

# Ricin

## Surveillance Protocol

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### **Provider Responsibilities**

Report suspected or confirmed ricin-related illness or exposure to poison control at (800)-222-1222.

Report suspect or confirmed intentional exposure or outbreaks of illness consistent with ricin to the local health department immediately, including patient name(s), contact information and other information requested by the local health department.

### **Laboratory Responsibilities**

Report suspected or confirmed ricin-related illness or exposure to poison control at (800)-222-1222.

Report suspect or confirmed intentional exposure or outbreaks of illness consistent with ricin to the local health department immediately, including patient name(s), contact information and other information requested by the local health department.

### **Local Health Responsibilities**

1. Notify DIDE immediately if a confirmed or suspected case of ricin intoxication is reported.
2. Evaluate occupational health risk. There is no risk to public health workers doing an epidemiological investigation unless there is environmental contamination with ricin due to aerosolization. Under that circumstance, initiate the epidemiological interview only after the patient has been removed from the contaminated environment and has undergone decontamination. Environmental investigation requires specialized knowledge and equipment and should not be undertaken except under guidance of a knowledgeable experienced investigator.
3. Epidemiological investigation should be individualized in consultation with DIDE. A single case of illness due to intentional exposure to ricin is considered an outbreak. Two or more cases of illness due to ricin exposure regardless of intent is considered an outbreak. See outbreak investigation protocol and consult an experienced epidemiologist for guidance on the investigation. Anticipate the need to interview / collect data on cases and suspect cases regarding:

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- a. Demographic characteristics
  - b. Onset date and time
  - c. (suspected or confirmed) exposure date and time
  - d. Symptoms
    - i. Abdominal pain
    - ii. Diarrhea (bloody or non-bloody)
    - iii. Vomiting
    - iv. Cough
    - v. Dyspnea
    - vi. Fatigue
    - vii. Fever
    - viii. Muscle pain
    - ix. Weakness
  - e. Complications
    - i. Hypoxemia
    - ii. Non-cardiogenic pulmonary edema.
    - iii. Seizures
    - iv. Hypovolemic shock
    - v. Renal failure
    - vi. Hospitalization
    - vii. ICU admission
    - viii. Mechanical ventilation
    - ix. Death
  - f. Laboratory data
    - i. Liver function tests
    - ii. Creatinine
  - g. Risk history:
    - i. 24 hour food history prior to onset
    - ii. 24 hour activity history prior to onset
    - iii. Any unusual observations in the 24 hours prior to onset
4. Develop and implement mitigation recommendations in consultation with the Bureau for Public Health.

### **State Health Responsibilities**

1. Coordinate epidemiological investigation with CDC, law enforcement (if applicable), poison control and local health department(s).
2. Develop, as indicated by the situation:
  - a. Standardized case investigation forms
  - b. Line lists

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- c. Background information for the public
- d. Provider alerts
3. Provide additional resources for investigation, including:
  - a. Surge capacity for interviews
  - b. Field team
  - c. Other resources as needed and as available

### **Disease Control Objectives**

If an outbreak of illness due to ricin is detected, reduce risk of morbidity and mortality by:

1. Investigation to identify and remove the source of exposure; and
2. Alerting providers to suspect the diagnosis and offer appropriate supportive therapy.

### **Disease Prevention Objectives**

If a source of intoxication is identified, alert providers and the general public to avoid exposure.

### **Disease Surveillance Objectives**

Rapidly detect, investigate and report an outbreak of ricin poisoning if it occurs in West Virginia.

### **Public Health Significance**

Ricin is a naturally occurring toxin found in castor beans. It has recently been used for criminal purposes, including contamination of letters addressed to public officials. The assassination of Bulgarian journalist Georgi Markov in 1978 in Great Britain was attributed to an injection of ricin.

Historically, the overwhelming majority of animal and human cases of ricin intoxication have occurred due to accidental ingestion of castor beans, with a case fatality of 1.5% in humans. By contrast, intentional injection of ricin has an estimated case fatality rate of 83% (i.e., 5 of 6 persons exposed) (ref 1). If ricin is used with the intention of causing disease in others, the most likely mode of exposure would be ingestion or inhalation.

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### Clinical Description

Cases of ricin poisoning have been reviewed extensively in references 1 -3. This water-soluble protein can circulate through the bloodstream and impact multiple organ systems, especially through parenteral or inhalation exposure. Common symptoms include abdominal pain, vomiting, diarrhea, muscle pain and cramps, circulatory collapse, shortness of breath and dehydration. The constellation of symptoms depends on the dose and the route of exposure:

Ingestion: Most common symptoms include abdominal pain, vomiting, diarrhea, heartburn, mouth and throat pain. Vomiting of blood or passing blood in the stools is less common. Fluid loss may result in dehydration or shock. Other symptoms include rapid pulse and respirations, and sweating.

Inhalation: Exposure by inhalation has been studied in animals, but there is very little data in humans. Pulmonary symptoms are likely to be most prominent: cough, respiratory distress, wheezing, and respiratory failure. Due to cell death, the lungs may fill with fluid: 'non-cardiogenic pulmonary edema.' Shock and multi-organ system failure may also occur. Influenza-like illness: fever, cough, dyspnea, chest tightness, and joint aches were also described in a series of eight patients presumed to be exposed to ricin.

Injection: There is also very little data in humans for exposure by injection. Early symptoms are non-specific: fever, headache, dizziness, nausea, loss of appetite, hypotension and abdominal pain. There may be local tissue damage at the site of injection. The patient then progresses to multi-organ failure including hepatic injury and renal failure.

### Etiologic Agent

Ricin is a protein toxin that occurs naturally in castor beans. The toxin acts by impairment of protein synthesis in cells and can produce cell death and failure of multiple organ systems.

