



USAMRIID

United States Army
Medical Research Institute
of Infectious Diseases

Biodefense Solutions To Protect Our Nation

***Pocket Reference Guide:
Biological Select Agents and Toxins***

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

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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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Precautions:

Standard



To be used with all patients.

Droplet



Standard precautions, surgical mask and eye protection, if available.

Airborne



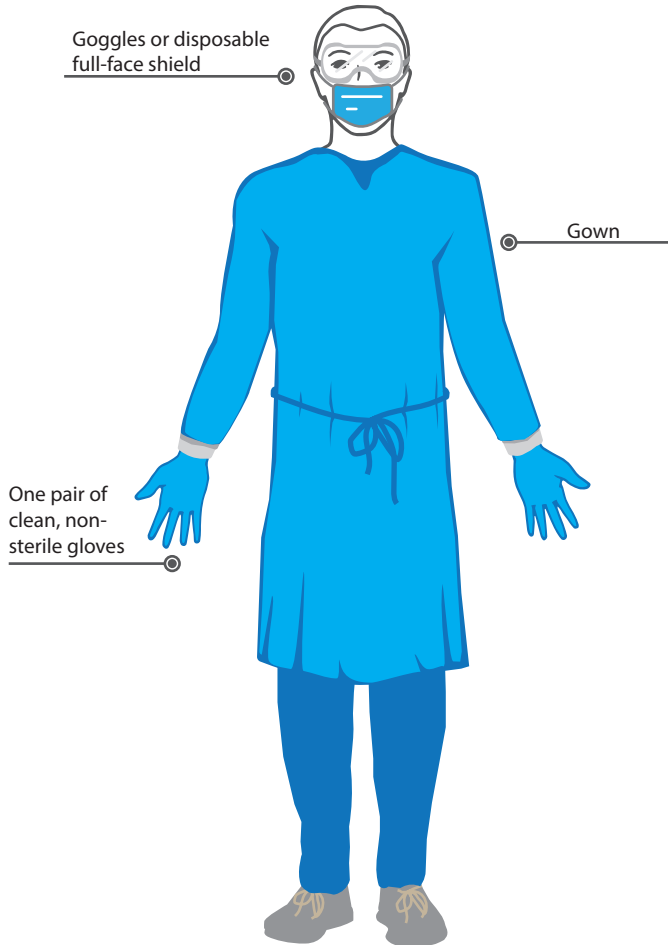
Standard precautions and N95 mask or higher level respirator.

Contact



Standard precautions and disposable gown.

Enhanced Precautions:



Crimean-Congo Hemorrhagic Fever (CCHF)



Agent: CCHF Virus (*Family Bunyaviridae*)

ICD-10: A98.0

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

Symptoms Summary: *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 or complete hair loss, polyneuritis, difficult breathing reported.

Labs/Imaging: *Routine labs:* Thrombocytopenia, DIC, increased LFTs, proteinuria. *Blood:* Ag-ELISA or PCR; viral culture; acute and convalescent serology.

Treatment: There is no proven antiviral treatment for CCHF infection. Ribavirin has been studied in vitro, in animal models and some patients. *IV Ribavirin (IND in U.S.):* 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 minutes in bedpan or commode prior to flushing. **Highly contagious.**

Risk Factors: *Travel:* Africa and Eurasia, including South Africa, Turkey, the Balkans, the Middle East (Afghanistan, Iran, Pakistan), Russia, and western China. *Reservoirs/Vectors:* ticks. *Occupation:* animal slaughtering.



Eastern & Western Equine Encephalitis (**EEE & WEE**)

Agent: EEE / WEE Viruses (*Alphavirus*)

ICD-10: A83.2

Incubation Period: *EEE:* 4-10 days

WEE: 2-10 days

Symptoms Summary: *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 a few days (confusion, somnolence, coma, stiff neck, muscle twitching, tremors, spastic paralysis, and 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.

Risk Factors: *Travel:* North and South America; EEE in Caribbean.

Reservoirs/Vectors: Aedes or Culex mosquitoes infected by horses or birds.

