



Ricin Toxin (Ricin)

Fact Sheet

Background

Ricin toxin or ricin, as it is more commonly known, is a protein that consists of A and B subunits that can be extracted from the beans of the castor plant, *Ricinus communis*. The castor plant originated in Asia and Africa and now grows in the southwestern United States. Ricin is a byproduct of castor oil production: when castor beans are crushed, they form a pulp from which castor oil is extracted, and ricin is what remains.

Castor oil is found in many commonly used substances such as paints, varnishes, and lubricating oils, and it is also used as a purgative. It is produced all over the world, but primarily in India, China, and Brazil.¹

The toxic effects of ricin are caused by its ability to inhibit protein synthesis. Ricin can be introduced to the body through inhalation of an aerosol, or through ingestion, injection, or infusion. Although ricin can be lethal, it has the potential for therapeutic use because it inhibits tumor growth. Thus, it has been tested in Phase I and II clinical trials and used in combination with tumor cell-specific antibodies to treat cancer.^{2,3}

Ricin as a Biological Weapon

Ricin was considered for use as a biological weapon by several nations. There is also documented use of ricin as an agent for assassination, most notably in the case of Georgi Markov, a Bulgarian exile, who, in 1978, was injected with a pellet of ricin from a spring-loaded needle that was mounted in his assassin's umbrella.

Ricin has made headlines more recently. In 2002, 6 suspected terrorists in Manchester, England, were arrested for possessing the toxin. In 2003, a ricin-filled envelope with a letter threatening to contaminate water supplies was processed through a mail facility in Greenville, South Carolina. In 2004, traces of ricin were detected in the mail room of the Dirksen Senate Office Building in Washington, DC. And in 2008, ricin was found in a hotel room near the Las Vegas strip. The ricin belonged to a man who, at the time, fell ill and was hospitalized for unintentionally contaminating himself with the toxin.^{2,4,5,6}

The Centers for Disease Control and Prevention (CDC) has classified ricin toxin as a Category B threat agent. Category B agents are the second highest priority agents because they can be disseminated with moderate ease, they cause moderate morbidity and low mortality, and they "require specific enhancements of CDC's diagnostic capacity and enhanced disease surveillance."⁷

Signs and Symptoms

Ricin exposure can occur through ingestion, injection, or inhalation. Oral ingestion most commonly occurs through consumption of castor beans, although ricin can be dissolved in water or a weak acid. Ricin may also be delivered through injection, as in the case of Georgi Markov; however, that method is limited by proximity to the target. As a biological weapon, ricin powder or mist would most likely be aerosolized, resulting in poisoning via inhalation.

The symptoms and severity of ricin poisoning depend on the route of exposure and the dose. Generally, intoxication through inhalation of aerosolized powder or mist is the most lethal route, and oral ingestion is the least deadly route. The exact mechanism by which ricin causes death is unclear and is probably route-specific. Ricin poisoning can lead to death within 36 to 72 hours.

Ricin intoxication produces a robust immune response, and patients will most likely have ricin antibodies circulating within 2 weeks of exposure.² Diagnosis may be confirmed by immunological analysis of a skin or nasal swab or from samples of bodily fluids. However, these applications have not been clinically validated, and there is no widely available commercial assay for ricin in biological samples.⁶

Transmission

Ricin is a toxin, and not a disease-causing agent; therefore, it is not contagious and cannot be spread from person to person through casual contact.

Infection Control Measures

Because there is no data on levels of respiratory protection necessary to prevent inhalational intoxication, recommendations are conservative. First responders and healthcare workers are urged to use the following personal protective equipment (PPE) when dealing with ricin contamination: level B PPE, self-contained breathing apparatus, disposable Tyvek suite coated with Saranex or polyethylene to prevent penetration, air purifying respirator with P-100 filter, and eye and face protection such as a full-face respirator.

