QUICK BIO-AGENTS

USAMRIID's Pocket Reference Guide to Biological Select Agents & Toxins

USAMRIID
United States Army Medical Research Institute of Infectious Diseases

Biodefense solutions to protect our nation

Quick Bio-Agents: USAMRIID's Pocket Reference Guide to Biological Select Agents & Toxins

First printing: 2012

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Purpose: This Guide is intended for primary care providers, emergency medicine providers, and others likely to be the first to see patients with symptoms of bio-agent diseases. Its intent is to serve as a guide to diagnosis, treatment, and precautions until infectious disease experts can be consulted.

Disclaimers:

1. While we have made our best effort to ensure the accuracy and completeness of the material contained in this Guide, no patient care decisions should be made based solely on this book without consultation of an authoritative medical text.
2. This Guide is not an official publication of the U.S. Department of the Defense nor is it official Doctrine, although every effort has been made to make this information consistent with official policy and doctrine.

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Emergency Response Numbers

USAMRIID's Emergency Response Line:	**888-872-7443**
National Response Center:	**800-424-8802**
National Domestic Preparedness Consortium:	**225-578-8187**
CDC's Emergency Response Line:	**770-488-7100**
FEMA Center for Domestic Preparedness	**866-213-9553**
US Army Chemical Materials Agency Operations Center	**410-436-4484 or DSN 584-4484**

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Biosafety Levels

Adapted from CDC's Biosafety in Microbiological and Biomedical Laboratories (BMBL) 5th edition

	BSL-2	BSL-3	BSL-4
Cutaneous Anthrax [1,2]	■	▒	
Pulmonary Anthrax [1,2]	■	▒	
Gastrointestinal Anthrax [1,2]	■	▒	
Tularemia [1,3]	■	▒	
Bubonic and Septicemic Plague [1,4]	■	▒	
Pneumonic Plague [1,4]	■	▒	
Brucellosis [1,5]	■	▒	
Q Fever [1,6]	■	▒	
Glanders [1,4]	■	▒	
Melioidosis [1,4]	■	▒	
Epidemic Typhus [1,6]	■	▒	
Smallpox			■
Ebola and Marburg			■
Rift Valley Fever		■	
Crimean-Congo Hemorrhagic Fever			■
Lassa Fever			■
Hemorrhagic Fever with Renal Syndrome[7]	▒	■	
Hantavirus Pulmonary Syndrome[7]	▒	■	
EEE and WEE		■	
Venezuelan Equine Encephalitis		■	
Botulism [1,2]	■	▒	
Ricin Intoxication	■		
Staphylococcal Enterotoxin B [1,2]	■	▒	
Trichothecene (T-2) Mycotoxins	■		

1. BSL-2: work involving routine clinical specimens of diagnostic quantities.
2. BSL-3: work involving large quantities or high concentrations of cultures, screening environmental samples, and for activities with a high potential for aerosol or droplet production.
3. BSL-3: manipulations of suspect cultures, animal necropsies and for experimental animal studies.
4. BSL-3: work involving large quantities or high concentrations of cultures, screening environmental samples, and for activities with a high potential for aerosol or droplet production.
5. BSL-3: manipulations of pathogenic cultures and handling products of conception containing pathogenic *Brucella*.
6. BSL-3: activities involving the inoculation, incubation, and harvesting of embryonated eggs or cell cultures, the necropsy of infected animals and the manipulation of infected tissues.
7. BSL-2: handling of sera from persons potentially infected with hantaviruses. Potentially infected tissue samples should be handled in BSL-2 facilities following BSL-3 practices and procedures.

Legend

■ Most commonly used BSL

▒ Secondary or less commonly used BSL

Risk Factors

	Travel	Reservoirs/ Vectors	Occupation	Food
Cutaneous Anthrax	endemic world-wide	cattle, sheep, goats, and horses	animal husbandry, processing of animal hides	
Pulmonary Anthrax			wool-sorter, processing of animal hides	
Gastrointestinal Anthrax				uncooked meat
Tularemia	northern hemisphere	infected ticks, deerflies, or mosquitoes	hunting	
Bubonic & Septicemic Plague	Africa, South Asia, Central Asia, Middle East, Western North America, and South America	rats, mice, ground squirrels, fleas		
Pneumonic Plague		rats, mice, ground squirrels, fleas		
Brucellosis	endemic world-wide	cattle, bison, cervids, goat, sheep, pig	animal husbandry, pork slaughtering	raw milk and soft cheeses
Q Fever	endemic world-wide	sheep, cattle, goats, cats, dogs, rodents, birds, rabbits, reptiles and ticks	animal husbandry, contact with animal birth-products	raw milk and soft cheeses
Glanders	Middle East, Asia, Africa, and South America	horses, donkeys, and mules	horse handlers	horse meat
Melioidosis	Southeast Asia, northern Australia, Papua New Guinea, much of the Indian subcontinent, southern China, Hong Kong, Taiwan and the Phillipines	Soil, dust	soldiers, farmers	contaminated water
Epidemic Typhus	refugees and homeless communities; also endemic to Andes regions of South America and in Burundi and Ethiopia	infectious feces from lice or from fleas on flying squirrels	homeless, refugees	
Smallpox	eradicated in 1980	humans		
Ebola & Marburg	Democratic Republic of the Congo, Uganda EBOLA: Republic of the Congo, Côte d'Ivoire, Gabon, Sudan ; MARBURG: Kenya, , Angola, and possibly Zimbabwe	bats(?), infected humans (person to person contact), nonhuman primates	cavers, miners	bush meat

Risk Factors (continued)

	Travel	Reservoirs/ Vectors	Occupation	Food
Rift Valley Fever	Egypt, Madagascar, Mauritania, Kenya, Somalia, Tanzania, Saudi Arabia and Yemen	Aedes mosquitos; blood from sheep, cattle or goats	animal slaughtering	
Crimean-Congo Hemorrhagic Fever	Africa and Eurasia, including South Africa, Turkey, the Balkans, the Middle East (Afghanistan, Iran, Pakistan), Russia, and western China	ticks	animal slaughtering	
Lassa Fever	West Africa	excreta from rodents		rodent meat
Hemorrhagic Fever with Renal Syndrome	Hantaan and Seoul viruses: endemic in Southeast Asia and Russia (east of Ural Mountains); Seoul virus also worldwide (mainly seaports) Puumala and Dobrava viruses: Europe and Russia (west of Ural Mountains)	Inhalation of infected rodent excreta (urine, saliva, stool)	mainly rural disease except for Seoul virus (urban)	
Hantavirus Pulmonary Syndrome	Sin nombre virus (SNV): major cause HPS in North America; Andes virus: Argentina and Chili	Inhalation of infected rodent excreta (urine, saliva, stool); person-to-person transmission with Andes virus only	mainly rural disease	
EEE and WEE	North and South America; EEE in Caribbean	Aedes or Culex mosquitos infected by horses or birds		
Venezuelan Equine Encephalitis	North and South America	Psorophora or Aedes mosquitos infected by horses		
Botulism			black-tar heroin users (also, "skin-popping" with heroin)	home-canned vegetables, fruits, and fish products
Ricin Intoxication				castor bean
Staphylococcal Enterotoxin B		Pyrogenic toxin–producing strains of Staphylococcus aureus and group A streptococcus		food poisoning with Staph aureus or group A streptococcus
Trichothecene (T-2) Mycotoxins		Fusarium tricinctum (a mold fungus)		moldy whole grains which can be inadvertently used to make bread