Ebola & Marburg



Agent: Viruses in family *Filoviridae*

ICD-10: A98.3 and A98.4

Incubation Period:

Ebola: 4–6 days (range 2–21 days)

Marburg: 5–7 days (range 2–14 days)

Symptoms Summary: 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, leukopenia, elevated LFT's, low albumin, increased BUN and creatinine, increased clotting times, elevated d-dimers, decreased fibrinogen.

Blood: PCR, Ag-ELISA, viral culture, and serology.

Treatment: Supportive care (IV fluids, colloids, fresh frozen plasma). Ervebo: FDA-approved vaccine for the prevention of Zaire ebolavirus. FDA approved monoclonal antibodies, like Inmazeb & Ebanga, which treats Zaire ebolavirus infection (not Marburg) in adult and pediatric patients. Some other non-FDA approved IND products may be available for emergency use only.

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.**

Risk Factors: *Travel:* Central Africa, West Africa. **Ebola:** Republic of the Congo, Cote d'Ivoire, Gabon, Sudan, Guinea, Liberia, Senegal, Uganda. **Marburg:** Kenya, Angola, and possibly Zimbabwe. **Reservoirs/Vectors:** bats (?), infected humans (person-to-person contact), nonhuman primates. **Occupation:** Health Care Workers, cavers and miners in affected areas. **Food:** bushmeat.



Hantavirus Pulmonary Syndrome

Agent: Hantavirus (family *Bunyaviridae*)

ICD-10: B33.4

Incubation Period: 14–17 days
(range 9–33 days)

Symptoms Summary: Febrile illness associated with respiratory failure due to pulmonary edema. **Initial presentation:** febrile prodrome with severe myalgia, headache, and malaise of 3–5 days (range 1–12 days) duration. Cough/dyspnea often not present until late in prodrome phase and 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 hours and 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 (SNV). **Duration of illness:** rapid improvement after onset of diuresis (onset generally in 2nd week of illness). **Case Fatality Rate:** ~40% with SNV & Andes virus.

Labs Imaging: Routine Labs: Thrombocytopenia, leukocytosis (mean WBC 35,000 cell/mm³), elevated LFTs & CPK. **CP Phase:** CXR for 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 care with invasive cardiac monitoring, respiratory support.

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

Risk Factors: Travel: Sin nombre virus SNV: major causes HPS in North America; Andes virus: Argentina and Chile. **Reservoirs/Vectors:** Infected rodent excreta (urine, saliva, stool); person-to-person transmission with Andes virus only. **Occupation:** mainly rural disease.

Hemorrhagic Fever with Renal Syndrome



Agent: Hantavirus (family *Bunyaviridae*)

ICD-10: A98.5

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

Symptoms Summary: 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 and 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 Imaging: **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 Hantavirus Pulmonary Syndrome.

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

Risk Factors: **Travel:** Hantaan and Seoul viruses: endemic in Southeast Asia & Russia (east of Ural Mountains); Seoul virus also worldwide (mainly seaports); Puumala and Dobrava viruses: Europe, Russia (west of Ural Mountains). **Reservoirs / Vectors:** Infected rodent excreta (urine, saliva, stool). **Occupation:** mainly rural disease except for Seoul virus (urban).



Lassa Fever

Agent: Lassa Virus (Family *Arenaviridae*)

ICD-10: A96.2

Incubation Period: 5–18 days

Symptoms Summary: *Prehemorrhagic:* Gradual onset fever, weakness, fatigue. *Days 3-4 of 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, and proteinuria or vomiting in endemic areas. *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 \geq 150 IU/ml (55% fatality); triad of fever, sore throat, & vomiting; high serum viral burden; bleeding. *Mortality:* 15–25% hospitalized cases; estimated 1% overall mortality.

Labs Imaging: *Routine labs:* Thrombocytopenia, increased LFTs, proteinuria. *Blood:* Ag-ELISA, RT-PCR, serology (ELISA IgM and IgG), viral culture.

Treatment: Supportive care. Ribavirin has been used as an off-label treatment and appears to be effective in treatment of Lassa fever if it is begun early enough in the course of the illness 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: Contact and Droplet precautions. Nosocomial infection mainly from infected body fluids or needles; may also occur from infected aerosols (particularly with severe hemorrhage). Isolate in negative airflow room. Wear gloves, gowns, face shields/surgical masks, eye protection, shoe covers, and N-95 mask. If prominent cough/hemoptysis, vomiting, diarrhea, or hemorrhage, wear increased protection (HEPA filter respirator, Tyvek suit). Contaminated fluids should be autoclaved, processed in chemical toilet, or treated with a 5% chlorine solution for at least 5 minutes in bedpan or commode prior to flushing. *Highly contagious.*

Risk Factors: *Travel:* Africa. *Reservoirs/Vectors:* excreta from rodents. *Food:* rodent meat.

