or abraded skin; person-to-person unlikely but possible; animal exposure

Incubation

10-14 days

Primary Symptoms of Pulmonary Glanders

High fever, chills, sweats, myalgias, rigors, headache, pleuritic chest pain, cervical adenopathy, pneumonia; bloody nodules or ulcers may form on mucous membranes.

Diagnostic Tools of Choice

Complement fixation test, Gram stain, chest X-ray

Treatment

Antibiotics (specific recommendations for best-choice vary) lasting for 60-150 days; 2-drug antibiotic therapy for severe cases

Post-Exposure Prophylaxis

TMP/SMX

Vaccine

Not available

Infection Control

- Use standard precautions.
- Use contact precautions when caring for patients with skin involvement.

Melioidosis

Biological Agent

The bacteria *Burkholderia pseudomallei*

Indications of Terrorist Release

Occurrence in the absence of animal contact and/or in a human epidemic form is strong evidence of a bioterror attack.

Possible Means of Exposure

Inhalation (most likely in bioterror attack), through skin abrasions; person-to-person rare but possible

Incubation

2 days to years



Chest X-ray showing melioidosis infection involving the right upper lung.

Primary Symptoms of Pulmonary Melioidosis

High fever, chills, sweats, myalgias, rigors, headache, chest pain, cough (productive or non-productive), cervical adenopathy, anorexia, pneumonia; cutaneous abscesses may appear months later.

Diagnostic Tools of Choice

Complement fixation test, Gram stain, chest X-ray

Treatment

Antibiotics (specific recommendations for best-choice vary) lasting for 60-150 days; 2-drug antibiotic therapy for severe cases

Post-Exposure Prophylaxis

Ciprofloxacin, doxycycline, or amoxicillin-clavulanate

Vaccine

Not available

Infection Control

- Use standard precautions.
- Use contact precautions when caring for patients with skin involvement.

Plague

Biological Agent

The bacteria *Yersinia pestis*

Indications of Terrorist Release

In a bioterrorism attack, *Y. pestis* would likely be released as an aerosol and inhaled; a large number of previously healthy persons rapidly progressing from flulike symptoms to cough, dyspnea, chest pain, to severe pneumonia and death suggestive of attack; most natural cases in the U.S. occur in southwestern states.

Possible Means of Exposure

Inhalation; person-to-person

Incubation

Bubonic: 2-8 days

Pneumonic (most likely in bioterror attack): 1-8 days



Bubonic plague patient with swollen, ruptured inguinal lymph node ("bubo").



Right hand of a plague patient displaying acral gangrene.

Primary Symptoms of Pneumonic Plague

Fulminant onset w/ high fever, chills, headache, extreme malaise, and myalgias; cough and hemoptysis w/in 24 hrs; nausea, vomiting, and abdominal pain may also occur; rapidly progresses to dyspnea, stridor, cyanosis, respiratory failure, and circulatory collapse.

Diagnostic Tools of Choice

Culture, serology, Gram/Wright stain, chest X-ray

Treatment

Streptomycin or penicillin

Post-Exposure Prophylaxis

Doxycycline or ciprofloxacin

Vaccine

No longer available (discontinued by its manufacturers in 1999)

Infection Control

- Use standard precautions.
- Mask suspected pneumonic plague patients in ER/transport; isolate confirmed patients, using strict droplet precautions.
- Decontaminate surfaces, clothing, and bedding thoroughly.

Q Fever

Biological Agent

The bacteria *Coxiella burnetii*

Indications of Terrorist Release

In a bioterrorism attack, *C. burnetii* would likely be released as an aerosol and inhaled; a bioterrorist release would cause disease similar to that occurring naturally.

Possible Means of Exposure

Inhalation, ingestion, bites from infected ticks, contact with infected animals; person-to-person (rare)

Incubation

14-40 days

Primary Symptoms of Inhalational Exposure / Pneumonic Q fever

Flulike symptoms including high fever and severe headache; fatigue, weight loss, myalgias, pleuritic chest pain, abdominal pain, vomiting, diarrhea; pulmonary presentation, sometimes of rapid progression, is atypical with dry, non-productive cough, or may present as pneumonia w/o pulmonary symptoms; hepatitis may also develop; there are many clinical syndromes that Q fever can present with, though not likely to occur after an aerosol attack; in rare circumstances it progresses to culture-negative endocarditis and chronic disease.

Diagnostic Tools of Choice

Serology, PCR

Treatment

Doxycycline (first-choice) or tetracycline

Post-Exposure Prophylaxis

Doxycycline or tetracycline

Vaccine

A vaccine is currently under investigation; previous Q fever patients should not receive the vaccine

Infection Control

- Use standard precautions.
- Person-to-person transmission is rare.