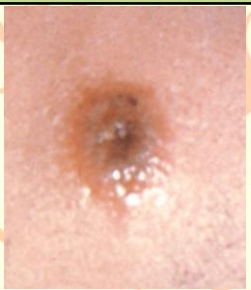
Cutaneous Anthrax

Agent: *Bacillus anthracis* | **ICD-10:** A22.0

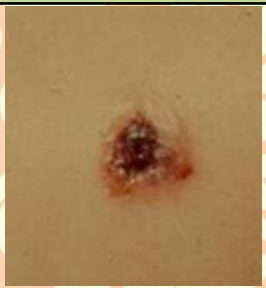
Incubation Period: 1-12 days

Signs & Symptoms	-Local skin involvement after direct contact with spores -**Painless papule** (often pruritic) that becomes vesicular with surrounding edema; subsequent development of necrotic ulcer with progression to a **coal-black scabbed lesion (eschar)** often within 7 to 10 days of the initial lesion -Fever, malaise, headache (systemic symptoms may not be present with early lesions)
Labs & Imaging	-**Skin lesion**: Gram stain, bacterial culture, PCR and IHC of the fluid of an unopened vesicle; if no vesicle is present, swab under an eschar or in the base of an ulcer -If gram stain, culture, and PCR are negative, collect a 4 mm punch biopsy of the leading margin of the lesion for general histology and IHC -**Blood:** Culture, PCR, acute and convalescent sera for antibody studies -**CXR** to assess for pulmonary anthrax
Treatment	-Ciprofloxacin (500 mg PO bid) or doxycycline (100 mg PO bid) for 7-10 days -May switch to amoxicillin (500 mg PO tid) if sensitive -If severe symptoms, use IV antibiotics (see Pulmonary Anthrax) -**Post-exposure prophylaxis:** 10-14 days of ciprofloxacin or doxycycline may be considered if no aerosol exposure; if aerosol exposure, see Pulmonary Anthrax

Precautions: Standard precautions. A 5% hypochlorite solution will kill spores. Autoclaving, steam sterilizing, or burning is required for complete eradication of spores. Avoid direct contact with wound or wound drainage. Decontamination of patients using soap and water is sufficient. Not communicable person-to-person.



Anthrax Papule



Anthrax Eschar

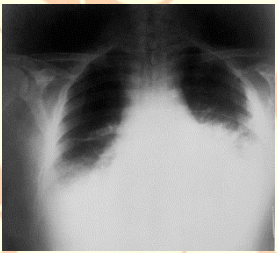
Pulmonary Anthrax

Agent: *Bacillus anthracis* | **ICD-10:** A22.1

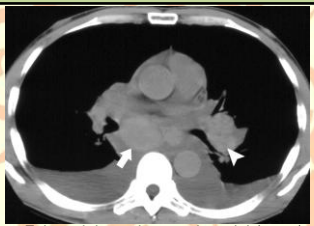
Incubation Period: 1-6 days (or up to 43 days; longer in animal studies)

Signs & Symptoms	-**Initial phase:** Non-specific symptoms: low-grade fever, nonproductive cough, malaise, headache, fatigue, myalgias, profound sweats, chest discomfort (upper respiratory tract symptoms such as rhinorrhea are rare). 1-5 days in duration. -**Subsequent phase:** May be preceded by 1–3 days of apparent improvement. Abrupt onset of high fever and severe respiratory distress (dyspnea, stridor, cyanosis), symptoms of meningitis (may be subclinical). Shock, death within 24–36 hours of onset of severe symptoms.
Labs & Imaging	-**Nasal swab, sputum, and induced sputum**: Gram stain, culture, FA, and PCR -**Blood:** Culture, PCR, and acute and convalescent sera for antibody studies -**CSF**: Gram stain, culture, and PCR -**Tissue**: Gram stain, culture, IHC and PCR -**CXR** (mediastinal widening, hemorrhagic mediastinitis, pleural effusions, and possible infiltrates) and **chest CT** (if CXR negative and anthrax strongly suspected)
Treatment	-Early initiation of appropriate antibiotics is paramount for patient survival -Ciprofloxacin (400 mg IV q12hr) or doxycycline (200 mg IV loading dose, followed by 100 mg IV q12hr) plus one or two additional antibiotics effective against anthrax (*e.g.* clindamycin, rifampin, vancomycin) -Drainage of pleural fluid -**Post-exposure prophylaxis:** Ciprofloxacin (500 mg PO bid) or doxycycline (100 mg PO bid) for 60 days. In the U.S., Anthrax Vaccine Adsorbed is available under IND for post-exposure use in conjunction with above drug therapy (contact USAMRIID for details)

Precautions: Standard Precautions. A 5% hypochlorite solution will kill spores. Autoclaving, steam sterilizing, or burning is required for complete eradication of spores. Decontamination of patients using soap and water is sufficient. Not communicable person-to-person.



Mediastinal widening and pleural effusion



Enlarged, hyperdense subcranial (arrow) and left hilar (arrowhead) lymph nodes, compatible with intranodal hemorrhage

Gastrointestinal Anthrax

Agent: *Bacillus anthracis* | **ICD-10:** A22.2

Incubation Period: 2-5 days

Signs & Symptoms

-Oropharyngeal anthrax: fever and severe pharyngitis followed by oral ulcers which progress from whitish patches to tan or gray pseudomembranes. Other features include dysphasia, regional non-purulent lymphadenopahty, and severe neck swelling. Edema can lead to airway compromise.
-Intestinal anthrax: fever, nausea, vomiting, mild to severe diarrhea, anorexia, and focal abdominal pain (tenderness, guard, and rebound). These symptoms can progress to hematemesis, hematochezia or melena, massive serosanguinous or hemorrhagic ascites, and sepsis.

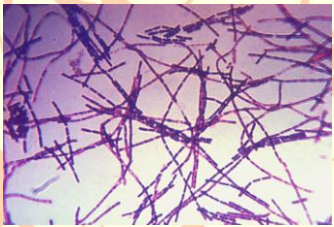
Labs & Imaging

-**Oral lesion tissue**: Gram stain, culture, IHC and PCR.
-**Stool**: Culture
-**Ascitic fluid**: Gram stain, culture, IHC, and PCR.
-**Blood**: Culture, PCR, and acute and convalescent serology
-**Abdominal radiographic**

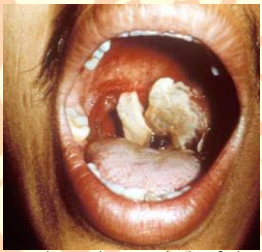
Treatment

-Supportive care: includes fluid, shock, and airway management
-For oropharyngeal anthrax, airway compromise is a significant risk; consider corticosteroids to reduce development of airway edema
-Ciprofloxacin (400 mg IV q12hr) for adults or doxycycline (200 mg IV loading dose, followed by 100 mg IV q12hr) plus one or two additional antibiotics effective against anthrax (clindamycin, vancomycin, rifampin)
-Post-exposure prophylaxis: 10-14 days ciprofloxacin or doxycycline may be considered if no aerosol exposure; if aerosol exposure, see Pulmonary Anthrax

Precautions: Standard Precautions. A 5% hypochlorite solution will kill spores. Autoclaving, steam sterilizing, or burning is required for complete eradication of spores. Decontamination of patients using soap and water is sufficient. Not communicable person-to-person.