Rift Valley Fever



Agent: RVF Virus (family Bunyaviridae)

ICD-10: A92.4

Incubation Period: 1–6 days

Symptoms Summary: 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. Ten percent of cases with retinitis (during acute phase or 4 wks after illness onset); may result in permanent vision loss. One percent of cases: hemorrhagic syndrome, hepatitis, or encephalitis. Mortality: ~ 1% overall mortality; 50% in severe disease (with lower mortality in regions with a more robust medical infrastructure)

Labs Imaging: 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 patient in private negative airflow 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.

Risk Factors: Travel: Africa, Saudi Arabia, and Yemen. **Reservoirs/Vectors:** Mosquitos, mainly *Aedes* species; blood and body fluids from infected animals. **Occupation:** animal slaughtering, veterinarian.



Smallpox

Agent: Variola virus (*Orthopoxvirus*)

ICD-10: B03

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

Symptoms Summary: *Acute clinical manifestations:* Fever, malaise, headache, rigors, prostration, vomiting and 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 Imaging: *Scrapings from lesions:* PCR, culture, histopathology, electron microscopy. *Drainage from skin lesions and nasopharynx and 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: ACAM2000 given within 3 days of being exposed. Given within 4-7 days of being exposed to the virus, the vaccine may give some protection from the disease. Tecovirimat, the first antiviral indicated in the treatment of smallpox, was approved for use in the US in JUL 2018, and available through the United States Government Strategic National Stockpile. ACAM2000, approved by FDA in 2007, is maintained in Strategic National Stockpile.

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.*

Risk Factors: Smallpox declared eradicated in 1980. Virus is now only located at two WHO approved laboratories.

Venezuelan Equine Encephalitis (VEE)



Agent: VEE virus (an Alphavirus)

ICD-10: A92.2

Incubation Period: 1–6 days

Symptoms Summary: 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: Supportive care. 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.

Risk Factors: **Travel:** North and South America. **Reservoirs/Vectors:** Psorophora or Aedes mosquitoes infected by horses.



Anthrax: Cutaneous

Agent: *Bacillus anthracis*

ICD-10: A22.0

Incubation Period: 1-12 days

Symptoms Summary: 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: Treat with ciprofloxacin 500mg PO BID or doxycycline 7-10 days unless inhalation exposure is suspected. Amoxicillin 1000 mg q8h for PCN susceptible strains. PEP: Recent analysis has suggested post-exposure vaccination with Biothrax may shorten the duration of antibiotic prophylaxis, providing the least expensive and most effective strategy to counter a bioterrorism event.

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.

Risk Factors: *Travel:* endemic worldwide. *Reservoirs/Vectors:* cattle, sheep, goats, and horses. *Occupation:* animal husbandry, processing of animal hides.

Anthrax: Gastrointestinal



Agent: *Bacillus anthracis*

ICD-10: A22.2

Incubation Period: 1–6 days

Symptoms Summary: *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 lymphadenopathy, 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. *X-ray: Abdominal.*

Treatment: *Supportive care:* fluids, shock, and airway management. Consider corticosteroids if airway compromised. Ciprofloxacin 400mg IV q8hr - 10-14 days. Consider ciprofloxacin or doxycycline if no aerosol exposure suspected; see pulmonary anthrax if aerosol exposure suspected.

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.

Risk Factors: *Travel:* endemic worldwide. *Reservoirs/Vectors:* cattle, sheep, goats, and horses. *Food:* uncooked meat.



Anthrax: Pulmonary

Agent: *Bacillus anthracis*

ICD-10: A22.1

Incubation Period: 1–6 days typical, up to 43 days possible; longer periods in animal studies)

Symptoms Summary: *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, Immunohistochemistry 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 400mg IV q8h. Drainage of pleural fluid. CDC: Clindamycin 900mg q8h or linezolid 600 mg q12h is preferred over loading dose of doxy. Biothrax for post-exposure prophylaxis.

