Rabies Virus Overview

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Rabies History
- A recognized disease as early as 2300 BC
- Aristotle wrote about rabies in 322 BC
- Saliva of rabid dogs was recognized as “venomous” in the 1st century AD

Rabies History
- First documented case in US
  - Virginia, 1753
- Colonial times-1950s
  - Dogs highest vector risk
- 1960s-today
  - Wildlife greatest reservoir

Rabies History
- Raccoon rabies:
  - Noticed in FL in mid 50s
  - Spread to VA in 1970s
  - Seen everywhere but sw VA
- Skunk rabies
  - Present in low levels in sw VA since 1960s

Why rabies?
- 20,000 – 40,000 people exposed to rabies each year in U.S.
- Infection is almost always fatal
- Public health costs (detection, prevention, control) > $300,000,000 annually in U.S.
- Rabies is endemic in Virginia

Rabies - Outline
- Virus
- Disease and diagnosis
- Animal epidemiology – US and VA
- Human epidemiology – US and VA
- Domestic animal control
- Human prevention
Rabies Virus

- A virus that only infects mammals
  - Not fish, birds or reptiles
- Inactivated by drying, sunlight, high temperatures and most disinfectants
- Survives freezing

Rabies Virus - Transmission

- Only saliva and central nervous system (CNS) tissue (brain, spinal cord) will be infectious in an animal with rabies
- Urine, blood and feces are NOT infectious/do not contain the rabies virus

Rabies Exposures

- Bite
  - Saliva enters the wound created by a bite
- Common non bite exposures
  - Virus enters eyes, nose or mouth
  - Virus enters an open wound
- Virus CANNOT enter intact skin
- Other possible routes
  - Aerosol
  - Transplantation

Rabies virus - Pathogenesis

- Virus enters the body
- Travels along nerves to spinal cord
- Then to brain
- After brain is infected, virus starts being shed in saliva

Rabies Incubation

- The time between when a dog, cat or ferret is bitten and when that animal will show signs of disease has been established
  - Typically 1-2 months, but can be as short as 10 days or as long as 6 months

Rabies Shedding

- The time between when a dog, cat or ferret starts shedding virus in its saliva and when that animal starts acting sick and then dies is also well established
  - Typically a dog, cat or ferret will start shedding the virus in its saliva the same day it starts acting sick and will only live for a couple of days after that (may live as long as 8 days)
Rabies Shedding - Other Animals

- For animals other than dogs, cats and ferrets, we do not know a definitive time period between when they start shedding the virus and when they start acting sick
  - This is why the only definitive observation times we have are for dogs, cats and ferrets

Rabies Virus - Variants

- Associated with certain animal species
- Associated with certain geographic areas (except bats)
- Spillover to other species
- Vaccines protect against all variants

Rabies Virus - Variants

- Reservoirs of virus variants, U.S.
  - Raccoon
  - Skunk
  - Fox
  - Coyotes
  - Bats – several species

Terrestrial Rabies Virus Variants in Virginia

- Two terrestrial wildlife rabies variants – raccoon and skunk
  - Spillover to other wild and domestic animals
  - Raccoon – endemic in most areas with cycling
  - Skunk – confined to southwest VA
- Multiple bat variants
  - Occasional spillover

Terrestrial Rabies Virus Variants in the United States and Puerto Rico, 2007

- CDC

Rabies – risk of transmission by animal type

- High risk
  - Carnivores (raccoons, skunks, foxes)
  - Large rodents (groundhogs in raccoon areas)
  - Opossums (in raccoon endemic areas)
  - Bats
- Low risk
  - Small rodents (squirrels, chipmunks)
  - Rabbits, hares
- Evaluate circumstances
  - Exotic animals/hybrids
  - Livestock
Rabies Risk by Animal Type

For those animals for which no observation time has been established and do not fit into either a distinctly high risk or low risk category, the response is based on consideration of a number of factors including the scientific family of the animal, circumstances of exposure, how the animal is housed and/or health of animal.

Rabies – signs and symptoms in animals

- Clinical presentation is variable
- Early – vague, nonspecific
- Behavioral – more or less aggressive, vocalization
- Physical – appetite loss, paralysis, seizures, coma, death
- Behavior or physical signs or symptoms that are clearly abnormal

Rabies Diagnosis in Animals

- Postmortem test
- Results available in about 24 hours
- Results reported to local health department

Rabies - Animal Epidemiology, US

Rabies - Animal Epidemiology, US

Animal Rabies Statistics - Virginia

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<th>Species</th>
<th>2005</th>
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<tr>
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<td>311</td>
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<tr>
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</tbody>
</table>

≤ 5/yr = beaver, coyote, deer, donkey, goat, groundhog, horse, opossum, otter, rabbit, rat
Human Rabies Epidemiology, U.S.

- 25 cases, 2000 – 2007
- 18 infected with a bat variant
  - Many with exact exposure unknown
- Travel to countries where domestic animal rabies is more common is also a risk factor.