Encapsulated, Gram-positive, nonmotile, aerobic, spore-forming rod



White pseudomembranous lesion 9 days after onset of symptoms

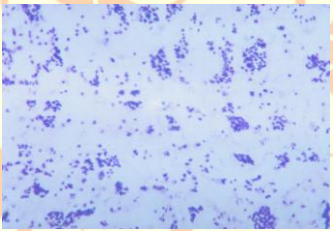
Tularemia

Agent: *Francisella tularensis* | **ICD-10:** A21

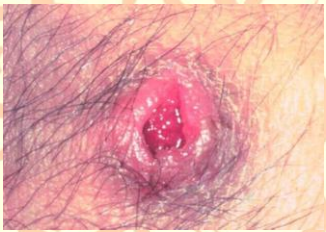
Incubation Period: 3-6 days (up to 21 days)

Signs & Symptoms	- **Ulceroglandular tularemia:** characterized by a sudden onset of fever, chills, headache, cough, and myalgias, concurent with the appearance of a painful papule at the site of inoculation. The papule progresses rapidly to pustule then painful ulcer (generally 0.4-3.0 cm in diameter with heaped-up edges) with localized painful regional lymphadenopathy. -**Typhoidal tularemia:** manifests as a **nonspecific febrile syndrome** consisting of abrupt onset of fever, headache, malaise, myalgias, cough, and prostration. Occasionally patients will present with nausea, vomiting, diarrhea, or abdominal pain. -**Pulmonic tularemia**: manifests as non-productive cough, chest discomfort, and/or dyspnea.
Labs & Imaging	-**Skin lesion**: Gram stain, culture, PCR, and FA. -**Nasal swab, sputum, induced sputum**: Gram stain, culture (culture medium containing cystine required), IHC, FA, and PCR. -**Blood:** Culture, PCR, and acute and convalescent serology. -**Pleural fluid**: Gram stain, culture, PCR, and FA. -**CXR** (hilar adenopathy, peribronchial infiltrates)
Treatment	-Streptomycin (1g IM bid) or gentamicin (5 mg/kg IM/IV qd) for 10 days OR doxycycline (100 mg PO/IV bid) or ciprofloxacin (500 mg PO bid) for 14-21 days **-Post-exposure prophylaxis:** Ciprofloxacin (500 mg PO bid), doxycycline (100 mg PO bid), or tetracycline (500 mg PO qid) for 14 days for contact with organism

Precautions: Standard Precautions. Control of ambient ticks, mosquitoes, deer flies, and lice is important in disrupting transmission. Not communicable person-to-person.



A methylene blue stain showing *F. tularensis* as a non-motile, aerobic pleiomorphic coccobacillus



Cutaneous ulcer with heaped up edges

Bubonic & Septicemic Plague

Agent: *Yersinia pestis* | **ICD-10:** A20.0 and A20.7

Incubation Period: 2-8 days

Signs & Symptoms

-Bubonic Plague: Acute and fulminant onset of nonspecific symptoms, including high fever up to 40°C, severe malaise, headache, myalgias, and nausea and vomiting. The characteristic bubo (a swollen, extremely painful, infected lymph node) occurs most commonly in femoral or inguinal lymph nodes, is typically 1-10 cm in diameter, and may become fluctuant or suppurate. A local lesion (i.e., papule, vesicle) may or may not be present at the site of inoculation. Secondary septicemia is common.

-Septicemic Plague: High fever, chills, malaise, hypotension, tachycardia, tachypnea, nausea, vomiting, and diarrhea. Thromboses in blood vessels may result in necrosis, gangrene, and disseminated intravascular coagulation. Can lead to secondary pneumonic plague.

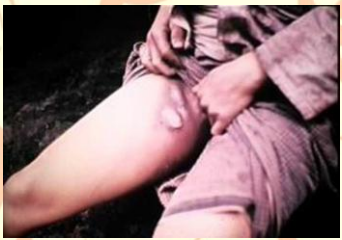
Labs & Imaging

-**Nasal swab, sputum, CSF, and induced sputum**: Culture, FA and PCR
-**Blood, sputum, and bubo/lymph node tissue aspirate**: Gram, Wright, Wrjght-Giemsa, or Wayson stains, culture, FA, F-1 Ag assays, IHC, and PCR.
-**Sera**: Acute and convalescent serology, and PCR
-CXR: to exclude pneumonic involvement

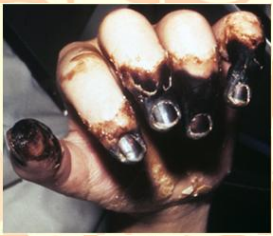
Treatment

- Streptomycin (1g IM bid) or gentamicin (5 mg/kg IM/IV qd or 2mg/kg loading dose followed by 1.7mg/kg IM/IV q8hr)
-IV antibiotics can be switched to oral antibiotics as the improvement in the clinical course dictates, to complete at least 10-14 total days of therapy.
-**Post-exposure prophylaxis:** Ciprofloxacin or doxycycline for 7 days (contact with organism). Required only after contact with patients with pneumonic plague (see Pneumonic Plague)

Precautions: Standard precautions. Person-to-person spread is rare unless pulmonary involvement.



Inguinal bubo



Distal digital gangrene

Pneumonic Plague

Agent: *Yersinia pestis* | **ICD-10:** A20.2

Incubation Period: 1-6 days

Signs & Symptoms

-Onset is acute and often fulminant. Initial symptoms of high fever, chills, headache, malaise, myalgias; cough and tachypnea within 24 hours, eventually producing **bloody sputum**.
-The pneumonia progresses rapidly, resulting in dyspnea, stridor, and cyanosis and terminating with respiratory failure and circulatory collapse.
-GI symptoms include nausea, vomiting, diarrhea, and abdominal pain.

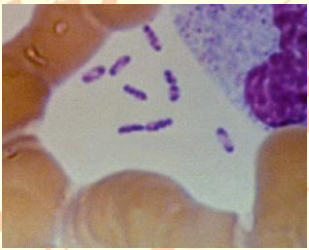
Labs & Imaging

-**Nasal swab, sputum, CSF, and induced sputum**: Culture, FA and PCR
-**Blood, sputum, and tissue**: Gram, Wright, Wrjght-Giemsa, or Wayson stains, culture, FA, F-1 Antigen assays, IHC, and PCR.
-**Serum**: Acute and convalescent antibody assays
-**CXR** (patchy or consolidated bilateral infiltrates)

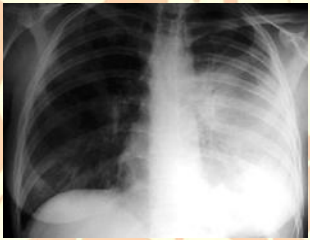
Treatment

-Streptomycin (1g IM bid) or gentamicin (5 mg/kg IM/IV qd or 2mg/kg loading dose followed by 1.7mg/kg IM/IV q8hr)
-IV antibiotics can be switched to PO as patient improves for a total of 10-14 days of antibiotic therapy
-**Post-exposure prophylaxis**: Doxycycline (100 mg PO bid) or ciprofloxacin (500 mg PO bid) for 7 days.

Precautions: **Respiratory droplet isolation** for at least the first 48 hours of therapy antibiotic. If plague pneumonia is confirmed, continue respiratory droplet isolation until sputum cultures are negative. Conduct terminal disinfection of all items used in the care of patients using standard hospital disinfectants. **Highly contagious**.



Wright-Giemsa stain showing non-motile, encapsulated, aerobic rod with “safety pin” appearance



Lobar consolidation

Brucellosis

Agent: *Brucella* species *(mellitensis, suis, abortus, and canis)* | **ICD-10:**A23

Incubation Period: ranges from 1 week to several months

Signs & Symptoms

-Fever of unknown origin
-Fever (undulation: hourly and daily fluctuations, night sweats, malaise, anorexia, vomiting, diarrhea, ileitis, arthralgias, fatigue, weight loss, depression
-Lymphadenopathy or hepatosplenomegaly and possible involvement of many other organs: sacroileitis, epididymo-orchitis, meningitis, endocarditis, and infiltrative hepatitis

Labs & Imaging

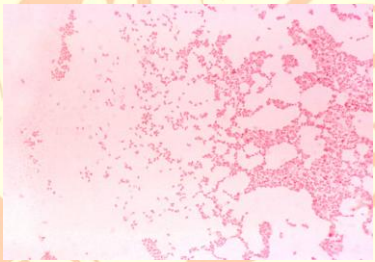
-**Blood**- Culture, PCR, and acute and convalescent serology
-**Bone marrow, tissue**: Culture, histopathology, and PCR

Treatment

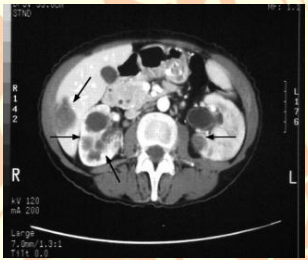
-Doxycycline (100 mg PO bid) for 6 weeks plus
1) rifampin (600 to 900 mg PO qd) for 6 weeks or
2) streptomycin (1 g IM qd) for the first 14 to 21 days (gentamicin can be substituted)

-Post-exposure prophylaxis: generally for lab exposures only: doxycycline (200 mg PO qd) or rifampin (600 mg PO qd) for 3 to 6 weeks

Precautions: Standard Precautions. Transmission can occur by direct exposure to infected body fluids. Rarely communicable from person-to-person.