Ricin

Biological Agent

Toxin from the castor bean plant (*Ricinus communis*)

Indications of Terrorist Release

Ricin intoxication should be considered in any cluster of patients with acute, unexplained, pulmonary injury or GI bleeding.

Possible Means of Exposure

Inhalation, ingestion, injection

Incubation

2 hours to 3 days

Primary Symptoms of Inhalational Ricin Intoxication

Fever, chest tightness, cough, dyspnea, nausea, arthralgias, progressive respiratory insufficiency, leading to cyanosis, necrotizing pneumonitis, and pulmonary edema; could be fatal within a few days. (Note that limited data exists, primarily animal studies.)

Primary Symptoms of Ingested Ricin

Abdominal pain, nausea, vomiting, profuse bloody diarrhea; severe GI lesions with irritation of the oropharynx, esophagus, or stomach; in severe cases shock may develop. Late-phase complications can include cytotoxic effects on the liver, CNS, kidney, and adrenal glands.

Diagnostic Tool of Choice

ELISA (serum and respiratory secretions)

Treatment

Supportive

Post-Exposure Prophylaxis

Under development

Vaccine

Under development

Infection Control

- Use standard precautions.
- The toxin is non-volatile and secondary aerosols are not expected to be a hazard.

Smallpox

Biological Agent

The Variola major virus

Indications of Terrorist Release

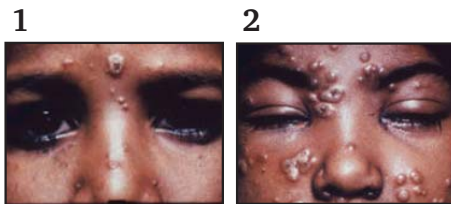
Since smallpox has been eradicated in the world since 1977, even one confirmed case would indicate a probable terrorist attack.

Possible Means of Exposure

Inhalation of airborne droplets; contact with skin sores, secretions, or clothing or bedding

Incubation

7-17 days



1) Chickenpox patient with pustules (day 5),
2) Smallpox patient with pustules (day 5).

Primary Symptoms

Initial symptoms are flulike, including fever, vomiting, myalgias, physical exhaustion; rash appears ~ day 12 post-exposure, at which point patient becomes highly contagious; then formation of macular rash → papules → vesicles → pustules → scabs, most densely on face and limbs, including palms and soles of feet (i.e., centrifugal distribution, unlike chickenpox, in which lesions are distributed evenly over the body, beginning on the trunk); lesions go through stages at the same time (unlike chickenpox, in which new lesions form and scab over at different times).

Diagnostic Tools of Choice

Culture followed by PCR and RFLP (by BSL-4 laboratory), electron microscopy

Treatment

Vaccination up to 4 days after exposure

Post-Exposure Prophylaxis

Vaccination

Vaccine

Currently available to high-risk groups (1st responders, etc.)

Infection Control

- Use strict standard, contact, droplet, and airborne precautions.
- Patients and contacts should wear N95 mask or better.
- Consider bedding and clothing of patients potentially infectious.
- Quarantine/respiratory isolation/vaccination program for patients and secondary contacts will be necessary in the event of an outbreak.

Staphylococcal Enterotoxin B

Biological Agent

The toxin Staphylococcal enterotoxin B (SEB), produced from a strain of the bacteria *Staphylococcus aureus*

Indications of Terrorist Release

In a bioterrorism attack, SEB could be released as an aerosol and inhaled; unlike natural food poisoning caused by SEB, pulmonary symptoms would be present and the source would not be traced to a common food source.

Possible Means of Exposure

Inhalation, ingestion

Incubation

Foodborne: 1-6 hrs

Inhalational: 3-12 hours

Primary Symptoms of Foodborne SEB

Begins abruptly with acute salivation, nausea, and vomiting, followed by abdominal cramps and diarrhea, which can be hemorrhagic; usually resolves within 8 hrs.

Primary Symptoms of Inhalational SEB

Flulike symptoms such as high fever, headache, chills, myalgias; nonproductive cough; conjunctivitis may be present; severe exposure may produce dyspnea, chest pain, nausea, vomiting, diarrhea, dehydration, hypotension; could progress to pulmonary edema and ARDS.

Diagnostic Tools of Choice

Obtain urine sample as soon as possible, as well as respiratory secretions and/or nasal swabs; antigen detection on environmental and clinical samples (ELISA, ECL)

Treatment

Supportive

Post-Exposure Prophylaxis

Experimental only

Vaccine

Under development

Infection Control

- Use standard precautions.
- SEB is not dermally active and secondary aerosols are not a hazard.

