

Chronic Wasting Disease (CWD)

Disease Agent:

- Chronic Wasting Disease (CWD) prion

Disease Agent Characteristics:

- Current evidence supports the theory that the infectious agent is a prion. However, the existence of accessory factors has not been excluded.
- Prions are considered members of the transmissible spongiform encephalopathy (TSE) group of agents that include kuru, Creutzfeldt–Jakob Disease (CJD) and variant CJD (vCJD); both CJD and vCJD are discussed in separate fact sheets. Prion diseases are either sporadic, inherited, or infectious. Prions are the agent, whether heritable through a germline mutation in the human gene, *PRNP*, or infectious.
- Prions are infectious proteins that are devoid of nucleic acid that result in certain disorders through binding and accumulation of the abnormal disease-causing prion isoform to the normal prion protein.
- Mammalian prions replicate by recruiting the normal cellular isoform of the prion protein PrP^C to form a disease-causing isoform designated PrP^{Sc}. PrP^{Sc} or PrP^{res} are the designations for the pathogenic forms and are used interchangeably in the literature.
- Prions are nonimmunogenic as a result of the sharing of epitopes with the normal cellular isoform.
- PrP^C is soluble and circulates in plasma, is also present on many cell membranes, and has a molecular weight of about 33-35 kDa.
- PrP^{Sc} has a more restricted tissue range than does PrP^C.
- Prion diseases represent disorders of protein conformation in which the tertiary structure of the precursor protein is profoundly altered. The transition occurs when the α helical protein of PrP^C changes into a β -sheet-rich molecule of PrP^{Sc}. PrP^{Sc} or PrP^{res} is folded into a form containing 50% β sheet and is resistant to proteases (proteinase K, lysosomal enzymes).
- PrP^{Sc} can form aggregates that precipitate as amyloid plaques in the CNS; these are a histopathological hallmark of the transmissible spongiform encephalopathies.
- Physicochemical properties: Resistance of prions to commonly used disinfectants (formaldehyde, glutaraldehyde, ethanol, and iodine) is well recognized. Immersion in undiluted bleach (60,000 ppm or mg/L of available chlorine) for 1 hour is only partially effective. Prions are resistant to ultraviolet light and ionizing radiation, ultrasonication, nucleases, boiling, and heat. High concentrations of NaOH (1-2 N) and prolonged autoclaving (1-5 h) at high temperatures (120-135°C) are advocated for disinfection.

Disease Name:

- Chronic wasting disease (CWD), a TSE of deer and elk

Priority Level:

- Scientific/Epidemiologic evidence regarding blood safety: Theoretical
- Public perception and/or regulatory concern regarding blood safety: Very low
- Public concerns regarding disease agent: Low/Moderate

Background:

- CWD was previously thought to be limited to endemic areas in northeast Colorado, southeast Wyoming, and southwest Nebraska. However, it has recently been found in the wild in several new areas in North America. It is also found in commercial game farms in several states and Canadian provinces.
- The origin of CWD is unclear but it appears to have emerged only a couple of decades ago in the wild. Transmission to other species in the wild or to humans has not been reported.
- A recent study showed that it could be experimentally transmitted to calves by direct intracerebral inoculation.
- Recent investigation of cases of classical Creutzfeldt–Jakob Disease (CJD) in deer hunters showed no epidemiologic link with CWD.

Common Human Exposure Routes:

- No known transmission to humans, but exposure could occur through handling or consuming deer and elk. A recent study found that the CWD prion might be present in meat from infected animals.

Likelihood of Secondary Transmission:

- Unknown, not reported

At-Risk Populations:

- In theory only: hunters, meat processors, taxidermists, and those who consume deer or elk meat

Vector and Reservoir Involved:

- Reservoir is infected deer and elk

Blood Phase:

- Unknown

Survival/Persistence in Blood Products:

- Unknown

Transmission by Blood Transfusion:

- Unknown

Cases/Frequency in Population:

- No human case of the disease has ever been confirmed.
- CWD in 15% of cervids in affected areas

Incubation Period:

- Difficult to determine in natural infection; experimentally, 1-2 years

Likelihood of Clinical Disease:

- Unknown in humans

Primary Disease Symptoms:

- Not applicable in humans
- Wasting, ataxia, tremors in infected animals

Severity of Clinical Disease:

- High among deer and elk (progressive, invariably fatal)

Mortality:

- 100% for symptomatic disease

Chronic Carriage:

- Unknown

Treatment Available/Efficacious

- Not applicable

Agent-Specific Screening Question(s):

- No specific question is in use.
- Not indicated because of the absence of recognized human infection.
- No sensitive or specific question is feasible. If risk to humans is confirmed and route of transmission is identified, exposure to deer and elk (e.g., hunting, meat consumption) could be evaluated as a screening question.

Laboratory Test(s) Available:

- No FDA-licensed blood donor screening test exists.
- No presymptomatic test is available.

Currently Recommended Donor Deferral Period:

- No FDA Guidance or AABB Standard exists.

Impact on Availability:

- Agent-specific screening question(s): Not applicable; would be significant if required given the popularity of hunting in the population
- Laboratory test(s) available: Not applicable

Impact on Blood Safety:

- Agent-specific screening question(s): Not applicable
- Laboratory test(s) available: Not applicable

Leukoreduction Efficacy:

- Unknown, but probably limited by analogy with other TSEs

Pathogen Reduction Efficacy for Plasma Derivatives:

- Inactivation data not available. Highly significant dilution and/or partitioning of infectivity away from final derivatives by fractionation process suggested in animal models using other prion agents.

Suggested Reading:

1. Angers RC, Browning SR, Seward TS, Sigurdson CJ, Miller MW, Hoover EA, Telling GC. Prions in skeletal muscles of deer with chronic wasting disease. *Science* 2006;311:1117.
2. Chronic Wasting Disease Alliance. [cited May 2009]. Available from: <http://www.cwd-info.org/>
3. Hamir AN, Kunkle RA, Miller JM, Greenlee JJ, Richt JA. Experimental second passage of chronic wasting disease (CWD^{mule deer}) agent to cattle. *J Comp Pathol* 2006;134:63-9.
4. Kim TY, Shon HJ, Joo YS, Mun UK, Kang KS, Lee YS. Additional cases of chronic wasting disease in imported deer in Korea. *J Vet Med Sci* 2005;67:753-9.
5. Mathiason CK, Powers JG, Dahmes SJ, Osborn DA, Miller KV, Warren RJ, Mason GL, Hays SA, Hayes-Klug J, Seelig DM, Wild MA, Wolfe LL, Spraker TR, Miller MW, Sigurdson CJ, Telling GC, Hoover EA. Infectious prions in the saliva and blood of deer with chronic wasting disease. *Science* 2006;314:133-6.
6. Xie Z, O'Rourke KI, Dong Z, Jenny AL, Langenberg JA, Belay ED, Schonberger LB, Petersen RB, Zou W, Kong Q, Gambetti P, Chen SG. Chronic wasting disease of elk and deer and Creutzfeldt-Jakob disease: comparative analysis of the scrapie prion protein. *J Biol Chem* 2006;281:4199-206.