Brucella abortus: Gram negative, non-motile aerobic coccobacilli



Hepatic and renal abscesses

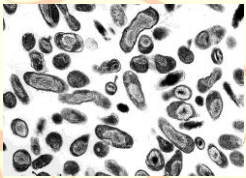
Q Fever

Agent: *Coxiella burnetii* | **ICD-10:** A78

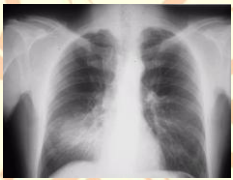
Incubation Period: 7-21 days (or up to 41 days)

Signs & Symptoms	-Abrupt onset of high fever (*e.g.* 40 C), fatigue, severe headache, chills, myalgias, dry cough, and nausea -Fever plateaus over 2-4 days and ends after 1-2 weeks -Atypical pneumonia or acute hepatitis can be present -Untreated disease often becomes chronic disease (such as endocarditis, chronic hepatitis, aseptic meningitis, encephalitis, osteomyelitis, etc.)
Labs & Imaging	-**Nasal swab, sputum, induced sputum**: DFA, PCR -**Blood**: PCR, acute and convalescent serology -**Tissue**: Microscopy, IHC, and PCR -**CXR:** mostly commonly non-segmental (multiple oval/rounded opacities) or segmental pleural-based opacities. May show perihilar infiltrates, hilar adenopahty, or small pleural effusions.
Treatment	-Doxycycline (100 mg IV or PO q12h) OR tetracycline (500 mg PO q6h) for 14 to 21 days (to reduce risk of chronic Q fever) -Prolonged antibiotics required for chronic Q fever -**Post-exposure prophylaxis**: Doxycycline (100 mg PO bid) OR tetracycline (500 mg PO qid) for 7 days (start 8 to 12 days post-exposure)

Precautions: Standard Precautions. Heavy environmental contamination with *C. burnetti* may pose a long-term risk due to persistence. Dust generated from the contaminated environment may continue to transmit the disease. Exposed clothing and equipment should be decontaminated. Culture of organism from blood, sputum, or urine is very difficult and hazardous. Not communicable person-to-person.



Pleomorphic Gram negative coccobacillus



Atypical pneumonia

Glanders

Agent: *Burkholderia mallei* | **ICD-10:** A24.0

Incubation Period: 1-21 days (cutaneous) or 10-14 days (inhalational)

Signs & Symptoms

-**Acute localized suppurative infection**: acute or subacute onset of local papular or pustular lesion with subsequent ulceration, mucopurulent discharge (if mucosal), and regional lymphangitis and lymphadenitis. Infected nodes may ulcerate and drain pus. May be associated with systemic symptoms.
-**Acute pulmonary infection:** May occur from inhalation or hematogenous seeding. Fever, chills, rigors, myalgia, fatigue, headache, with pleuritic chest pain (purulent nasal discharge in naturally occurring cases).
-**Acute septicemia infection:** May occur after localized infection or inhalational exposure. Generalized papular eruption (may become pustular) with abscess of internal organs (liver, spleen, lungs) and intramuscular abscesses (especially legs and arms).
-**Chronic suppurative infection**: multiple chronic abscess (mainly subcutaneous and IM abscesses, but also pulmonic, ocular, skeletal, liver, spleen); 6 weeks to 15 years duration.

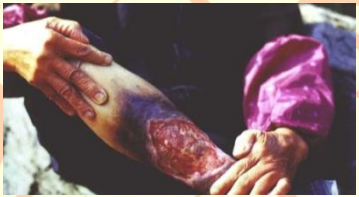
Labs & Imaging

-**Local lesions**: Gram, Wright, or Methylene blue stain and culture of exudate
-**Sputum**: Gram, Wright, Methylene blue stain; culture
-**Blood**: Culture (usually negative until patient moribund—requires special media such as glycerol potato agar), acute/convalescent serology, PCR, antibiotic sensitivity testing
-**Urine**: Culture
-**CXR:** (miliary nodules, lobar pneumonia, or lung abscess) or abdominal ultrasound or CT scan (liver/splenic abscesses)

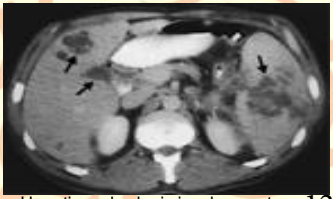
Treatment

Intensive therapy: Ceftazidime (40mg/kg IV q6-8hrs, max 8 g/day), imipenem (15mg/kg IV q 6hr, max 4 g/day), OR meropenem (25mg/kg IV q 8hr, max 3g/day) *plus* TMP/SMX (TMP 8 mg/kg/day IV every 12 hours). Continue IV therapy for minimum of 10 to 14 days and until improved and stable. Surgical drainage of abscess, if possible.
Maintenance therapy: Following intensive therapy. Oral TMP/SMX with or without doxycycline for 12-20 weeks if localized to the lungs, but 6-12 months if deep-seated infections (severe visceral, CNS, prostate disease).

Precautions: Person-to-person spread of glanders may occur. Standard precautions.



Cutaneous ulcer



Hepatic and splenic involvement

Melioidosis

Agent: *Burkholderia pseudomallei* | **ICD-10:** A24.1

Incubation Period: 1-21 days

Signs & Symptoms

-**Mucocutaneous exposure**: local nodule or abscess formation and regional lymphadenitis (less common than with glanders). Most percutaneous exposures initially presented with either pneumonia or sepsis. Rarely, will present as a distal, focal abscess with or without obvious site of primary inoculation; (*e.g.* primary purulent parotitis, primary prostatic abscess).
-**Inhalational exposure** typically results in an acute or subacute pneumonia and septicemia.
1) Septicemic melioidosis typically presents with fever, rigors, night sweats, myalgia, anorexia, and headache. Most patients are bacteremic.
2) Pneumonic melioidosis can present in many forms, but is most commonly seen as a lobar or segmental consolidation. Cavitation is common, sputum is often purulent, and hemoptysis may be present.

Labs & Imaging

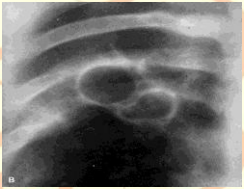
-**Gram stain** and culture of exudate from cutaneous lesions
-**Sputum:** Gram, Wright, or methylene blue stain, culture; DFA
-**Blood:** Culture (McConkey and Ashdown agar), PCR, GLC, acute and convalescent serology
-**Throat:** Culture
-**Urine:** Culture (if prostatis or renal involvement)
-**CXR:** (miliary nodues, pneumonia) ; abdominal ultrasound or CT scan (hepatic, splenic abscesses); transrectal ultrasound/MRI/CT (prostatic abscess)

Treatment

-**Intensive Therapy**: Ceftazidime (40mg/kg IV q8hrs), or imipenem (15mg/kg IV q6hr max 4 g/day), or meropenem (25mg/kg IV q8hr, max 6g/day), plus, TMP/SMX (TMP 8 mg/kg/day IV in four divided doses). Continue IV therapy for at least 14 days and if patient clinically improved, switch to oral maintenance therapy for 4-6 months.
-**Maintence Therapy**: Oral TMP/SMX with or without doxycycline for 12-20 weeks, or longer(6-12 months) if deep-seated disease (i.e., severe visceral, CNS, or prostatic diseases).