PPE should be decontaminated by soaking in a 0.1% sodium hypochlorite solution for 30 minutes and washing with soap and water after use. It is not necessary for decontaminated patients to be isolated or placed in negative pressure rooms. Standard precautions should be observed.⁵

Increasing Lethality from Left to Right



Clinical Presentation of Ricin Poisoning^{2,5,6,7}

Route of Intoxication	Signs and Symptoms
Inhalation	Within a few hours of inhaling significant amounts of ricin, symptoms would include respiratory distress, fever, cough, nausea, and tightness in the chest. Patients may experience heavy sweating and pulmonary edema resulting in cyanosis. Low blood pressure and respiratory failure may occur, leading to death. Patients experiencing respiratory symptoms within 12 hours of inhaling ricin should seek medical care.
Parenteral; subcutaneous or intramuscular injection; intravenous	Ricin is unlikely to be absorbed through intact skin, although contact may cause redness and pain of the skin and the eyes. Parenteral exposure results in fever, tachycardia, tachypnea, hypotension, hepatitis, pancreatitis, nephritis, myocardial injury, cerebral edema, vomiting, diarrhea, and bone marrow suppression.
Ingestion	Swallowing significant amounts of ricin may result in vomiting and diarrhea that may become bloody. Severe dehydration may result, followed by low blood pressure. Other signs or symptoms may include hallucinations, seizures, and blood in the urine. Multi-organ failure and death may follow shortly after.

Prophylaxis and Treatment

Currently, there are no U.S. Food and Drug Administration (FDA) approved treatments specifically for ricin poisoning. Patients suffering from ricin poisoning should be provided supportive therapy.^{2,5,6}

Decontamination of surfaces is therefore necessary in response and can be accomplished by simply washing surfaces with 0.1% sodium hypochlorite for 30 minutes, followed by soap and water. Ricin is also heat sensitive and can be inactivated by heat above 80 degrees Centigrade (176 degrees Fahrenheit).⁵

Decontamination

Ricin is a toxin and cannot be transmitted from human to human. However, the persistence of ricin in an environment can increase the number of individuals exposed and increase the dose that individuals receive.

Countermeasures

Currently, there are no treatments specifically for ricin poisoning that are approved by the U.S. Food and Drug Administration (FDA); however, there are ricin countermeasures under development.

References

1. Food and Agriculture Organization of the United Nations. FAOSTATA. <http://faostat.fao.org/site/567/DesktopDefault.aspx?PageID=567#ancor>. Accessed November 10, 2008.
2. Spivak L, Hendrickson RG. Ricin. *Crit Care Clin* 2005;21:815-824.
3. Centers for Disease Control and Prevention. Facts about Ricin. Updated March 5, 2008. <http://emergency.cdc.gov/agent/ricin/facts.asp>. Accessed October 25, 2011.
4. Friess S. In accord, ricin owner enters plea of guilty. *The New York Times*. August 5, 2008. <http://www.nytimes.com/2008/08/05/us/05ricin.html>. Accessed October 25, 2011.
5. Audi J, Belson M, Patel M, et al. Ricin poisoning a comprehensive review. *JAMA*. 2005;294(18):2342-2350.
6. Poli MA, Roy C, Huebner KD, et al. Ricin. In: *Medical Aspects of Biological Warfare*. U.S. Department of Defense, Office of The Surgeon General, U.S. Army, Borden Institute. 2007:323-335. http://www.bordeninstitute.army.mil/published_volumes/biological_warfare/BW-ch15.pdf. Accessed October 25, 2011.

Fact Sheet: Ricin Toxin (Ricin)

7. Bioterrorism Agents/Diseases (by Category). Emergency Preparedness and Response Web site. U.S. Department of Health and Human Services: The Centers for Disease Control and Prevention. <http://emergency.cdc.gov/agent/agentlist-category.asp#b>. Accessed October 25, 2011.
8. DOR BioPharma reports achievement of two-year stability milestone for RiVax(TM), its vaccine against ricin toxin. *Medical News Today*. January 30, 2008. <http://www.medicalnewstoday.com/articles/95477.php>. Accessed October 25, 2011.
9. Smallshaw JE, Richardson JA, Vitetta, ES. RiVax, a recombinant ricin subunit vaccine, protects mice against ricing delivered by gavage or aerosol. *Vaccine*. 2007;25:7459-7469.

See Also

Mirarchi FL. CBRNE- Ricin. February 14, 2008. <http://emedicine.medscape.com/article/830795-overview>. Accessed October 25, 2011.

U.S. Department of Health and Human Services. Response to a Ricin Incident: Guidelines for Federal, State, and Local Public Health and Medical Officials. http://emergency.cdc.gov/agent/ricin/pdf/ricin_protocol.pdf. June 2006. Accessed October 25, 2011.