Rabies-Symptoms in Humans

- Initial clinical symptoms include anxiety, headache, mild fever, irritation at bite site
- Progresses to muscle spasms, difficulty swallowing, hydrophobia
- Clinical course is typically short

Human Rabies Epidemiology Virginia Cases

- 1953 – veterinary hospital worker
  - Unknown exposure
- 1998 – prisoner in work program
  - Unknown exposure
  - Pipistrelle/silver-haired bat variant
- 2003 – office worker
  - Unknown exposure
  - Raccoon variant

Rabies Control – Domestic Animals and Humans

- Animal and human vaccination
- Animal control
- Pre- and postexposure management

Rabies in Domestic Animals, 1957-2007

- Total
- Cats
- Cattle
- Dogs

- Year
- Cases

Percent of Animals Testing Positive

Virginia, 1989 – 2006

- 0%
- 2%
- 4%
- 6%
- 8%
- 10%
- 12%
- 14%
- 16%
Rabies Control – Domestic Animal Vaccination

- Virginia code requires dogs and cats to be vaccinated by 4 months of age
- Booster dose given 1 year after initial vaccination
- Thereafter, should vaccinate every year or every 3 years, depending on vaccine type
- Encourage use of 3 year vaccine

Rabies Control – Domestic Animal Vaccination

- Virginia code requires vaccine administration by currently licensed veterinarian or veterinary technician under direct supervision
- Veterinarians must practice in a licensed facility
- Exception – rabies clinics outside licensed facility
  - Governing body finds number of resident veterinarians inadequate
  - Clinic approved by LHD and local government

Rabies Control – Human

What constitutes an exposure?
- Any bite, scratch, or other situation where saliva or central nervous system tissue from a potentially rabid animal enters an open fresh wound or contacts a mucous membrane by entering the eye, mouth, or nose

Bat Exposure
- Small bites; may go unrecognized
- Always ideal to test bat if available
- PEP indicated in response to:
  1. Known bite
  2. Direct contact and bite cannot be ruled out
  3. Situations where exposure may have gone unrecognized like bat found in the same room as a sleeping or mentally impaired or very young person

Scratches:
- A scratch should be evaluated like any other open wound, i.e. did saliva or some other virus containing material (cerebral spinal fluid, brain) contaminate the wound while it was fresh. A scratch in and of itself is not an exposure unless the paws were soaked with saliva, e.g., cat is salivating/drooling profusely or paws are visibly wet.

Rabies Control – Domestic Animals

What constitutes an exposure?
- Any circumstance where saliva or central nervous system tissue from a potentially rabid animal did have or could have had direct contact with mucous membranes or a break in the skin of a domestic animal
- Note: The actual witnessing of a bite or attack by a potentially rabid animal is not required for an exposure to have occurred. (a suspect animal...witnessed in the vicinity of...
Rabies Control Guidelines for Humans

Pre exposure series
- High risk occupations: DVMs, ACOs, LVTs
- Titers every 2 years
- Boosters if exposed or low titer (routine boosters not recommended)
- Should never receive RIG

If a person is potentially exposed and the animal is not available for observation or testing then post-exposure vaccination (PEP) is recommended. PEP will differ depending on whether or not a person has had rabies vaccines before.

Rabies Control Guidelines for Domestic Animal Exposure

If a domestic animal is exposed, the response will vary depending on the animal’s vaccination status and may include a combination of vaccine booster, confinement, strict isolation, or euthanasia.

Confinement
- House animal in a building, pen, or other escape-proof method or enclosure
- Do not remove animal unless on leash and under control of responsible adult
- Owner should notify Health Department at first sign of illness and take to veterinarian

Strict isolation
- Vaccinated dog, cat, or ferret exposed to proven or suspected rabid animal
- Should receive immediate booster of vaccine
- Confined for 45 days observation
- Veterinary evaluation at first sign of illness
- If thought to be rabies, euthanize and test

Rabies Control Guidelines for Domestic Animal Exposure

Vaccinated dog, cat, or ferret exposed to proven or suspected rabid animal
- Should receive immediate booster of vaccine
- Confined for 45 days observation
- Veterinary evaluation at first sign of illness
- If thought to be rabies, euthanize and test
Rabies Control Guidelines for Domestic Animal Exposure

Unvaccinated dog, cat, or ferret exposed to proven or suspected rabid animal
- If available, test exposing animal
- If exposing animal unavailable, euthanize exposed animal or 6 months strict isolation
- Veterinary evaluation at first sign of illness
- If thought to be rabies, euthanize and test
- Vaccinate exposed animal before release from 6 months isolation

Rabies Control Guidelines for Domestic Animal Exposure

Dog, cat, or ferret with expired vaccination exposed to proven or suspected rabid animal
- Immediate booster to exposed animal (unless euthanized)
- If available, test exposing animal
- If exposing animal unavailable, 6 months strict isolation for exposed animal
- Contact Office of Epidemiology to discuss situations where vaccination is recently expired

Rabies Control Guidelines for Domestic Animal Exposure

Vaccinated livestock exposed to proven or suspected rabid animal
- Immediate booster
- If available, test exposing animal
- Confinement in manner routine for species
- 45 day observation

Unvaccinated livestock exposed to proven or suspected rabid animal
- Euthanize immediately, or
- 6 months physically separated from unexposed animals if possible
- If available, test exposing animal

Rabies Awareness Campaigns

Rabies Awareness Week
- A statewide campaign sponsored by VDH and the VVMA

World Rabies Day
- An international campaign sponsored, in part, by the CDC

Rabies Control Messages for the Public

- Keep rabies vaccinations up-to-date on dogs, cats, and ferrets
- Supervise pets so they do not come into contact with wild animals
- Call animal control to remove strays
- Teach children never to handle unfamiliar animals
Rabies Control
Messages for the Public
- Enjoy wild animals from afar
- Never adopt wild animals
- Do not encourage wild animals to come close to/into your house
  - Avoid leaving pet food outside
  - Keep trash inside or use lids on trash
  - Block areas where wild animals could enter
- Do not relocate wildlife
- Call DGIF or licensed rehabber for support

Good Rabies Resources
- www.vdh.virginia.gov
  - VDH Programs
  - Epidemiology Program
  - Division of Environmental Epidemiology

- www.cdc.gov/healthypets
- www.cdc.gov/ncidod/dvrd/rabies
- www.nasphv.org

Contacts for Rabies Advice
- Local health department
- State health department
- Julia Murphy
  - State Public Health Veterinarian
  - julia.murphy@vdh.virginia.gov
  - 804-864-8141