Precautions: Standard precautions are indicated. Person to person spread is rare. Possible transmission sexual fluids. BSL-2 facilities may be used for clinical specimens and cultures, provided procedure not associated with production of droplets or aerosol.

5X magnification of colonies of *Burkholderia pseudomallei* on Ashdown's agar after 4 days' incubation



Melioid cavitation

Epidemic Typhus

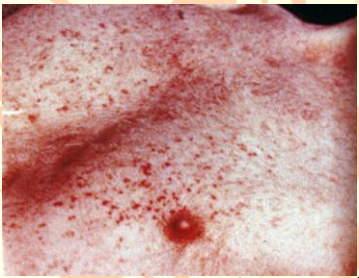
Agent: *Rickettsia prowazekii* | **ICD-10:** A75.0

Incubation Period: 7 to 14 days after infected louse bite

Signs & Symptoms	-Non-specific: Abrupt fever, severe headache, and malaise. Possibly also cough, abdominal pain, nausea, diarrhea, chills, and muscle tenderness -Rash begins a few days after onset of above symptoms: red macules on the trunk, later spreading to the extremities, sometimes sparing palms and soles. -Neurological: confusion or drowsiness, rarely seizures or coma.
Labs & Imaging	-**Blood**: Chemistry, CBC, LFT's (expect jaundice, elevated LFT's, and thrombocytopenia), IHC staining (in conjunction with Weil-Felix test), and culture (cannot be grown on cell-free media) -**Serum:** PCR (17-kDa gene)
Treatment	-Doxycycline (200 mg po once, followed by 100 mg bid) for at least 7 days or chloramphenicol (500 mg po qid) for 7 days

Precautions: Standard precautions; prevention through delousing. Not communicable person to person.

Flying squirrel flea - *Orchopeas howardi*



Macular rash on trunk

Smallpox

Agent: Variola virus | **ICD-10:** B03

Incubation Period: 7-19 days (average 12 days)

Signs & Symptoms

-Acute clinical manifestations: fever, malaise, headache, rigors, prostration, vomiting, backache.
-Within 2 to 3 days, a rash develops in the oropharynx, followed by (or concomitantly with) a rash on the face, then forearms and legs, then trunk, and subsequently hands and feet. Lesions progress from macules to papules, then vesicles generally at day 3, and pustules at day 5 or 6 (pustules described as umbilicated lesions deeply embedded in skin; hard round foreign body sensation on palpation of lesion). Lesions remain synchronous in stages of development. At day 10-14 , the pustules begin to scab. Considered no longer contagious after all scabs have fallen off (generally by 3 weeks after onset of the rash).
-Clinical presentation: Febrile illness with synchronous rash characteristic of smallpox should suggest diagnosis

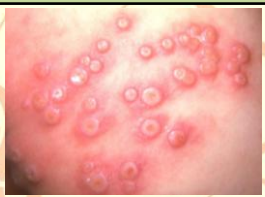
Labs

-**Scraping of lesions**: PCR, culture, histopathology, electron microscopy,
- **Drainage skin lesions, nasopharynx, respiratory secretions**: PCR, culture
-**Serum**: PCR, Ag-ELISA, viral culture, serology
-Samples should be sent to international reference labs such as CDC or WHO.

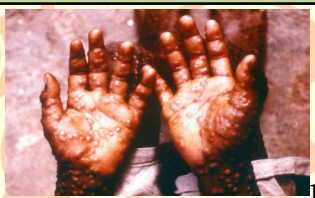
Treatment

-Supportive therapy
-Vaccine given 3-4 days after exposure can decrease disease severity
-Cidofovir and ST-246 shown to be effective in studies (IND only)
Post-exposure prophylaxis: Vaccinia (Smallpox) vaccine

Precautions: **Airborne and contact precautions**. Person-to-person spread - most commonly by droplets (within 3-6 feet of person) and uncommonly by airborne route; also spread by contact with infected fluids or fomites. Airborne/contact precautions until scabs separated. Deposit all contaminated wastes in Biohazard bags and autoclave or incinerate. Sterilize contaminated equipment and clothing. Decontaminate room (floors, walls, hard surfaces) with 5% hypochlorite. **Highly contagious**.



Umbilicated lesions



Pustular lesions appearing on the hands

Ebola and Marburg

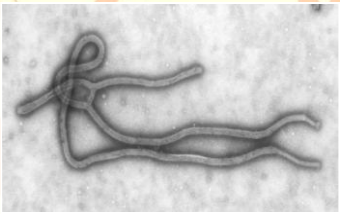
Agents: Viruses in the family *Filoviridae*

ICD-10: A98.3 and A98.4

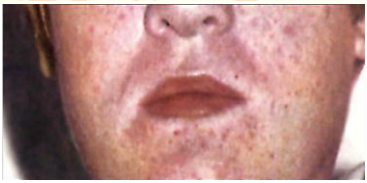
Incubation Period: Ebola: 4- 6 days (range 2 to 21 days) Marburg 5-7 days (range 2-14 days)

Signs & Symptoms	-Onset is abrupt with fever, constitutional symptoms, nausea, vomiting, diarrhea, abdominal pain, lymphadenopathy, pharyngitis, conjunctival injection, jaundice, and pancreatitis. - Maculopapular rash often occurs at approximately day 5 -Delirium, obtundation, and coma are common -Hemorrhagic features develop as disease progresses
Labs & Imaging	-**Routine labs**: thrombocytopenia, leucopenia, elevated LFT's, low albumin **-Blood:** PCR, Ag-ELISA, viral culture, and serology
Treatment	-Supportive care (IV fluids, colloids, fresh frozen plasma)

Precautions: Barrier precautions. Caregivers to wear double gloves; face shields, goggles or eyeglasses with side shields, gowns, shoe coverings. If resources available, N95 mask. Isolate in negative-pressure private room. When caring for patients with prominent cough, vomiting, diarrhea, or hemorrhage, may consider Tyvek suits and HEPA filter air purifying respirator (if available). Sewage, bulk blood, suctioned fluids, secretions, and excretions should be autoclaved, processed in a chemical toilet, or treated with a 5% chlorine solution for at least 5 minutes in bedpan or commode prior to flushing. **Highly contagious.**



Ebola virus



Maculopapular rash on day 5

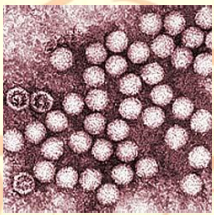
Rift Valley Fever

Agent: RVF Virus (family *Bunyaviridae)* | **ICD-10:** A92.4

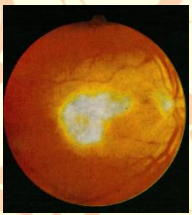
Incubation Period: 1-6 days

Signs & Symptoms	- Initial presentation most commonly as an undifferentiated febrile illness with malaise, fever, chill, and headache. Often self-limited. -Hospitalized patients (moderate and severe disease) with nausea, vomiting, abdominal pain, diarrhea, and myalgia. - 10% cases with retinitis (during acute phase or 4 wks after illness onset); may result in permanent vision loss - 1% cases: hemorrhagic syndrome, hepatitis, or encephalitis -**Mortality**: ~ 1% overall mortality; 50% in severe disease (varies by region 5% to 80%)
Labs	- **Routine Labs**: Thrombocytopenia, leukopenia, elevated LFTs. **- Blood**: Viral culture, PCR, Ag-ELISA, acute and convalescent serology
Treatment	-Supportive care

Precautions: Standard precautions. No human-to-human transmission yet demonstrated. Caregivers to wear gloves; facial and eye protection (i.e. goggles or eyeglasses with side shields) and gown in patient care (activities likely to generate aerosol/splash). If severe hemorrhage, isolate in private negative air flow room; HEPA filter air purifying respirator or Tyvek suits only considered if massive hemorrhage. Sewage, contaminated fluids, secretions, and excretions should be autoclaved, processed in a chemical toilet, or treated with a 5% chlorine solution for at least 5 minutes in bedpan or commode prior to flushing.