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.

Risk Factors: *Travel:* endemic world-wide. *Reservoirs/Vectors:* cattle, sheep, goats, and horses. *Occupation:* wool-sorter, processing of animal hides.

Brucellosis



Agent: *Brucella* species (*mellitensis*, *suis*, *abortus*, and *canis*)

ICD-10: A23

Incubation Period: Ranges from 1 week to several months

Symptoms Summary: Fever of unknown origin. Fever (undulation with 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 rifampin 600 to 900 mg PO qd for 6 weeks or 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.

Risk Factors: *Travel:* endemic world-wide. *Reservoirs/Vectors:* cattle, bison, cervids, goat, sheep, pig. *Occupation:* animal husbandry, pork slaughtering. *Food:* raw milk and soft cheeses.



Epidemic Typhus

Agent: *Rickettsia prowazekii*

ICD-10: A75.0

Incubation Period: 7–14 days after infected louse bite or inculcation/inhalation of infected lice feces

Symptoms Summary: *Non-specific:* Abrupt fever, severe headache, and myalgia. Possibly also cough, abdominal pain, nausea, chills, and muscle tenderness. Recrudescence of epidemic typhus called Brill-Zinsser disease may occur years following initial illness, during times of extreme stress or when the immune system becomes weakened. ***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. Expect jaundice. Neurological: confusion or drowsiness, rarely seizures or coma.

Labs Imaging: ***Blood:*** Chemistry, CBC, elevated LFT's, thrombocytopenia, IHC staining, and culture (cannot be grown on cell-free media). Weil-Felix test may be used in developing countries, but is not optimally sensitive or specific. PCR of whole blood and serum immunofluorescent assay.

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 of people, bedding, and clothing. Not communicable person to person.

Risk Factors: ***Travel:*** refugees and homeless communities; also endemic to Andes regions of South America and in Burundi and Ethiopia. ***Reservoirs/Vectors:*** infectious feces from lice or from fleas on flying squirrels. ***Occupation:*** homeless, refugees.

Glanders



Agent: *Burkholderia mallei*

ICD-10: A24.0

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

Symptoms Summary: *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:* May occur after localized infection or inhalational exposure. Generalized papular eruption (may become pustular) with abscess of internal organs (liver, spleen and 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. *Imaging:* *CXR* (miliary nodules, lobar pneumonia, or lung abscess) or abdominal ultrasound or CT scan (liver/splenic abscesses).

Treatment: Ceftazidime 50 mg/kg IV q6-8hrs, max 8g/day. Add TMP/SMX for patients with severe infection involving the brain and prostate. If included, continue for entire duration. Duration of intensive therapy is generally 10-14 days, however greater than four weeks of parenteral therapy may be necessary in cases of more severe disease.

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

Risk Factors: *Travel:* Middle East, Asia, Africa, and South America. *Reservoirs/Vectors:* horses, donkeys, and mules. *Occupation:* horse handlers. *Food:* horse meat.



Melioidosis

Agent: Burkholderia pseudomallei

ICD-10: A24.1

Incubation Period: 1–21 days

Symptoms Summary: *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. Septicemic melioidosis typically presents with fever, rigors, night sweats, myalgia, anorexia, and headache. Most patients are bacteremic. 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 prostatitis or renal involvement). *Imaging:* *CXR* (miliary nodules, pneumonia); abdominal ultrasound or CT scan (hepatic, splenic abscesses); transrectal ultrasound/MRI/CT (prostatic abscess).

Treatment: *Initial intensive therapy:* Ceftazidime 50 mg/kg up to 2 g IV q6h, Meropenem 25 mg/kg up to 1g IV q8h, Imipenem 24 mg/kg up to 1g IV q6h. TMP-SMX also recommended.

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

Risk Factors: *Travel:* Southeast Asia, northern Australia, Papua New Guinea, much of the Indian subcontinent, southern China, Hong Kong, Taiwan, and the Philippines. *Reservoirs/Vectors:* Soil, dust. *Occupation:* soldiers, farmers. *Food:* contaminated water.