Tularemia

Biological Agent

The bacteria *Francisella tularensis*

Indications of Terrorist Release

In a bioterrorism attack, *F. tularensis* would likely be released as an aerosol and inhaled; due to its low incidence in the U.S., an outbreak of pneumonic or typhoidal tularemia should bring suspicion of an attack; natural cases in the U.S. are virtually all rural and/or involve animal contact.

Possible Means of Exposure

Inhalation, ingestion, through abraded skin and mucous membranes, insect bites, animal contact

Incubation

Pneumonic (most likely in bioterror attack): 1-21 days (average is 3-5 days)

General Symptoms

Abrupt onset of fever, chills, headache, anorexia, malaise, fatigue; other Sx include cough, myalgias, chest discomfort, vomiting, sore throat, abdominal pain, diarrhea.

Primary Symptoms/Pneumonic Tularemia

General Sx + localized lymphadenopathy, no or minimal sputum production, chest tightness and pain, rales; may have no symptoms of clinical pneumonia; lung abscesses may occur; can progress to severe respiratory symptoms, including respiratory failure.

Primary Symptoms/Typhoidal Tularemia

Defined as a febrile illness caused by *F. tularensis* w/o lymphadenopathy and that does not fit into other categories; immune-deficient or people w/ other medical disorders especially prone; Sx similar to general Sx; possible severe, fulminant pneumonia.

Diagnostic Tools of Choice

Direct fluorescent antibody stain, PCR, antigen detection

Treatment

Antibiotics (streptomycin or gentamycin) as early as possible

Post-Exposure Prophylaxis

Doxycycline or ciprofloxacin

Vaccine

Previously available for laboratory personnel; currently under review by FDA

Infection Control

- Use standard precautions.
- No patient isolation required due to lack of person-to-person transmission.

Viral Hemorrhagic Fevers (VHFs)

Biological Agents

Viruses from 4 major families: filoviruses (Ebola, Marburg fevers), arenaviruses (Lassa, New World fevers), bunyaviruses (Rift Valley fever, hantavirus infection), and flaviviruses (yellow fever)

Indications of Terrorist Release

In a bioterrorism attack, VHFs would likely be released as an aerosol and inhaled; any outbreak outside the area of a virus's natural occurrence should be highly suspect of a bioterror attack, particularly w/ no known risk factors (e.g., travel to Africa or Asia, handling of animal carcasses, contact w/ sick animals or people, or arthropod bites w/in 21 days of onset of symptoms).

Possible Means of Exposure

Inhalation, through mucous membranes; mosquito bite or direct contact with an infected person or animal or their secretions, depending on the VHF

Incubation

2-21 days

Primary Symptoms

Flulike symptoms such as high fever, headache, malaise, myalgias, and nausea; other possible symptoms, depending on syndrome, are extreme weakness, conjunctivitis, hypotension, edema, lymphadenopathy, rash, flushing of the skin, petechiae and bruising, hemorrhaging, renal dysfunction, tremors, jaundice, deafness.

Diagnostic Tools of Choice

ELISA, RT-PCR

Treatment

Ribavirin for some (used under IND protocol); for others, supportive care only

Post-Exposure Prophylaxis

Prophylactic post-exposure ribavirin is not recommended

Vaccine

Available for yellow fever only; Ebola, Rift Valley, and Hantavirus vaccines under investigation

Infection Control

- Use strict standard precautions.
- For some, contact, droplet, and/or airborne precautions also required.
- Patients generally have significant amounts of virus in their blood and other secretions (hantavirus is an exception).

Chemical Agents Overview

Examples of Chemical Agents

Nerve Agents; Blister Agents (also known as "vesicants" or "mustard agents");

Chemical Asphyxiants (also known as "blood agents"); **Pulmonary Irritants** (also known as "choking agents")

Indications of Terrorist Release

Most chemical agents work relatively fast, hence the presence of one would initially primarily be detected by the symptom pattern victims were experiencing.

PRIMARY CHARACTERISTICS

Nerve Agents

See next panel of this brochure.