RVF virus



Macular lesion with hemorrhage and edema

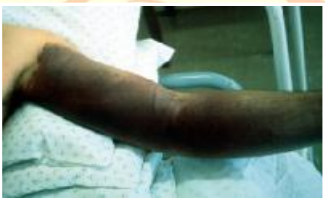
Crimean-Congo Hemorrhagic Fever

Agent: CCHF Virus (Family *Bunyaviridae*) | **ICD-10:** A98.0

Incubation Period: 1-6 days (range 1-13 days)

Signs & Symptoms	–**Prehemorrhagic** (lasts 3 days): fever, myalgias, vomiting, headache, photophobia, dizziness, conjunctivitis, hyperemia of face/neck, congested sclera, jaundice –**Hemorrhagic** (lasts 2-3 days, starts 3-5 days after onset): petechiae, ecchymosis, epistaxis, gingival bleeding, hematemesis, and melena –**Convalescence** (day 10-20 after onset): weakness, confusion, labile pulse, poor vision/hearing/memory, temporary complete hair loss, polyneuritis, difficulty breathing reported
Labs	-**Routine labs**: Thrombocytopenia, DIC, increased LFTs, proteinuria -**Blood**: Ag-ELISA or PCR; viral culture; acute and convalescent serology
Treatment	-Supportive care -IV Ribavirin (IND in US): 33 mg/kg loading dose (LD), then 16 mg/kg q6h for 4 days, then 8 mg/kg q8h for 6 days OR - Oral ribavirin (off-label use): 2 g LD, then 1 g q6h x 4 days, then 0.5 g q6h x 6 days -**Post-exposure prophylaxis:** Ribavirin 500 mg PO qid for 7 days (for those in contact with patient within 3 weeks of onset of illness)

Precautions: **Contact and Droplet precautions**. Nosocomial infection mainly from contact with infected body fluids or needles, but may also occur from infected aerosols (particularly with severe hemorrhage). Isolate in negative air flow room. Wear gloves, gowns, face shields/surgical masks, eye protection (i.e., goggles or glasses with side shields), shoe covers, and N-95 mask (if available). If prominent cough/hemoptysis, vomiting, diarrhea, or hemorrhage, may wear increased protection (i.e., HEPA filter air purifying respirator, Tyvek suit). All contaminated fluids (sewage, suctioned fluids, secretions, excretions) should be autoclaved, processed in chemical toilet, or treated with a 5% chlorine solution for at least 5 min in bedpan or commode prior to flushing. **Highly contagious**.



Diffuse ecchymosis, one week after symptom onset

Tick of genus *Hyalomma*, known to spread CCHF

Lassa Fever

Agent: Lassa Virus (Family *Arenaviridae*) | **ICD-10: A96.2**

Incubation Period: 5-18 days

Signs & Symptoms

–**Prehemorrhagic:** Gradual onset fever, weakness, fatigue. **Days 3-4 illness**: arthralgias, back pain, nonproductive cough, sharp or burning retrosternal or epigastric pain; **Days 4-5 of illness**: onset severe headache, sore throat, gastrointestinal symptoms (cramping, nausea, vomiting, diarrhea). Diagnosis suggested by triad of pharyngitis, retrosternal chest pain, & proteinuria or vomiting in endemic area.

-**Mild disease**: most cases mild; recovery within 8 to 10 days.

-**Moderate-severe disease**: rapid disease progression (days 6 to 10); severe cases may develop respiratory distress, shock, bleeding, or encephalopathy.

-**Poor prognostic factors**: AST ≥150 IU/ml (55% fatality); triad of fever, sore throat, & vomiting; high serum viral burden; bleeding.

-**Mortality**: 15 to 25% hospitalized cases; estimated 1% mortality all cases.

Labs

-**Routine labs**: Thrombocytopenia, increased LFTs, proteinuria

-**Blood**: Ag-ELISA,RT-PCR, serology (ELISA IgM and IgG), viral culture

Treatment

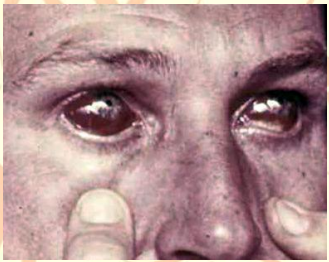
-Supportive care

-IV Ribavirin (IND in US): 33 mg/kg loading dose (LD), then 16 mg/kg q6h for 4 days, then 8 mg/kg q8h for 6 days OR

- Oral ribavirin (off-label use): 2 g LD, then 1 g q6h x 4 days, then 0.5 g q6h x 6 days

-**Post-exposure prophylaxis:** Ribavirin 500 mg PO qid for 7-10 days (for those in contact with infected body fluids or close contact to patient without adequate protective equipment (off-label use).

Precautions: See Precautions of CCHF for severe hemorrhage.



Conjunctival injection in Lassa fever

Facial edema observed in severe cases

Hemorrhagic Fever with Renal Syndrome

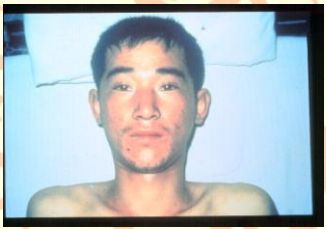
Agent: Hantavirus (family *Bunyaviridae)* | **ICD-10: A98.5**

Incubation Period: 2 to 3 weeks (range 4-42 days)

Signs & Symptoms	-Febrile illness with renal failure; generally only mild hemorrhage manifestations -**Initial presentation**: undifferentiated febrile illness with acute onset fever, headache, malaise, myalgia, and nausea/vomiting. Abdominal, flank, or back pain common. Injected conjunctiva, facial edema, facial flushing, petechiae often present. Decreased platelet count & proteinuria may help differentiate from nonspecific febrile illness. - **Oliguric phase:** often associated with renal failure (dialysis in 40% cases of Hantaan & Dobrava; 20% of Seoul, and 3-6% of Puumala viruses. -**Duration of illness**: ~3 weeks (improvement during 2nd week) -**Mortality** : ~ 5-12% Hantaan & Dobrava; 1% Seoul, <0.5% Puumala
Labs	- **Routine Labs**: Thrombocytopenia, proteinuria, increases creatinine,normal or increased WBC; mild elevation LFTs. **- Blood**: IgM and IgG ELISA (IgM positive early in illness); RT-PCR
Treatment	-Supportive care (fluid management, vasopressors, dialysis) -IV ribavirin: (IND) 33 mg/kg loading dose, then 16 mg/kg q4hrs X 4 days, then 8 mg/kg q8hrs X 3 days (associated with decreased mortality, severity of renal failure, and hemorrhage in blinded-controlled trial)—not recommended in Pulmonary Virus HFRS.

Precautions: Standard precautions (no human-to-human transmission yet demonstrated). Nosocomial transmission not reported (lower serum viral burden).