Plague: Bubonic & Septicemic



Agent: *Yersinia pestis*

ICD-10: A20.0 & A20.7

Incubation Period: 2–8 days

Symptoms Summary: *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, Wright-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.

Risk Factors: *Travel:* Africa, South Asia, Central Asia, Middle East, Western North America, and South America. *Reservoirs/Vectors:* rats, mice, ground squirrels, fleas.



Plague: Pneumonic

Agent: *Yersinia pestis*

ICD-10: A20.2

Incubation Period: 1–6 days

Symptoms Summary: Onset is acute and often fulminant. Initial symptoms of high fever, chills, headache, malaise, myalgias with 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, Wright-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: Gentamicin 5mg/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 100mg PO bid or Cipro 500mg PO bid for 7 days.

Precautions: Droplet precautions: Respiratory droplet isolation for at least the first 48 hours of antibiotic therapy. 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.*

Risk Factors: *Travel:* Africa, South Asia, Central Asia, Middle East, Western North America, and South America. *Reservoirs/Vectors:* rats, mice, ground squirrels, fleas.

Q Fever



Agent: *Coxiella burnetii*

ICD-10: A78

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

Symptoms Summary: 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 adenopathy, or small pleural effusions.

Treatment: Doxycycline 100mg IV or PO q12hr for 14 days. Hydroxychloroquine in addition to doxycycline for patients with persistent infections for 18+ months, as well as surgical removal of nidus of infection.

Post-exposure prophylaxis: doxycycline 100mg bid for 5-7 days can be considered in groups determined to be at high risk for exposure, but not recommended for the prevention of naturally occurring Q fever. Chemoprophylaxis is only considered effective if administered within 8-12 days of exposure.

Precautions: Standard Precautions. Heavy environmental contamination with *C. burnetii* 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.

Risk Factors: *Travel:* endemic world-wide. *Reservoirs/Vectors:* sheep, cattle, goats, cats, dogs, rodents, birds, rabbits, reptiles and ticks. *Occupation:* animal husbandry, contact with animal birth-products. *Food:* raw milk and soft cheeses.



Tularemia

Agent: Francisella tularensis

ICD-10: A21

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

Symptoms Summary: *Ulceroglandular tularemia:* characterized by a sudden onset of fever, chills, headache, cough, and myalgias, concurrent 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, peri-bronchial infiltrates).

Treatment: *Severe illness:* Streptomycin adults = 10 mg/kg IM q12 for 7-10 days. Gentamicin 5 mg/kg IM or IV daily, divided q8hr for 7-10 days.

Mild to moderate: Doxycycline 100 mg PO bid for 14-21 days. Ciprofloxacin 500-750 mg bid for 10-14 days.

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

Risk Factors: *Travel:* northern hemisphere. *Reservoirs/Vectors:* infected ticks, rabbits, deer flies, or mosquitoes. *Occupation:* Veterinarians, hunters or others with routine exposure to potentially infected animals or their carcasses

Botulism



Agent: Toxin produced by *Clostridium botulinum*

ICD-10: A05.1 and A48.52

Incubation Period:

12–36 hours (range 2 hours to 8 days)

Symptoms Summary: 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 patient 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, and/or urinary retention.

Labs Imaging: *Clinical diagnosis:* Labs and imaging are of limited diagnostic value; the decision to treat with antitoxin is based on clinical diagnosis. - Acute/convalescent serologies usually negative - Chemistries, CBC, CXR usually normal. *Nerve conduction studies:* Support diagnosis (normal in up to 40% cases). *Toxin mouse bioassay or PCR:* Serum, stool, wound, vomitus, food (PCR provides quicker results but it is 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, HBAT, available at CDC. Supportive care: Monitor in ICU for respiratory failure; Neurology consult. Public health notification.

Precautions: Standard Precautions. Not communicable person-to-person.

Risk Factors: *Occupation:* black-tar heroin users (also, “skin-popping” with heroin) *Food:* home-canned vegetables, fruits, and fish products.



Ricin Intoxication

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

ICD-10: T62.2

Incubation Period: 4–8 hours post-inhalation or injection; 1–2 hours post-ingestion

Symptoms Summary: *Inhalation:* Fever, chest tightness, cough, dyspnea, nausea, and/or diaphoresis with sublethal doses in humans. Higher doses in NHPs cause labored breathing within 18-24 hrs; pulmonary edema due to airway necrosis and capillary leak, and severe respiratory distress and death in 36-48 hours. *Ingestion:* Onset of 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 toxic due to toxin degradation by digestive enzymes and poor GI 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 hours.

