

Scenario A

Poliovirus

Summary of Experiment

A basic research project is using wild type Poliovirus for immune response studies using an animal model.

Humans are the only known natural hosts of Poliovirus, monkeys can be experimentally infected and they have long been used to study Poliovirus. However, Poliovirus is not known to infect monkeys outside of the research lab. A small animal model of paralytic Poliomyelitis has been developed by genetically engineering mice to express a human receptor to Poliovirus (hPVR). Unlike normal mice, transgenic hPVR mice are susceptible to Poliovirus injected intravenously or intramuscularly and when injected directly into the spinal cord or the brain.

Poliovirus will be grown in cell culture using standard cell culture techniques with virus introduced into naïve cells from a stock solution. Viral supernatant will be collected and pooled. Less than 1 liter volume of material is handled at any time. Low speed centrifugation will be used to pellet cellular debris. All cell culture work will be done in a Class II A2 Biological Safety Cabinet (BSC).

Virus will be injected into (hPVR) transgenic mice. Mice will be euthanized at various times post infection. Necropsies will be performed, organs and tissues collected and samples prepared for standard histopathology studies. All injections and necropsies are done in a BSC.

Equipment

- Laminate bench top (old, cracked, some holes and peeling up in some places)
- Basic centrifuge (no sealed rotor or safety cups)
- Vortexer
- Incubator 37°C
- Cell culture flasks (plastic 250 mL)
- 250 mL plastic conical centrifuge tubes
- Glass pipettes
- Bunsen burner
- Glass flasks
- Scissors, scalpels and push pins (for necropsy)
- Microscope
- Sink for disposing of liquid waste and hand washing
- Plastic bag for collecting solid waste (no trash can)
- Class II A2 BSC (has never been certified or tested)

Lab Environment

- Open window ventilation (screens fitted to window but some screens have unrepaired holes)

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- Ceramic tiled floor
- Humid environment
- Urban setting
- Small crowded laboratory with limited work space

PPE

- Lab coats are worn in the lab and occasionally taken home for laundry
- Gloves are available but generally not worn

Personnel Practices

- Although an effective vaccine is available (Sabin or Salk), no records are kept of whether or not researchers have not been vaccinated.
- No occupational health services available
- Hand washing done occasionally
- Sharps are collected together with other lab waste
- Lab waste is untreated and collected by municipal (local government) waste services
- Occasional (~weekly) cleaning done by a building custodian.
- Surface decontamination done sporadically

Security Practices

- Interior doors are unlocked and propped open during the day
- Exterior doors are only locked at night
- Cultures not secured
- No personnel verification program
- Laboratory notebooks maintain a log of isolates and are kept on top of the freezer
- No inventory other than what is recorded in personal lab notebooks and no inventory checking
- Isolates are kept in a freezer in the hallway next to the laboratory

Agent Facts

Infectious Dose: unknown

Stability:

SUSCEPTIBILITY TO DISINFECTANTS: 0.5 % Sodium Hypochlorite for 10 minutes

PHYSICAL INACTIVATION: Heat-labile

SURVIVAL OUTSIDE HOST: In inanimate surfaces, Polio virus particles have been found to survive up to 2 months. Particles can survive up to 11 days in tap water at room temperature, longer in colder temperature, with similar results for primary sewage.

Incubation Period: Commonly 7-14 days for paralytic cases; reported range of 3 to possibly 35 days.

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Mortality Rate: 15 in 10,000

Morbidity:

Duration of Illness: 2 weeks

Severity of Illness: High

Duration of Infection: 4-6 weeks

Long term effects after infection: Yes. Irreversible paralysis, usually in the legs, is possible. Also, post-Polio syndrome occurs in 25% of paralytic Polio patients 30-40 years after infection.

Allergen (yes/no): No

Carcinogenic/mutagenic (yes/no): No

Abortogenic (yes/no): No

Toxin Production (yes/no): No

Immune Suppression (yes/no): No

Ability to Mutate in Host or Environment (yes/no): Yes

Infection Mitigation Measures:

For human pathogens

Immunization: Yes (OPV, IPV vaccines)

Prophylaxis: No

Post Infection Treatment: No

Existence of Diagnostic tests: Yes, isolation of virus from patient fluid samples (definitive), CSF testing, serology.

Routes of Infection:

Inhalation: No

Ingestion: Yes, primary (most likely) route of transmission

Percutaneous: Possible

Contact: Possible

Vector-Borne: No

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Sexual Transmission: No

Vertical Transmission: No

Communicability:

Human to Human: Yes, primarily through fecal-oral route, but also through pharyngeal route.

Human to Animal: No Evidence

Animal to Animal: No Evidence

Animal to Human: No Evidence

Multiple Species: No Evidence

Geographical distribution: Wild-type endemic in areas of Afghanistan, India, Nigeria, and Pakistan. Re-emergence can occur in other areas.

Perception of malicious use: LOW

Culture: Poliovirus culture can be conducted in a small, well-equipped BSL2 laboratory. Virus is grown on L20B or RD cell lines. The L20B line is a modified mouse cell line that is susceptible and highly specific to Poliovirus, whereas the RD line is human and highly susceptible to Poliovirus as well, but not as specific. In a diagnostic laboratory, cells from these lines are exposed to patient samples (usually fecal) and incubated at 36C for a week, with daily observation for CPE (cytopathic effect, evidence of viral infection). Large-scale culture of cell lines and virus is possible and employed for vaccine production in an industrial setting.

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