Striped-field mouse- rodent reservoir of Hantan virus



Facial flushing in HRFS

Hantavirus Pulmonary Syndrome (HPS)

Agent: Hantavirus (family *Bunyaviridae)* | **ICD-10: B33.4**

Incubation Period: 14 to 17 days (range 9-33 days)

Signs & Symptoms

-Febrile illness associated with respiratory failure due to pulmonary edema.
Initial presentation: febrile prodrome with severe myalgia, headache, and malaise of 3 to 5 days (range 1-12 days) duration. Cough/dyspnea often not present until late in prodrome phase-often precedes onset of pulmonary edema. Low platelet count may help differentiate from self-limited febrile illness.
- **Cardiopulmonary (CP) phase:** often abrupt onset of pulmonary edema and shock; pulmonary edema may progress rapidly over 4-24 hrs & require ventilator support; lasts ~3 to 6 days in survivors (death in 1-3 days in severe cases). Renal failure, hemorrhage, and myopericarditis with Andes virus but uncommon in Sin nombre virus.
-**Duration of illness**: rapid improvement after onset of diuresis (onset generally in 2nd week of illness). **Mortality** : ~ 40% with SNV & Andes virus

Labs

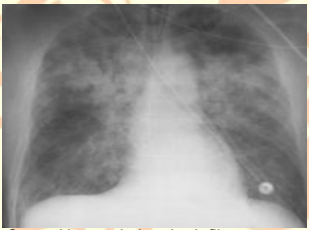
- **Routine Labs**: Thrombocytopenia, leukocytosis (mean WBC 35,000 cell/mm³), elevated LFTs & CPK. **CP Phase**: CXR-pulmonary edema (central and then peripheral lung fields), thrombocytopenia, ≥10% immunoblastic lymphocytes, myelocytes, metamyelocytes. Andes virus: proteinuria, elevated creatinine.
- Blood: IgM/IgG ELISA (IgM positive early in illness); recombinant immunoblot test strips (rapid test), Western blot.

Treatment

-Supportive: invasive monitoring cardiac output & wedge, ventilator, vasopressors

Precautions: Standard precautions for SNV. Andes virus-isolate in negative pressure room- N95 mask, gloves, face shields, goggles or eyeglasses with side shields, gowns.

Deer mouse-rodent reservoir of SNV



Central located alveolar infiltrates

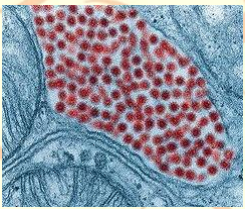
Eastern & Western Equine Encephalitis

Agent: EEE or WEE Viruses (Alphavirus) | **ICD-10:** A83.2

Incubation Period: EEE: 4-10 days and WEE: 2-10 days

Context	-EEE virus on eastern coast U.S. and Canada, northern S. America, Caribbean -WEE virus primarily in Americas (west of Mississippi in the U.S.) -Causes encephalitis in equids and humans
Signs & Symptoms	**EEE:** Prodrome of malaise, followed by fever, headache, nausea, vomiting, and diarrhea. Within few days (up to 11 days) abrupt onset CNS symptoms (stiff neck, tremors, muscle twitching, spastic paralysis, confusion, somnolence, coma, seizures). Neurological sequelae ~30% cases. Mortality 36-80%. **WEE:** Headache, fever, chills, nausea, vomiting, diarrhea, sore throat, photophobia, myalgias, vertigo. May progress to CNS involvement within few days (confusion, somnolence, coma, stiff neck, muscle twitching, tremors, spastic paralysis, seizures). Most adults recover in ~10 days without sequelae (30% infants with sequelae). Mortality 3-10%.
Labs & Imaging	-**Blood**: culture (generally negative in WEE), RT-PCR or Ag-ELISA, IgM and IgG ELISA, acute and convalescent serology -**Throat**: Culture, PCR -**CSF**: Culture, PCR, CSF WBC count, protein & glucose. -**EEG**: EEE- generalized slowing and disorganization of the background -**Head MRI or CT**: focal lesions in basal ganglia, thalamus, and brainstem (EEE only)
Treatment	Supportive Treatment

Precautions: Standard precautions. Prevention focuses on avoidance of mosquito bites and mosquito control. Not communicable person to person.



EEE virus

Culiseta melanura mosquito

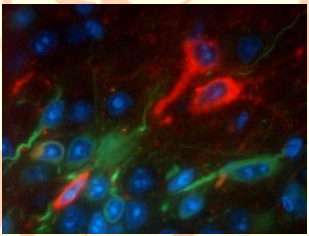
Venezuelan Equine Encephalitis

Agents: VEE virus (an Alphavirus) | **ICD-10:** A92.2

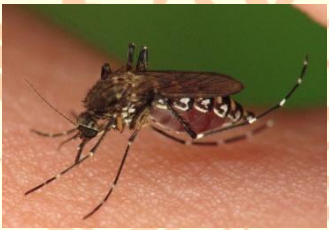
Incubation Period: 1-6 days

Context	-Endemic in South and Central America, Mexico, Florida, and Trinidad. -Natural infection by bite of infected mosquito. -Causes severe disease in equids (i.e., horses, mules) but rarely fatal in humans.
Signs & Symptoms	-Acute onset of fever, chills, severe headache, generalized malaise, photophobia, and myalgias that are prominent in the thighs and lower back; followed by nausea, vomiting, cough, sore throat, and diarrhea. -Severe symptoms generally subside within 2-5 days, followed by malaise and fatigue for 1-2 weeks before full recovery in most adults. - Encephalitis in ~0.5% adults and 4% children. Mortality <1%.
Labs & Imaging	-**Blood**: viral culture, PCR, Ag ELISA, or ECL; acute and convalescent serology (including IgM and IgG ELISA) -**Throat:** viral culture, PCR, Ag ELISA -**CSF**: viral culture, PCR, Ag ELISA, WBC, protein & glucose (if indicated) -**CT scan & EEG**: if indicated
Treatment	- No specific therapy exists, hence treatment is supportive only. Uncomplicated VEE infection may be treated with analgesics to relieve headache and myalgia. Encephalitis may require anticonvulsants and intensive supportive care.

Precautions: Standard Precautions. Control mosquito vectors and vaccinate horses in the vicinity. Not communicable person to person.



VEE virus



Aedes taeniorhynchus mosquito

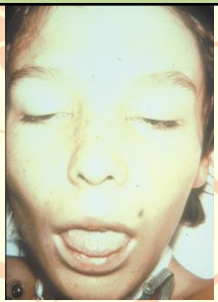
Botulism

Agent: toxin produced by *Clostridium botulinum*	**ICD-10:** A05.1 and A48.52

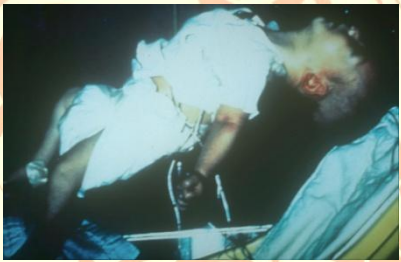
Onset: 12-36 hours (range 2 hours to 8 days)

Signs & Symptoms	-Acute symmetrical, descending, flaccid paralysis, that begins initially with cranial nerve palsies (ocular symptoms of blurred vision, diplopia, and/or ptosis followed by dysarthria, dysphonia, and/or dysphagia) in an afebrile with normal sensorium. Followed by weakness/paralysis of arms, accessory respiratory muscles, and then lower extremities. No sensory nerve involvement. - Respiratory failure may occur abruptly due to obstruction of the upper airway or weakness of accessory respiratory muscles. - Autonomic symptoms: Dry mouth, ileus, constipation, urinary retention
Labs & Imaging	-**Clinical diagnosis**: Decision to given antitoxin based on clinical diagnosis -**Nerve conduction studies**: Support diagnosis (normal in up to 40% cases) -**Toxin mouse bioassay or PCR**: Serum, stool, wound, vomitus, food (PCR quicker results but not fully validated; use in conjunction with mouse bioassay) -**Culture**: Stool, wound -Acute/convalescent serologies usually negative -Chemistries, CBC, CXR usually normal
Treatment	-Botulinum heptavalent antitoxin: H-BAT IND product available at CDC; HE-BAT IND product in DoD facilties if H-BAT not available. - Supportive care: Monitor in ICU for respiratory failure; Neurology consult - Public health notification

Precautions: Standard Precautions. Not communicable person to person.