Labs Imaging: *Nasal swabs and induced respiratory secretions:* Toxin assays (PCR, Ag ELISA) if within 24 hr of 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. Use caution in gastric lavage due to necrotizing action of ricin.

Precautions: Standard Precautions. Not communicable person to person.

Risk Factors: *Food:* castor bean.

Staphylococcal Enterotoxin B



Agent: Toxin produced by *Staphylococcus aureus*

ICD-10: A05

Incubation Period: 2–12 hours (range 1.5–24 hours)
post-inhalation; 1–12 hours post-ingestion

Symptoms Summary: Initial: nonspecific flu-like symptoms such as fever, chills, headache, and myalgias. Later symptoms depend upon the route of exposure.

Ingestion: GI symptoms: nausea, vomiting, and diarrhea for 1-2 days.

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.

Ocular: Conjunctivitis, localized swelling, GI symptoms (from inadvertent swallowing of toxin or direct CNS effect). Resolves 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 post-exposure in animals). *CXR:* may reveal increased interstitial markings, atelectasis, pulmonary edema, or ARDS. *Leukocytosis:* common (can be >15,000 cells/mm³).

Treatment: Supportive Treatment.

Precautions: Standard Precautions. Not communicable person-to-person.

Risk Factors: *Reservoirs/Vectors:* Pyrogenic toxin-producing strains of *Staphylococcus aureus*. **Food:** food poisoning with *Staph aureus* or group A streptococcus.



Trichothecene (T-2) Mycotoxins

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

ICD-10: T64

Incubation Period: Minutes to hours after exposure

Symptoms Summary: *Cutaneous:* burning pain, redness, tenderness, blistering, and progression to skin necrosis. *Upper respiratory:* nasal itching, pain, sneezing, epistaxis, and rhinorrhea. Pulmonary and tracheo-bronchial 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; activated charcoal should be given orally if the toxin is swallowed. Soap and water washing 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.

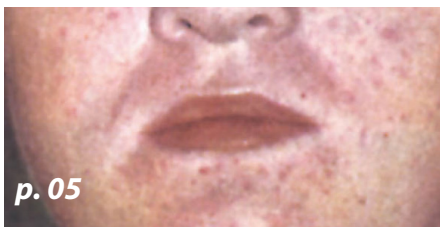
Risk Factors: *Reservoirs/Vectors:* *Fusarium tricinctum* (a mold fungus).

Food: Moldy whole grains which can be inadvertently used to make bread.

Image Archive



Diffuse ecchymosis in a patient with CCHF, one week after symptom onset. Courtesy of Robert Swanepoel, PhD, DTVM, MRCVS; National Institute of Virology, South Africa



Maculopapular Rash in Marburg Disease. A nonpruritic maculopapular rash (resembling the rash of measles) may occur in up to 50% of patients infected with the Ebola or Marburg viruses within the first week of illness. The rash is more common in light-colored skin and desquamates on resolution. Reprinted with permission from Thieme (Martini GA, Knauff HG, Schmidt HA, et al. A hitherto unknown infectious disease contracted from monkeys. *Ger Med Mon.* 1968;13:457-470). *JAMA: The Journal of the American Medical Association*, May 8th, 2002, Volume 287



Facial flushing in HFRS. Photo courtesy of John Huggins, PhD.



p. 08

Patient with Lassa fever manifesting conjunctival injection and blood clots at the angles of the mouth. Courtesy of Emerging Infectious Diseases; Donald S. Grant, Humarr Khan, John Schieffelin and Daniel G. Bausch; Kenema Government Hospital, Ministry of Health and Sanitation, Kenema, Sierra Leone, and Tulane Health Sciences Center, New Orleans, LA, USA



p. 10

This 1973 image from Bangladesh, depicts a closer view of a child's face, as she was being held by her father. This girl who was infected with smallpox, displayed a classic, though severe maculopapular rash over her entire body. Courtesy of CDC/Public Health Image Library (PHIL)