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### Reservoir

Ricin is found in castor beans. By-products of castor oil may find their way into fertilizer and animal feed. Ricin may contaminate these products through errors in the manufacturing process and cause intoxications in animals.

### Mode of Transmission

Ricin can cause disease by ingestion, inhalation or parenteral administration. Accidental or intentional intoxications (i.e., suicides) most commonly result from ingestion of castor beans. Outbreaks of animal illness have resulted from ingestion of contaminated food. Intentional exposure has also occurred through injection of ricin.

### Incubation Period

Inhalation: usually 4 to 8 hours / not more than 24 hours

Ingestion: 4 to 10 hours

Injection: within 12 hours

### Period of Communicability

Not applicable. Ricin is a toxin, and cannot be spread from one person to another.

### Outbreak Recognition

Recognition of an outbreak of ricin poisoning would likely be difficult because the signs and symptoms are non-specific and there is no readily available laboratory test.

An outbreak of ricin intoxication due to a point source should result in cases tightly clustered in time (within a few hours) after a common exposure. With ingestion, the spectrum of illness might range from mild gastroenteritis to systemic poisoning with hepatic and renal failure. Similarly, with inhalation, the spectrum of illness might range from mild influenza-like illness to ARDS and multi-organ failure.

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### Laboratory Diagnosis

Laboratory diagnosis is available through the laboratory referral network. The Office of Laboratory Services can test environmental specimens, but not clinical specimens.

### Case Definitions (CDC)

#### *Case Definition: Ricin Ingestion*

##### **Clinical description**

Ingestion of ricin typically leads to profuse vomiting and diarrhea, which might be bloody, followed by hypovolemic shock and multisystem organ dysfunction.

##### **Laboratory criteria for diagnosis**

- Biologic: CDC can assess selected specimens on a provisional basis for urinary ricinine, an alkaloid in the castor bean plant. Only urinary ricinine testing is available at CDC or the Laboratory Response Network.

- OR -

- Environmental: Detection of ricin in environmental samples, as determined by CDC. Ricin can be detected qualitatively by time-resolved fluoroimmunoassay (TRF) in environmental specimens (e.g., filters, swabs, or wipes).

##### **Case classification**

- Suspected: A case in which a potentially exposed person is being evaluated by health-care workers or public health officials for poisoning by a particular chemical agent, but no specific credible threat exists.

- Probable: A clinically compatible case in which a high index of suspicion (credible threat or patient history regarding location and time) exists for ricin exposure, or an epidemiologic link exists between this case and a laboratory-confirmed case.

- Confirmed: A clinically compatible case in which laboratory tests have confirmed exposure.

The case can be confirmed if laboratory testing was not performed because either a predominant amount of clinical and nonspecific laboratory evidence of a particular chemical was present or the etiology of the agent is known with 100% certainty.

#### *Case Definition: Ricin Inhalation*

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### **Clinical description**

Inhalation of ricin typically leads to cough and respiratory distress followed by pulmonary edema, respiratory failure, and multi-system organ dysfunction. Weakness and influenza-like symptoms of fever, myalgia, and arthralgia might also be reported.

### **Laboratory criteria for diagnosis**

- Biologic: CDC can assess selected specimens on a provisional basis for urinary ricinine, an alkaloid in the castor bean plant. Only urinary ricinine testing is available at CDC or the Laboratory Response Network
  - OR-
- Environmental: Detection of ricin in environmental samples, as determined by CDC. Ricin can be detected qualitatively by TRF in environmental specimens (e.g., filters, swabs, or wipes).

### **Case classification**

- Suspected: A case in which a potentially exposed person is being evaluated by health-care workers or public health officials for poisoning by a particular chemical agent, but no specific credible threat exists.
- Probable: A clinically compatible case in which a high index of suspicion (credible threat or patient history regarding location and time) exists for ricin exposure, or an epidemiologic link exists between this case and a laboratory-confirmed case.
- Confirmed: A clinically compatible case in which laboratory tests have confirmed exposure.

The case can be confirmed if laboratory testing was not performed because either a predominant amount of clinical and nonspecific laboratory evidence of a particular chemical was present or the etiology of the agent is known with 100% certainty.

Note: A case should not be considered ricin poisoning if another confirmed diagnosis exists to explain the signs and symptoms.

### **Preventive Interventions**

For responders, CDC has an extensive manual on-line with guidance for occupational health and environmental decontamination. See:

[http://emergency.cdc.gov/agent/ricin/pdf/ricin\\_protocol.pdf](http://emergency.cdc.gov/agent/ricin/pdf/ricin_protocol.pdf)

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### Treatment

Treatment is supportive. There is no vaccine and no specific antidote.

### Surveillance Indicators

See the West Virginia outbreak investigation protocol.

### References

1. Worbs, S., et.al. *Ricinus communis intoxications in human and veterinary medicine – a summary of real cases*. *Toxins*, 2011; 3:1332-1372.
2. Griffiths, G D. *Understanding ricin from a defensive viewpoint*. *Toxins*, 2011; 3: 1373-1392.
3. Audi, J, et.al. *Ricin poisoning a comprehensive review*. *JAMA*, 2005; 294: 2342-2351.
4. CDC. Response to a ricin incident: guidelines for federal, state and local public health and medical officials. Accessed at: [http://emergency.cdc.gov/agent/ricin/pdf/ricin\\_protocol.pdf](http://emergency.cdc.gov/agent/ricin/pdf/ricin_protocol.pdf) on June 4, 2013.
5. <http://emergency.cdc.gov/agent/ricin/>
6. CDC. *Investigation of a ricin-containing envelope at a postal facility – South Carolina, 2003*. *MMWR*, 2003; 52:1129-1131.

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