Blister Agents

Examples: Lewisite (military code name L),

mustards (HD, HN, HT), phosgene oxime (CX); **Common odors:** Odorless, garlic, mustard, onion, geraniums, pepper; **Onset of symptoms:** Immediate (L, CX) to 2-48 hrs (HD); **Symptoms:** Erythema, pruritus, burning of the skin, large blister formation, eye and airway irritation, sore throat, cough, chest pain, profuse rhinorrhea, copious pulmonary secretions, nausea and vomiting can also occur; **Rx:** Iodophors for skin; dimercaprol for L

Chemical Asphyxiants

Examples: Hydrogen cyanide (AC), cyanogen chloride (CK), arsine (SA); **Common odors:** Bitter almonds, garlic; **Onset of symptoms:** Most immediate, SA may be delayed by hrs; **Symptoms:** AC/CK—Irritation to eyes, nose, and airways; dyspnea, agitation, weakness,

nausea, vomiting, muscular trembling; SA—Conjunctival redness, garlic breath odor, headache, thirst, shivering, weakness, abdominal pain; **Rx:** Sodium nitrite/sodium thiosulfate for AC and CK; supportive

Pulmonary Irritants

Examples: Phosgene (CG), chlorine (CL), diphosgene (DP), chloropicrin (PS), and ammonia; **Common odors:** Green corn, newly mown hay; **Onset of symptoms:** Usually rapid, effects of CL may be delayed; **Symptoms:** Burning eyes, nose, and throat; conjunctival injection, lacrimation, rhinorrhea, laryngeal spasm, chest pain and tightness, dyspnea; after 3 hrs to days, respiratory symptoms may progress to pulmonary edema and respiratory failure; **Rx:** Supportive

Nerve Agents

Examples of Nerve Agents

Sarin (military code name GB), tabun (GA), soman (GD), cyclosarin (GF), VX, VE, VG, VM

Indications of Terrorist Release

Since nerve agents in their pure form are odorless and colorless, an attack would initially primarily be identified by the symptoms victims were experiencing.

Possible Means of Exposure

Inhalation, absorption through mucous membranes; dermal absorption upon contact with the liquid form (particular danger for VX, which is most commonly an oily, amber-colored liquid)

Time from Exposure to Illness

Inhalation: Seconds to minutes

Dermal absorption: 1 minute to 18 hours

Primary Symptoms of Inhalational Exposure

Miosis (13% will have dilated pupils); dimmed or blurred vision; lacrimation; rhinorrhea; sudden excess oral, nasal, and respiratory secretions; headache; dyspnea/wheezing; sweating; sneezing; urinary and fecal incontinence; vomiting; sudden loss of consciousness; muscle fasciculations; seizure; flaccid paralysis.

Primary Symptoms of Dermal Exposure

May include localized sweating, fasciculations, nausea, vomiting, diarrhea, generalized diaphoresis, generalized weakness, miosis; large exposure will resemble inhalational exposure.

Diagnostic Tools of Choice

Clinical syndrome + percent reduction of RBC-cholinesterase

Treatment

Atropine and pralidoxime

Prophylaxis

Under development for sarin

Decontamination

Thorough decontamination of patient is important as risk of secondary contamination is high.



Nerve agent antidote kits (NAAK), also known as Mark-1 kits, contain 1 dosage of the antidotes atropine and pralidoxime.

Nuclear / Radiation Emergencies

Examples of N/R Events

DIRTY BOMBS: Conventional explosive dispersing radiological substances. Most injuries would occur from the blast itself. Acute radiation poisoning extremely unlikely after dirty-bomb detonation since radioactive materials would most certainly be low grade.

AEROSOL RELEASE: Radioactive materials would likely be low-grade.

NUCLEAR REACTOR BREACH: Could result in radioactive fallout, including radioactive iodine.

NUCLEAR BOMB: Massive explosion of atomic, hydrogen, or neutron bomb. Widespread radioactive fallout could occur, including radioactive iodine. Neutron bombs create minimal blast and heat but a high degree of penetrative radiation.

Indications of Terrorist Release

The determination of radiation dispersal will likely be made rapidly after a suspected event. See **Symptoms** below for physical effects.

Possible Means of Exposure

Inhalation, ingestion, dermal absorption

Time from Exposure to Illness

Hours to years

Symptoms of Severe Radiation Exposure

Signs of severe radiation exposure ("radiation poisoning") include burning of skin with redness, blistering, and peeling; inflammation of skin and mucous membranes; dehydration; nausea; vomiting; diarrhea; convulsions; exhaustion. Delayed symptoms include open sores on skin and in mouth or along intestinal

tract; bloody diarrhea; hematemesis; bleeding from the nose, mouth, and gums; bruising; and hair loss.

Diagnostic Tools of Choice

Geiger counters/dose-rate meters for external radiation measures; difficult to determine individual absorption but tests are available; WBC count helpful

Treatment

Potassium iodide (KI) w/in 3-4 hrs if radioactive iodine is present (priority to those under 18 yo); otherwise, supportive

Decontamination

External and internal decontamination should take place. For external, gently wash wounds and orifices first; chelating agents can be used for internal. At minimum, remove clothes, wash w/ soap and water, and flush eyes. Use standard precautions when caring for patients.