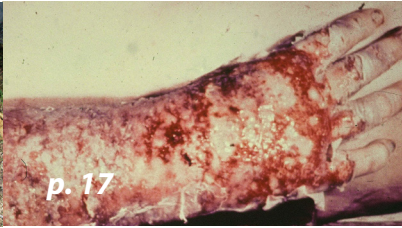


p. 10

This 1973 image depicts the dorsum of a Bangladeshi smallpox patient's right hand, revealing the numerous umbilicated maculopapular lesions, which are characteristic of this viral illness. Image courtesy of CDC/ Public Health Image Library (PHIL)



This image depicts a man's left forearm with a cutaneous lesion, which was diagnosed as cutaneous anthrax, caused by *Bacillus anthracis*. The bacterium derives its name from characteristic dark-brown to black-colored eschar that covers the lesion. The color of the lesion resembles the color of anthracite coal. Image courtesy of CDC / Public Health Image Library (PHIL)



This case of glanders shows extensive ulceration and sloughing of the skin of the forearm and the hand; the underlying tissues are edematous and hemorrhagic. Ulcers may be connected by lymphatic vessels ("Farcy Pipes") full of thick purulent exudate. Courtesy of Dr. Steve Sorden and Dr. Claire Andreasen and Center for Food Security and Public Health (CFSPH)



This image depicts a palmar view of the right hand of a 59-year-old man, who had been infected by the plague bacterium, *Yersinia pestis*, after having come into contact with both an infected cat, and a dead mouse in his neighborhood. The gangrenous condition of the fingers and palm had turned the dead digits black, and mummified. See PHIL 16550, 16552, and 16553 for three more images depicting this patient's gangrenous feet and hands. Image Courtesy of CDC / Public Health Image Library (PHIL).



This plague patient shows symptoms that included a number of swollen inguinal lymph nodes or buboes, caused by a *Yersinia pestis* bacterial infection. Image Courtesy CDC / Public Health Image Library (PHIL).

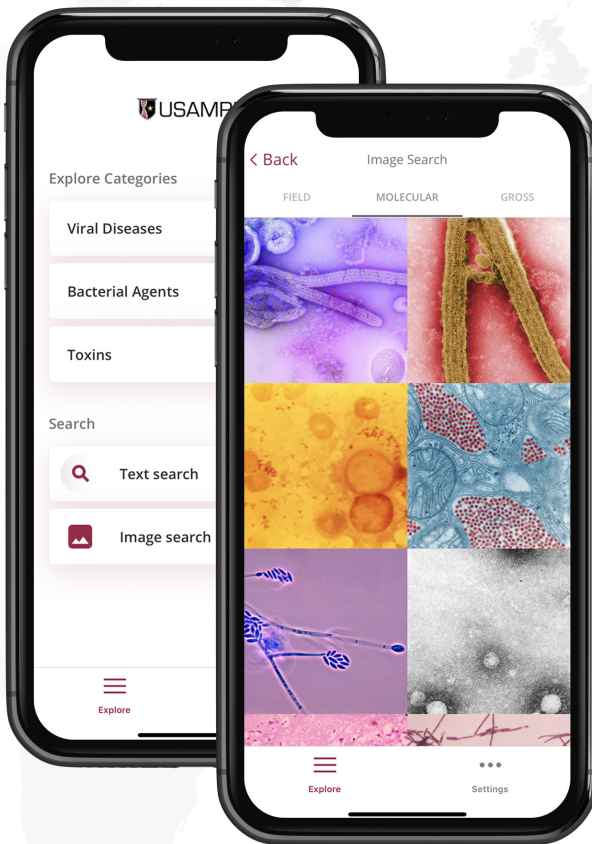
Five days after sustaining a compound fracture of his right arm and being infected with *Clostridium botulinum*, this 14-year-old boy noticed that he had blurred vision. Four days later, he could not swallow, move his lips, or protrude his tongue. Other findings included bilateral total ophthalmoplegia with ptosis (left) and dilated, fixed pupils (right). His mental status and sensory examination were normal. Image courtesy Herbert L. Fred, MD, Hendrik A. van Dijk