Paralysis of facial muscles



"Floppy baby" syndrome of botulism

Ricin Intoxication

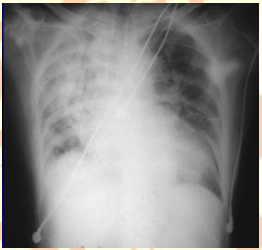
Agent: toxin derived from castor beans | **ICD-10:** T62.2

Onset: 4-8 hours post-inhalation or injection; 1-2 hours post-ingestion

Signs & Symptoms	**-Inhalation:** Fever, chest tightness, cough, dyspnea, nausea, and/or diaphoresis with sublethal doses in humans. Higher doses in NHPs causes labored breathing within 18-24 hrs; pulmonary edema due to airway necrosis and capillary leak; severe respiratory distress and death in 36-48 hours. **-Ingestion**: Onset severe nausea, vomiting, abdominal cramps; followed by diarrhea, vascular collapse, shock, death (if higher dose). Necrosis of gastrointestinal epithelium, local hemorrhage; hepatic, splenic, and renal necrosis. Ricin ingestion less toxin due to toxin degradation by enzymes/poor absorption. -**IM or SC injection**: Pain, induration, and necrosis of tissue at injection site with localized lymphadenopathy; systemic symptoms of weakness, nausea, vomiting, fever, diarrhea, headache, chest/abdomen pain; bleeding; end organ failure (liver, renal), hypotension/vascular collapse, and death within 72 hrs.
Labs & Imaging	- **Nasal swabs and induced respiratory secretions**: Toxin assays (PCR , Ag ELISA) if within 24 hr aerosol exposure -**Blood**: toxin assays, acute and convalescent sera antibody assays -**Tissues**: Histopathology with immunohistological stain
Treatment	-Supportive care. **- Pulmonary intoxication**: May require mechanical ventilation -**Gastrointestinal intoxication**: Vigorous gastric lavage, superactivated charcoal, followed by cathartics such as magnesium citrate. Volume replacement of gastrointestinal fluid losses.

Precautions: Standard Precautions. Not communicable person to person.

Castor beans (*Ricinus communis)*



ARDS developing 36 hours after inhalation

Staphylococcal Enterotoxin B

Agent: toxin produced by *Staphylococcus aureus* | **ICD-10:** A05

Onset: 2-12 hours (range 1.5-24 hours) post-inhalation; 1-12 hours post-ingestion

Signs & Symptoms

-Initial: nonspecific flu-like symptoms such as fever, chills, headache, and myalgias. Later symptoms depend upon the route of exposure.
1) Ingestion: GI symptoms: nausea, vomiting, and diarrhea for 1-2 days.
2) Inhalation: respiratory symptoms of nonproductive cough, retrosternal chest pain, dyspnea (may progress to pulmonary edema), shock, and death. URTI symptoms (rhinorrhea, sinus congestion, pharyngitis) in ~ one third cases. Fever/symptoms may persist up to 5 days and cough up to 4 weeks.
3) **Ocular**: Conjunctivitis, localized swelling, GI symptoms (from inadvertent swallowing of toxin or direct CNS effect). Resolved within 4-5 days.

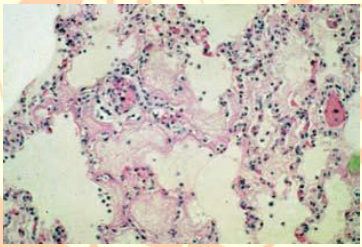
Labs & Imaging

-**Nasal swabs, induced respiratory secretions**: Toxin assays if within 24 hrs of aerosol exposure (PCR, Ag ELISA, electrochemiluminescence (ECL) tests).
-**Serum**: toxin assays (usually negative at time of symptoms); serology
-**Urine**: Toxin assays (may be detected several hrs postexposure in animals)
-**CXR**: may reveal increased interstitial markings, atelectesis, pulmonary edema, or ARDS
- **Leukocytosis**: common (not uncommonly >15,000 cells/mm^3)

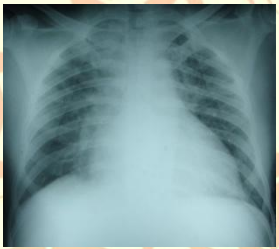
Treatment

-Supportive Treatment

Precautions: Standard Precautions. Not communicable person to person.



Lung of a rhesus monkey that died from inhaled SEB showing marked perivascular interstitial edema and focal loss of bronchial epithelium



Pulmonary edema

Trichothecene (T-2) Mycotoxins

Agent: A group of compounds produced by fungi *Fusarium*

ICD-10: T64

Onset: Minutes to hours after exposure

Signs & Symptoms

-**Cutaneous:** burning pain, redness, tenderness, blistering, and progression to skin necrosis.
-**Upper respiratory**: nasal itching, pain, sneezing, epistaxis, and rhinorrhea. Pulmonary and tracheobronchial toxicity produces dyspnea, wheezing, and cough. Mouth and throat exposure causes pain and blood-tinged saliva and sputum.
-**GI**: anorexia, nausea, vomiting, and watery or bloody diarrhea with crampy abdominal pain
-**Systemic**: via any route of exposure, and results in weakness, prostration, dizziness, ataxia, and loss of coordination. Tachycardia, hypothermia, and hypotension follow in fatal cases.

Labs & Imaging

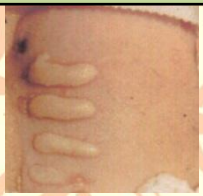
- **Routine labs:** For acute management
- **Serum and urine:** Send to reference labs for antigen detection

Treatment

No specific antidote. Supportive treatment. Superactivated charcoal should be given orally if the toxin is swallowed. Soap and water washing (even 4-6 hours after exposure) may significantly reduce dermal toxicity; washing within 1 hour may prevent toxicity entirely.

Precautions: **Contact precautions** are warranted until decontamination is accomplished. Remove outer clothing and decontaminate exposed skin with soap and water. Treat eye exposure with copious saline irrigation. Secondary aerosols are not a hazard; but, contact with contaminated skin and clothing can produce secondary dermal exposures. T-2 mycotoxins are the only BSAT that **can penetrate intact skin**.

Microscopic image of a Fusarium species



Vesicles on the back of a hairless guinea pig after application of toxin

Acronyms

Ag	antigen
ARDS	acute respiratory distress syndrome
AST	aspartate transaminase
bid	twice per day
BSAT	biological select agents and toxins
BSL	biosafety level
CBC	complete blood count
CCHF	Crimean-Congo Hemorrhagic Fever
CDC	Centers for Disease Control and Prevention
CP	cardio-pulmonary
CPK	creatine protein kinase
CSF	cerebrospinal fluid
CNS	central nervous system
CT	computed tomography
CXR	chest x-ray
DFA	direct fluorescent antibody
EEG	electroencephalogram
ELISA	enzyme-linked immunosorbent assay
FA	fluorescent antibody
GI	gastrointestinal
GLC	gas liquid chromatography
HBAT	heptavalent botulinum antitoxin
HEBAT	heptavalent, equine, botulinum antitoxin
HEPA	high efficiency particulate air
HFRS	Hemorrhagic Fever with Renal Syndrome
HPS	Hantavirus pulmonary syndrome
ICD	International Classification of Diseases
ICU	intensive care unit
IgG	Immunoglobulin G
IgM	Immunoglobulin M
IHC	immunohistochemistry
IM	intramuscular
IND	investigational new drug
IV	intravenous
LD	loading dose
LDH	lactate dehydrogenase
LFT	liver function test
MRI	magnetic resonance imaging
NHP	non-human primate
PCR	polymerase chain reaction
PEEP	positive end-expiratory pressure
PO	by mouth
PPE	personal protective equipment
qd	once per day
qid	four times per day
RT	reverse transcriptase
RVF	Rift Valley Fever
SEB	Staphylococcal Enterotoxin B
SC	subcutaneous
SNV	Sin Nombre Virus
tid	three times per day
TMP/SMX	trimethoprim and sulfamethoxazole
WBC	white blood cell
WHO	World Health Organization

ISBN (13): 978-0-16-090016-7