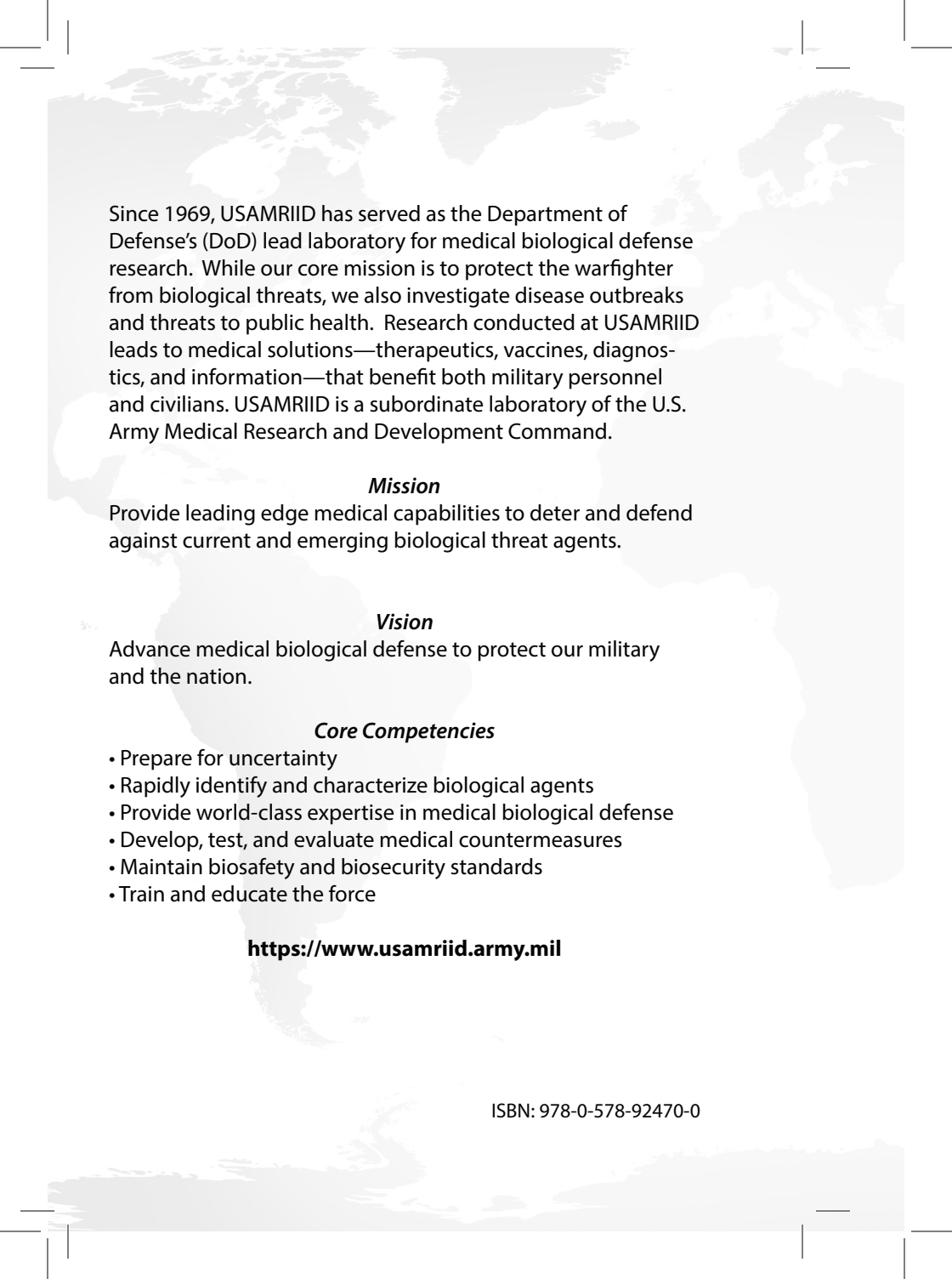
This image depicts a lateral view of a patient's left thumb showing an ulcerative skin lesion, which was diagnosed as tularemia, caused by the Gram-negative bacterium, *Francisella tularensis*. Courtesy of CDC/Public Health Image Library (PHIL)

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
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
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
SC	subcutaneous
SNV	Sin Nombre Virus
tid	three times per day
TMP / SMX	trimethoprim and sulfamethoxazole
WBC	white blood cell
WHO	World Health Organization



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